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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ACADEMIC HANDBOOK 2024/2025

FOR BACHELOR DEGREE AND DIPLOMA PROGRAMMES

FACULTY OF ELECTRICAL TECHNOLOGY AND ENGINEERING

ACADEMIC HANDBOOK 2024/2025

FOR BACHELOR DEGREE AND DIPLOMA PROGRAMMES

FACULTY OF ELECTRICAL TECHNOLOGY AND ENGINEERING
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FIRST PUBLISHED 2024

Member of the Malaysian Scholarly Publishing Council (MAPIM)
Member of the Malaysian Book Publishers Association (MABOPA)
Member of Clarivate Analytics

Published and Printed in Malaysia by:
Penerbit UTeM Press
Universiti Teknikal Malaysia Melaka
Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia.
Tel: +606 270 1241 Faks: +606 270 1038

ACKNOWLEDGEMENT

The Faculty would like to extend our gratitude and appreciation to all who have contributed to the success of Academic Handbook Session 2024/2025 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 Bachelor Degree and Diploma Programme for the Academic Session of 2024/2025 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 2024/2025. 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.

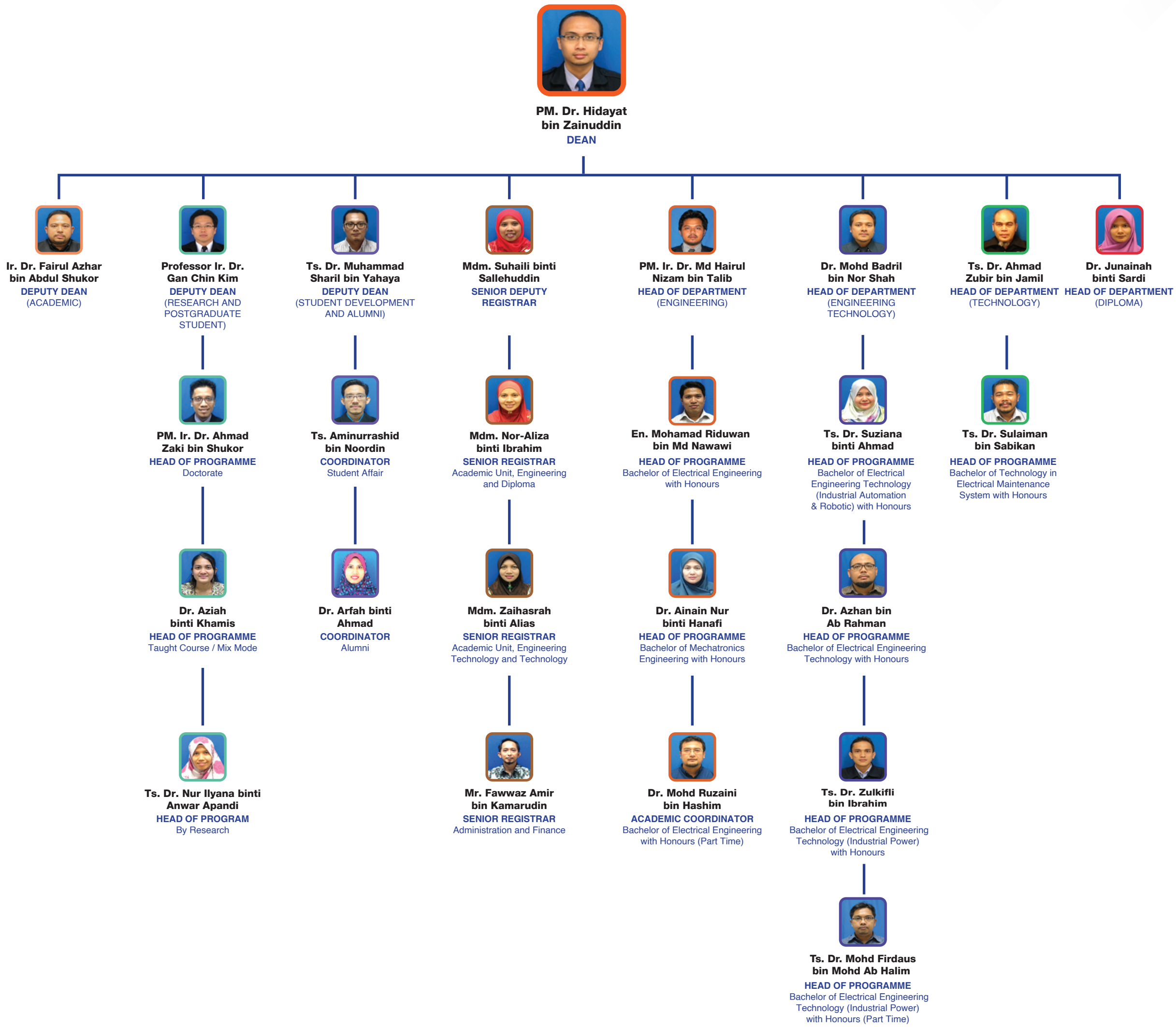
Last but not least, I would like to extend my thanks and gratitude to all the committee members for their hard work, support and effort towards publishing this handbook.

Wassalam.

“Towards Academic Excellence”

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

FACULTY ORGANISATION STRUCTURE



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 eight (8) Undergraduate Programmes and three (3) types of Postgraduate Programmes:

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

Postgraduate Programmes:
1. Electrical Engineering & Mechatronics Engineering (Research Mode)
   a) Doctor of Philosophy (PhD)
   b) Doctor of Engineering (DEng)
   c) Master of Science (MSc)

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

The academic curriculum of the Diploma of Electrical Engineering consists of both engineering and non-engineering courses. Besides that, laboratory work, industrial training, and final year projects are among the key elements of the curriculum content. In addition, engineering application, integrated exposure to professional engineering practice, including Occupational Safety and Health, Embeded System, Low Voltage System Design and Automation are also part of the programme's curriculum. In order to expose the students to engineering practice, technical talks by guest lecturers from industry and industry visits are also included.

The academic curriculum of the Diploma of Electrical Engineering is made up of a total of 90 credits spread over 2 special semester with 8 weeks, 4 semesters with 14 weeks and a 16 week industrial training. The curriculums are also balanced between the essential courses forming the programme core (Teras Program) and elective courses (Kursus Elektif). The total credits hours of both engineering (engineering + mathematics) and non-engineering courses are (64 + 12) and 14 credits respectively.

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 = $k_1m_1 + k_2m_2 + ...k_nm_n$

Total Calculated Credit, JKK = $k_1 + k_2 + ...k_n$

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

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 = $[JMN_1 + JMN_2 + ...JMN_n] / [JKK_1 + JKK_2 + ...JKK_n]$

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 $\geq$ 2.00
Conditional (KS)	1.70 $\leq$ 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
Prof. Ts. Dr. Wan Zuha bin Wan Hasan	Universiti Putra Malaysia	01.05.2022- 30.04.2024	BELR
Prof. Madya Ts. Dr. Baharuddin bin Ismail	Universiti Malaysia Perlis	01.03.2022- 29.02.2024	BELS
Prof. Ir. Dr. Ahmad Farid Bin Abidin	Universiti Kebangsaan Malaysia PhD in Electrical Engineering	01.12.2023 - 30.11.2025	DEL

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. Ts. Mohd Nazam Bin Mohd Nasir	Post: Principal Engineer (Maintenance Planning) Company: Tenaga Nasional Berhad Johor	01.01.2024 - 31.12.2025	DEL
Muhamad Khuzaizie Musa	Post: Technical & Quality Manager Company: Central Cables Berhad	01.01.2024 - 31.12.2025	DEL

INDUSTRIAL ADVISORY PANEL	POSITION	APPOINTMENT PERIOD	PROGRAM
Ts. Dr. Muhammad Ikhwan Bin Zamhuri	Post: Head of Department/ Senior Engineer Company: Healthcare Technical Services Sdn Bhd (HTSSB)	01.01.2024 - 31.12.2025	DEL
Ir. Ajmal bin Suria	Post: Managing Director Company: Servelead Sdn. Bhd.	01.01.2024 - 31.12.2025	DEL

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 electrical engineering/electrical 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-DK9) 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, computing and engineering fundamentals and an engineering specialisation as specified in DK1 to DK4 respectively to wide 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 well-defined technical problems and assist with the design of systems, components or processes to meet specified needs with appropriate consideration for public health and safety as well as, cultural, societal, and environmental considerations as required (DK5)
4.	Investigation: Conduct investigations of well-defined problems; locate and search relevant codes and catalogues, conduct standard tests and measurements (DK8)
5.	Tool Usage: Apply appropriate techniques, resources, and modern engineering computing and IT tools to well-defined engineering problems, with an awareness of the limitations (DK2 and DK6)
6.	The Engineering Technician and the World: Consider sustainable development impacts* to: society, the economy, sustainability, health and safety, legal frameworks, and the environment, in solving well-defined engineering problems. (DK1, DK5, and DK7)
7.	Ethics: Understand and commit to professional ethics and responsibilities and norms of technician practice and including compliance with national and international laws. Demonstrate an understanding of the need for diversity and inclusion; (DK9)
8.	Individual and Collaborative Team Work: Function effectively as an individual, and as a member in diverse and inclusive teams in multi-disciplinary, face-to-face, remote and distributed settings (DK9)
9.	Communications: Communicate effectively and inclusively 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

10.	Project Management and Finance: Demonstrate awareness of engineering management principles as a member or leader in a technical team and to manage projects in multidisciplinary environments
11.	Life Long Learning: Recognize the need for, and have the ability for i) independent and life-long learning and ii) critical thinking in the face of specialised technical knowledge; (DK8)

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 BREAK	SEMESTER 2	SPECIAL SEMESTER	LONG SEMESTER BREAK	SEMESTER 3	SEMESTER 4	LONG SEMESTER BREAK	SEMESTER 5	
CORE PROGRAM (P)		DELA 1212 ALGEBRA		DELA 1222 CALCULUS	DELC 1323 EMBEDED SYSTEM		DELA 2333 DIFFERENTIAL EQUATIONS	DELA 2342 ENGINEERING MATHEMATICS		DELU 3118 INDUSTRIAL TRAINING	
		DELA 1113 PHYSICS		DELG 1213 COMPUTER PROGRAMMING	DELA 1312 SAFETY AND HEALTH FOR ENGINEERS		DELE 2123 POWER ELECTRONICS	DELP 2243 POWER SYSTEM AND DISTRIBUTION			
		DELE 1133 ELECTRONIC DEVICES		DELE 1213 ANALOGUE ELECTRONICS			DELC 2113 CONTROL SYSTEM ENGINEERING	DELP 2214 DIPLOMA PROJECT			
		DELE 1123 DIGITAL ELECTRONICS		DELC 1113 INSTRUMENTATION & MEASUREMENT			DELE 2113 ELECTRICAL MACHINE				
		DELP 1213 ELECTRICAL CIRCUIT I		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 5 ELECTIVE COURSES			
								DELP 2223 RENEWABLE ENERGY AND APPLICATION			
								DELP 2233 BUILDING MAINTENANCE AND MANAGEMENT			
								DELC 2213 INDUSTRIAL ROBOTIC			
								DELC 2223 INDUSTRIAL PROCESS CONTROL			
								DELE 2213 INDUSTRIAL POWER ELECTRONICS			
								6			6
UNIVERSITY REQUIREMENT (W)	DLLW 1112 FOUNDATION ENGLISH	DLLW 2122 ENGLISH FOR EFFECTIVE COMMUNICATION		DLLW 3132 ENGLISH FOR MARKETABILITY	DTMW 1012 FUNDAMENTALS OF ENTERPRENEURSHIP ENCULTURATION						
	DLHW 2722 INTEGRITY AND ANTI-CORRUPTION	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 2722	INTEGRITY AND ANTI CORRUPTION	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 1133	ELECTRONIC DEVICES	P	3
	DELE 1123	DIGITAL ELECTRONICS	P	3
	DELP 1213	ELECTRIC CIRCUIT I	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
	DELC 1113	INSTRUMENTATION & MEASUREMENT	P	3
	DMKU 1163	INTRODUCTION TO MECHANICAL SYSTEM	P	3
	DELG 1213	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 1323	EMBEDED SYSTEM	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 2243	POWER SYSTEM AND DISTRIBUTION	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
	DELE 2213	INDUSTRIAL POWER ELECTRONICS	E	3
	DELC 2223	INDUSTRIAL PROCESS CONTROL	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 2722	INTEGRITY AND ANTI CORRUPTION	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	23		60.5	5	120.2
	DELA 1212	ALGEBRA	28	3			45	4	80
	DELE 1133	ELECTRONIC DEVICES	28	4	23		60.5	5	120.2
	DELP 1213	ELECTRIC CIRCUIT I	28	4	23		60.5	5	120.2
	DELE 1123	DIGITAL ELECTRONICS	28	4	23	6	60.5	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
	DELG 1213	COMPUTER PROGRAMMING	28	4	23		60.5	5	120.2
	DMKU 1163	INTRODUCTION TO MECHANICAL SYSTEM	28	4	23		60.5	5	120.2
	DELC 1113	INSTRUMENTATION & MEASUREMENT	28	4	23		60.5	5	120.2
	DELP 1211	ELECTRICAL WORKSHOP			25		14.5	0.5	40
	DELE 1213	ANALOGUE ELECTRONICS	28	4	23		60.5	5	120.2
	DKKX 1XX1/ 2XX1	CO-CURRICULUM II			40				40
Special Semester	DTMW 1012	FUNDAMENTALS OF ENTREPRENEURSHIP ENCULTURATION	28	3			45	4	80
	DELC 1323	EMBEDED SYSTEM	28	4	17	6	60.5	5	120.2
	DELA 1312	SAFETY AND HEALTH FOR ENGINEERS	28	6		3	41.5	2.25	80
3	DELP 2113	ELECTRICAL CIRCUIT II	28	4	23		60.5	5	120.2
	DELE 2123	POWER ELECTRONICS	28	4	23		60.5	5	120.2
	DELA 2333	DIFFERENTIAL EQUATIONS	42	7			64.8	6.75	120.55
	DELE 2113	ELECTRICAL MACHINES	28	4	23		60.5	5	120.2
	DELC 2123	AUTOMATION	28	4	17	6	60.5	5	120.2
	DELC 2113	CONTROL SYSTEM ENGINEERING	28	4	23		60.5	5	120.2
4	DELA 2342	ENGINEERING MATHEMATICS	28	3			45	4	80
	DELP 2243	POWER SYSTEMAND DISTRIBUTION	28	4	23		60.5	5	120.2
	DELP 2214	DIPLOMA PROJECT					160		160
	CHOOSE ONLY TWO (2) ELECTIVE COURSES								
	DELP 2223	RENEWABLE ENERGY AND APPLICATION	28	4	23		60.5	5	120.2
	DELP 2233	BUILDING MAINTENANCE AND MANAGEMENT	28	4	23		60.5	5	120.2
	DELC 2213	INDUSTRIAL ROBOTIC	28	4	23		60.5	5	120.2
	DELE 2213	INDUSTRIAL POWER ELECTRONICS	28	4	23		60.5	5	120.2
	DELC 2223	INDUSTRIAL PROCESS CONTROL	28	4	23		60.5	5	120.2
5	DELU 3118	INDUSTRIAL TRAINING					320		320
		TOTAL HOURS	**798**	**108**	**423**	**21**	**2048.8**	**131**	**3609.8**

COURSE DETAILS FOR DIPLOMA PROGRAMME (DEL)

Year 1 Semester 1

DELA 1212
ALGEBRA
Credit Hours: 2

Course 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.

Learning Outcomes
At the end of this course, the students should be able to:
1. Describe the graph of functions and perform the operation on polynomial using appropriate methods. (PO1)
2. Evaluate the trigonometric functions and its engineering application using trigonometric properties. (PO1)
3. Solve the linear system and its engineering application using properties of matrix. (PO1)
4. Solve equations of complex numbers using appropriate theorem. (PO1)

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 1113
PHYSICS
Credit Hours: 3

Course Synopsis
This course covers mechanics, electricity and magnetism. The topics covers in this course are: Kinematics in One and Two dimension, Newton's Law of Motion and its Applications, Work and Energy, Conservation of Energy, Linear Momentum and Collisions, Rotational Kinematics and Dynamics, Electric Charge and Electric Field, Capacitance and Dielectrics and Megnetism. Experiments covered Mechanics and Electricity.

Learning Outcomes
At the end of this course, the students should be able to:
1. Explain basic concept in physics, covering aspect such as mechanics, electricity and magnetism. (PO1)
2. Use concepts systematically to solve problems in mechanics, electricity and magnetism. (PO2)
3. Demonstrate the ability of performing experimental works involving mechanics, electricity and magnetism. (PO5)

References
1. Walker, J. S., Physics, 5th Edition, Pearson, 2022.
2. Giancolli, D. C., Physics for Scientists and Engineers, 5th Edition, Pearson, 2022.
3. Giambatista, A., Richardson, B.M., Richardson, R.C., College Physics, 5th Edition, Mc-Graw Hill, 2020
4. Serway, R. A., Jewett, J. W., Physics for Scientists and Engineers With Modern Physics 10th Edition, Cengage Learning, 2019.

DELE 1133
ELECTRONIC DEVICES
Credit Hours: 3

Course Synopsis
This course will equip students with basic principle of semiconductor and diode operation using appropriate rules and basic laws. It will also covers topics such as BJT, JFET, MOSFET circuits using appropriate rules and laws and their analysis and applications.

Learning Outcomes
At the end of this course, the students should be able to:
1. Applied the concept of semiconductor and diode operation using appropriate rules and basic laws. (PO1)
2. Analyze BJT, JFET, MOSFET circuits using appropriate rules and laws. (PO2)
3. Measure electronics circuit such as Diode, BJT amplifier, JFET, MOSFET parameters using appropriate tools (PO5)

References
1. Thomas L. Floyd, David M. Buchia, Gary D. Synder, Electronics Fundamentals: Circuits, Devices, And Applications, Nineth Edition, Pearson, 2021
2. Christopher Siu, Electronic Devices, Circuits, and Applications, Springer Cham, 2022.
3. Thomas L. Floyd, David M. Buchla, Steven Wetterling, Electronics Devices (Electron Flow Version), Tenth Edition, Pearson, 2022.
4. Thomas L. Floyd, David M. Buchla, Electronics Fundamentals (A System Approach), First Edition, Pearson, 2014.

DELP 1213
ELECTRIC CIRCUIT I
Credit Hours: 3

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

Learning Outcomes
At the end of this course, the students should be able to:
1. Introduction to basic law in an electric circuit and apply the method of analysis (PO1)
2. Apply and solve circuit theorems in analyzing electrical circuits (PO2)
3. Analyze circuits using appropriate simulation and hardware tools (PO5)

References
1. C.K. Alexander and M.N.O. Sadiku, Fundamentals of Electric Circuit, 6th Ed 2017, McGraw Hill.
2. Gengsheng Lawrence Zeng, Megan Zeng, Electric Circuits A Concise, Conceptual Tutorial, Springer International Publishing 2021.
3. C.K. Alexander and M.N.O. Sadiku, Fundamentals of Electric Circuit, 6th Ed 2017, McGraw Hill.
4. Boylestad R.,L. Nashelsky, Electronic Devices and Circuit Theory, Pearson Education Inc.,Eleventh Edition 2014
5. J.W.Nilson, S.A.Riedel, Electric Circuits, 10th Ed 2015, Pearson Education, Inc.

DELE 1123
DIGITAL ELECTRONICS
Credit Hours: 3

Course 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.

Learning Outcomes
At the end of this course, the students should be able to:
1. Describe the concept of digital electronics system such as basic numbering system, basic gates, combinational logic circuit and types of gate. (PO1)
2. Solve problems using dogital logic circuit based on provided information by using basic gates, MSI, flip-flop and latch. (PO2)
3. Demonstrate the ability to use appropriate engineering tool in the application of digital logic circuit. (PO5)

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.

DELP 1111
BASIC ELECTRICAL SKILL
Credit Hours: 1

Course 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 introduced with basic electronic components knowledge (read, testing and measure) schematic reading and soldering technique. Concentration is given on the safety aspects and quality of works. For the last session, 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.

Learning Outcomes
At the end of this course, the students should be able to:
1. Apply the knowledge of basic electronic measurement, basic microcontroller programming, and electronic soldering processes. (PO1)
2. Demonstrate appropriate instruments / tools handling skills required to solve engineering problems adequetly. (PO5)
3. Comply with rules, procedure and ethics skills through experiment project. (PO7)
4. Cooperate effectively as a teamwork during laboratory activities. (PO8)

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.
4. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, Digital Systems : Principles and Applications, 12th Edition, Pearson 2017.

<u>Year 1 Semester 2</u>

DELA 1222
CALCULUS
Credit Hours: 2

Course 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.

Learning Outcomes
At the end of this course, the students should be able to:
1. Identify limits and continuity of functions using computational methods of limits.(PO1)
2. Solve derivatives of algebraic, trigonometric, logarithmic and exponential functions using differentiation technique. (PO1)
3. Solve integrals of algebraic, trigonometric, logarithmic and exponential functions using integration techniques. (PO1)
4. Apply the knowledge of calculus to deal with the engineering problems.(PO1)

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
Credit Hours: 3

Course Synopsis
This subject serves as an electronic fundamental course for engineering students. The topics that will be covered including the 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.

Learning Outcomes
At the end of this course, the students should be able to:
1. Define the characteristics and operation of the Power Amplifier and Operational Amplifier. (PO1)
2. Analyse the characteristics and operation of the Active Filter, Voltage Regulator, and Feedback and Oscillator.(PO2)
3. Conduct and demonstrates practical experiments of Power Amplifier, Operational Amplifier, Active Filter, Voltage Regulator, and Feedback and Oscillator. (PO5)

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

DELC 1113
INSTRUMENTATION & MEASUREMENT
Credit Hours: 3

Course 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.

Learning Outcomes
At the end of this course, the students should be able to:
1. Understand of electrical measurement and instrumentation principles. (PO1)
2. Analyze various methods/techniques involve in measurement and instrumentation of electrical engineering.(PO2)
3. Demonstrate related experiment on measurement and instrumentation of electrical engineering. (PO5)

References
1. Measurement and instrumentation : theory and application / Alan S. Morris, Reza Langari. Second edition, Elsevier Inc., 2016
2. Instrumentation : operation, measurement, scope and application of instruments / N.V.S. Raju, CRC Press 2016
3. Measurement and instrumentation theory and application, Andre Chanzy, Jean-Claude Gaudu et al. United Kingdom Auris Reference,2015.
4. HS Kalsi, Electronic Instrumentation, 3rd Ed., Tata McGraw Hill, 2010

DELG 1213
COMPUTER PROGRAMMING
Credit Hours: 3

Course 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.

Learning Outcomes
At the end of this course, the students should be able to:
1. Identify the fundamental principles of problem solving, programming techniques and structures in program development. (PO1)
2. Apply the principles of problem solving and programming techniques to solve given problems. (PO2)
3. Apply appropriate modern programming language to produce program codes by applying suitable programming structures and techniques. (PO5)
4. Communicate effectively on well-defined engineering activities involving fundamentals of programming, problem solving and software development. (PO9)

References
1. Gaddis, T., (2022), “Starting Out with C++: From Control Structures through Objects”, Brief Version, 10th Edition, Pearson Education.
2. Etter, D.M., Ingber, J.A., (2017), “Engineering Problem Solving with C++”, 4th Edition, Pearson Education.

DELP 1211
ELECTRICAL WORKSHOP
Credit Hours: 1

Course 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. Then 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.

Learning Outcomes
At the end of this course, the students should be able to:
1. Demonstrate appropriate troubleshoot skills on relay control circuit and domestic wiring installation. (PO4)
2. Ability to apply and use engineering drawing software tools for design electrical system. (PO5)
3. Demonstrate an awareness on the safety, regulation and responsibility through practical competence on the relay control circuit and domestic wiring installation. (PO6)
4. Demonstrate the ability to work in a team for the practical competence on circuitry design. (PO8)

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.

<u>**Year 1 Semester 3**</u>

DELC 1313
EMBEDDED SYSTEM
Credit Hours: 3

Course Synopsis
This course is about hardware and microprocessor handling, type of microprocessor systems, system handler and timing diagrams. The course covers the concept of 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.

Learning Outcomes
At the end of this course, the students should be able to:
1. Design memory and peripheral device interface . (PO3)
2. Apply the microprocessor instruction set operation using any suitable programming language. (PO4)
3. Design and develop, simulate and construct an embedded system solution and analyze the overall design performance.s (PO5)
4. Present in oral and the technical report for the microprocessor-based system project. (PO9).
5. Demonstrate the ability to manage the development process of the microprocessor-based system project (PO10).

References
1. Donald Norris, Programming with STM32: Getting Started with the Nucleo Board and C/C++, McGraw-Hill Education TAB, 2018.
2. Dogan Ibrahim, "Nucleo Boards Programming with the STM32CubeIDE", Elektor, 2020.

3. Muhammad Ali Mazidi, "STM32 Arm Programming for Embedded Systems ", MicroDigitalEd, 2018.
4. John Catsoulis, "Embedded Systems Vol 2: Real-Time Interfacing to ARM Cortex-M Microcontroller-4th ed.", Jonathan W. Valvano, 2014.
5. Jason D. Bakos, "Embedded System: ARM programming and Optimization", Morgan Kaufmann Publication, 2016.

DELA 1312
SAFETY AND HEALTH FOR ENGINEERS
Credit Hours: 2

Course Synopsis
The primary objective of this course is to instill in students the awareness of and ability to engage in lifelong learning. Students will be exposed to topics including Occupational Safety and Health, industrial safety, quality management concept and various quality tools, as well as knowledge of contemporary safety and health issues in engineering-related disciplines. In addition, the student will present a case study on a pre-determined safety and health topic based on related assigned building.

Learning Outcomes
At the end of this course, the students should be able to:
1. Implement the acquired knowledge in order to resolve engineering safety concerns through the identification of hazard types, prevention of occupational injuries, risk management, management planning, training, and incident investigations. (PO2)
2. Use appropriate engineering tool pertained to the Occupational Safety and Health policies, obligations, and understanding concerning sustainability and workplace safety. (PO5)
3. Demonstrate societal awareness on pertinent safety norms and standards that must be upheld in accordance with regulatory mandates and engineering constraints. (PO6)
4. Work effectively in a team to explore the current engineering safety and health procedures and issues that have an impact on society and engineering professionals. (PO8)

References
1. ROGER L. BRAUER, Ph.D., CSP, PE, Safety and Health for Engineers, Second Edition, Wiley-Interscience. (2006).
2. Mohamad Sohaimi Man. Keselamatan dan Kesihatan Pekerja. Dewan Bahasa & Pustaka. Kuala Lumpur, (2018).
3. Occupational Safety and Health Master Plan 2016-2020,Department of Occupational Safety and Health,Ministry of Human Resources, Malaysia (2016).
4. Laws Of Malaysia: Act 514 - Occupational Safety And Health Act 1994 (1994).
5. Australian Work Health and Safety (WHS) Strategy (2023-2033).
6. Laws Of Malaysia: Act 139 - Factories And Machinery Act 1967 (1974).

<u>Year 2 Semester 1</u>

DELA 2333
DIFFERENTIAL EQUATIONS
Credit Hours: 3

Course Synopsis
This course 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 differential equation and lastly, apply the various solving techniques to the learner's engineering problem.

Learning Outcomes

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

1. Describe the fundamental concepts of the first and second order differential equations, Laplace transform and Fourier Series. [PO1]
2. Solve differential equation using an appropriate technique. [PO1]
3. Apply the knowledge of differential equation to deal with the engineering problems. [PO1]

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 MACHINE
Credit Hours: 3

Course 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.

Learning Outcomes

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

1. Explain various types, physical construction and equivalent circuit diagrams of electrical machines. [PO1]
2. Analyze electrical machines parameters such as torque, power, efficiency and speed. [PO2]
3. Demonstrate the performance of electrical machines and motor starters installation during laboratory session. [PO5]

References

[1] Stephen J. Chapman, Electric Machinery Fundamentals, 5th ed., McGraw-Hill, 2012
[2] Thomas A Lipo, Introduction to AC Machine Design, Wiley, 2017
[3] Albert, Malvino, Donald Leach, Digital Principles and Applications, 7th Edition, McGraw Hill,2010.
[4] Jan Melkebeek, Electrical Machines and Drives: Fundamental and Advanced Modelling. Springer. 2018
[5] Jacek F. Gieras, Electrical Machines: Fundamentals of Electromechanical Energy Conversion, Taylor & Francis, 2017

DELE 2123
POWER ELECTRONICS
Credit Hours: 3

Course 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.

Learning Outcomes

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

1. Identify the semiconductor power switches and analyze the performance of rectifiers, choppers and inverters in power converter application. [PO2]
2. Demonstrate the ability of performing experimental works involving power electronics

converters and devices. [PO5]
3. Discuss the operation and performance of power electronic conversion. [PO11]

References

[1] Daniel W. Hart, Power Electronics International Edition, Mc-Graw Hill, 2011.
[2] Robert W. Erickson, Dragan Maksimović, Fundamentals of Power Electronics, Springer International Publishing, 2020.
[3] J. S. Chitode, Power Electronics, UNICORN Publishing Group, 2020.
[4] Hidaia Mahmood Alassouli, Power Electronics, 2021.
[5] C. Bharatiraja, Farooque Azam, Neeraj Priyadarshi, P. Sanjeevikumar, Rajesh Singh, Advanced Power Electronics Converters for Future Renewable Energy Systems, CRC Press Publisher, 2023.
[6] Issa Batarseh, Power Electronics - Circuit Analysis and Design, Springer, 2018.

DELP 2113
ELECTRIC CIRCUIT II
Credit Hours: 3

Course Synopsis

This course 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. The course also cover AC Power Analysis for Single Phase Circuit and calculation on power factor correction.

Learning Outcomes

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

1. Apply the principle of AC voltage and current in RLC single phase circuits. [PO1]
2. Solve transient response of first order and second order DC circuits and steady state parameters of AC circuits. [PO2]
3. Demonstrate the ability to use appropriate engineering tool to analyse transient response of DC circuits and steady state parameters of AC circuits. [PO5]

References

[1] C.K. Alexander and M.N.O. Sadiku, Fundamentals of Electric Circuits, 7th Ed, McGraw-Hill, (2021).
[2] J.W. Nilsson and S.A. Riedel, Electric Circuits, 10th Ed, Pearson Education, Inc, (2015).
[3] T.L. Floyd, Principles of Electric Circuits, 9th Ed, Pearson Education, Inc, (2014).
[4] Edward Hughes, Electrical & Electronic Technology, 12th Edition, Pearson Prentice Hall, (2016).

DELC 2113
CONTROL SYSTEM ENGINEERING
Credit Hours: 3

Course Synopsis

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

Learning Outcomes

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

1. Describe fundamental knowledge, concepts of control system and the transient output response of a linear time invariant system. [PO1]
2. Analyze control system representation and time response for a linear time invariant system in time and frequency domain solving control problems using root locus and/or bode plot techniques. [PO2]

3. Demonstrate experiments of control systems, interpret data, analyse results manually and by simulations. [PO5]

References

[1] Nise, S Norman, Control Systems Engineering, 8th Edition, John Wiley & Sons Inc., 2019.
[2] Syed Najib, Azrita Alias, Aliza Che Imran, Sahazati Md Rozali, Saleha Mohamed Salleh, Basic Control System, Penerbit Universiti Teknikal Malaysia Melaka, 2008.
[3] Dorf, R.C. & Bishop, R.H., Modern Control Systems, 14th Edition, Prentice Hall, 2021.

DELC 2123
AUTOMATION
Credit Hours: 3

Course 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 covers 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.

Learning Outcomes

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

1. Explain and apply the concept of Automation, Programmable Logic Controller (PLC), Pneumatic and Hydraulic as well as their components. [PO1]
2. Analyze and solve well-defined problems based on provided information by using PLC, Pneumatic, Hydraulic and other automation components. [PO2]
3. Construct and demonstrate automation system based on design requirement, symbols and schematic diagram. [PO5]
4. Demonstrate the basic concept of Hydraulic and Pneumatic through knowledge transfer program (SULAM) to the local community.[PO6]

References

[1] D. Petruzella, Frank, Programmable Logic Controllers Ise, 6th Ed. McGraw Hill. 2022
[2] B.Ghosh, R. Prasad, G.Pallail The Automation Advantage, McGraw Hill, 2021
[3] S. Manesis, G. Kotrkoupolos, Introduction To Industrial Automation, Crc Press, 2018
[4] U. Arnwine Programming Plc And Hmi For Sensors Automation, 2021

<u>Year 2 Semester 2</u>

DELA 2342
ENGINEERING MATHEMATICS
Credit Hours: 2

Course 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.

Learning Outcomes

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

1. Recognise the multivariable function and extend the principle ideas of calculus in such function. [PO1]
2. Solve the mathematical problems that involve multivariable function, double integral and vector calculus. [PO1]

3. Apply the knowledge of engineering mathematics to deal with the engineering problems. [PO1]

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 AND DISTRIBUTION
Credit Hours: 3

Course Synopsis

The purpose of this subject is to introduce students with principle and fundamental on power system network configurations (i.e., network basic concept, short line analysis, and per-unit system), industrial and commercial building wiring (i.e., cables and circuit breaker selection, switchboard and distribution board). This course will cover the procedures on basic design, safety, erect protection relays, inspection, testing and commissioning of an electrical installation. The experimental section will cover the working procedures of 3-phase industrial wiring system and also construction of a basic motor starter circuit (D.O.L/Forward-Reverse/Star-Delta).

Learning Outcomes

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

1. Analyse the fundamental knowledges in electrical power system and parameters of low voltage system design. [PO2]
2. Investigate the suitable low voltage system design based on standard design procedures and technical protection specifications. [PO4]
3. Utilise appropriate engineering tools to analyse the electrical power system and low voltage wiring system. [PO5]
4. Apply the regulations and standard requirements for low voltage electrical wiring system. [PO11]

References

[1] Glover and Sharma, Power System Analysis and Design, Cengage Learning; 7th edition (January 1, 2022)
[2] Paul Cook, Electrical Installation Design Guide: “Calculations for Electricians and Designers.” 5th Edition, IET Publication 2022
[3] Hadi Saadat, Power System Analysis, 3rd Edition, 2011.
[4] Electrical installations of buildings - Guide to MS IEC 60364 (First revision), MS1936:2016.
[5] Electrical installations of buildings - Code of practice (First revision), MS1979:2015.

DELP 2214
DIPLOMA PROJECT
Credit Hours: 4

Course 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.

Learning Outcomes

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

1. Apply engineering design to solve electrical engineering problem. [PO3]
2. Conduct investigation using equipment tool and methods [PO4]
3. Identify and analyze electrical engineering problem. [PO6]
4. Present the results in written and in oral format effectively. [PO9]

5. Identify basic entrepreneurship skills in project management. [PO10]
6. Engage in independent and lifelong learning. [PO11]

References

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

Elektif

DELC 2213
INDUSTRIAL ROBOTICS
Credit Hours: 3

Course 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.

Learning Outcomes

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

1. Identify, apply, and analyse basic knowledge of industrial robot system components, including motion profile and mechanical aspect. [PO2]
2. Apply specific robotic programming and simulations for industrial robots used in industrial automation systems. [PO3]
3. Demonstrate the ability to use modern tools in the industrial automation system. [PO5]
4. Demonstrate ability to use robotic technologies in a safe manner and sustainable operation. [PO6]

References

[1] Mikell P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, 5th Ed., Person, 2021.
[2] Craig, J. J., Introduction to Robotics, Mechanics and Control, 3rd Ed., Addison Wesley Longman, 2014.
[3] Groover, Industrial Robotics, Mc Graw Hill, 2012.

DELP 2233
BUILDING MAINTENANCE AND MANAGEMENT
Credit Hours: 3

Course Synopsis

This subject covers the concept of building services and systems for mechanical, electrical, plumbing, 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.

Learning Outcomes

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

1. 1. Analyze any regulation and standard related to building maintenance and management problem. [PO2]
2. Design the solution of energy management for building maintainace purpose. [PO3]
3. Use appropriate engineering tools for the practical competence on building maintenance and management. [PO5]
4. Identify the impact of energy usage in building towards environment and sustainability. [PO6]

References

[1] Moncef Krarti, Energy Audit of Building Systems – An Engineering Approach, Third Edition, CRC Press, 2021
[2] Mechanical and Electrical Equipment for Buildings, 13th Edition, Walter T. Grondzik, Alison G. Kwok, John Wiley & Sons, 2019.
[3] Building Maintenance Management, 2nd Edition Chanter B, Swallow P, 2017
[4] Alexander, Sadiku,Fundamentals of Electric Circuits, 7th edition, 2020.

DELP 2223
RENEWABLE ENERGY & APPLICATION
Credit Hours: 3

Course 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, biomass, etc.

Learning Outcomes

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

1. Analyze the existing government policy on renewable energy and related matters to sustainability. [PO2]
2. Design a renewable energy system to suit with specific need, criteria and conditions. [PO3]
3. Apply an approriate technique on the installation and measurement procedure of renewable energy system. [PO5]
4. Demonstrate knowledge of the impact of utilizing renewable energy towards society, in terms of health, environment, safety and legal. [PO6]

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.
[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.

DELE 2213
INDUSTRIAL POWER ELECTRONICS
Credit Hours: 3

Course Synopsis

This subject will discuss the principles of power generation, power application, and power quality improvement by means of power electronics devices. The basic design and operation of power supply and gate drive will be reviewed at glance. Subsequently, students will be given fundamental knowledge on how to design common power electronics system 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.

Learning Outcomes

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

1. Understand the application of power electronics in renewable energy, power system, industrial appliances and transportation. [PO2]
2. Apply specific modeling and simulations for power electronics converter used in industrial application. [PO3]
3. Demonstrate the ability of performing experimental works involving power electronic application systems. [PO5]
4. Demonstrate ability to use power electronics converter in a safe manner and discuss the operation and performance of power electronic application systems in industry. [PO6]

References

[1] Vinod Kumar, Ranjan Kumar Behera, Dheeraj Joshi, Ramesh Bansal, Power Electronics, Drives, and Advanced Applications, CRC Press, 2020.
[2] Ivo Barbi, Fabiana Pöttker, Soft Commutation Isolated DC-DC Converters, Springer International Publishing, 2019.
[3] Ali Emadi, Abdolhosein Nasiri, Stoyan B. Bekiarov, Uninterrruptible Power Supplies And Active Filters, CRC PRESS, 2017.
[4] Mehrdad Ehsani, Yimin Gao, Stefano Longo, Kambiz M. Ebrahimi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Taylor & Francis Group, 2019.
[5] Suman Bhowmick, Flexible AC Transmission Systems (FACTS), CRC Press, 2018.

DELC 2223
INDUSTRIAL PROCESS CONTROL
Credit Hours: 3

Course Synopsis

This course intends to expose to the students the implementation of control system engineering in industrial processess. This includes the concept of process control system and its dynamic behaviour. The basic analog controller such as P, PI and PID controller and advanced control structure will be reviewed. Subsequently, students will be given fundamental knowledge on method of tuning and its performance criteria. The basic operation of Final Control Elements and Transducers will be exposed to the students.

Learning Outcomes

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

1. Describe fundamental knowledge and concepts of process control and its characteristics and challenges of typical processes in industry. (PO2)
2. Analyze the controllers and its tuning method used in industrial application. (PO3)
3. Demonstrate the ability of performing experimental works and data interpretation involving industrial process control systems. (PO5)
4. Demonstrate the ability to apply industrial process control system in a safe manner and discuss the performance of process control application systems in industry. (PO6)

References

1. Curtin D. Johnson, Process Control Instrumentation Technology, Pearson Prentice-Hall, 8th Edition, 2014
2. B Wayne Bequette, Process Control: Modeling, Design and Simulation, 2nd Edition, 2024
3. Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, Process Dynamics and Control, John Wiley & Sons, 2017.
4. D.P. Eckman, Automatic Process Control, Pearson, 2021.

Year 3 Semester 1

DELU 3118
INDUSTRIAL TRAINING
Credit Hours: 8

Course 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.

Learning Outcomes
At the end of this course, the students should be able to:
1. Apply appropriate techniques and technical knowledge which are relevant to the student's field of study. [PO1]
2. Demonstrate the ability to adapt with the working environment efficiently and ethically. [PO7]
3. Demonstrate soft skill especially communication skill at all level. [PO9]
4. Work affectively as an individual, team members and as a leader as well. [PO8]
5. Acquire new knowledge, life-long learning and aware to new technology. [PO11]

References
Dasar Latihan Industri UTeM, 2013

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.

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)
PO1	**Engineering Knowledge** - Apply knowledge of mathematics, natural science, computing and engineering fundamentals, and an engineering specialization as specified in WK1 to WK4 respectively to develop solutions to complex engineering problems.
PO2	**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 with holistic considerations for sustainable development (WK1 to WK4).
PO3	**Design/Development of Solutions** - Design creative solutions for complex engineering problems and design systems, components or processes that meet identified needs with appropriate consideration for public health and safety, whole-life cost, net zero carbon as well as resource, cultural, societal, and environmental considerations as required (WK5).
PO4	**Investigation** - Conduct investigation of complex engineering problems using research methods including research-based knowledge and research methods, including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions (WK8).
PO5	**Tool Usage** - Create, select, and apply, and recognise limitation of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations (WK2 and WK6).
PO6	**The Engineer and the World** - Analyze and evaluate sustainable development impacts to society, the economy, sustainability, health and safety, legal frameworks, and the environment, in solving complex engineering problems (WK1, WK5 and WK7).

PO7	**Ethics** - Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion (WK9).
PO8	**Individual and Collaborative Teamwork** - Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multidisciplinary, face-to-face, remote and distributed settings (WK9).
PO9	**Communication** - Communicate effectively and inclusively 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, taking into account cultural, language, and learning differences.
PO10	**Project Management and Finance** - Apply 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, and to manage projects in multidisciplinary environments.
PO11	**Lifelong Learning** - Recognize the need for and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change (WK8).

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:

COMPONENTS		CREDIT HOURS	PERCENTAGE
Compulsory University Course (W)		16	11.85%
Co-Curriculum (W)		2	1.48%
Core Course (P)	Programme	96	71.11%
	EngineeringSeminar	1	0.74%
	Industrial Training	5	3.70%
	Final Year Project	6	4.44%
Elective (E)	Programme	9	6.67%
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 - 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 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
	BITG 1233 COMPUTER PROGRAMMING		BELG 1413 DIGITAL ELECTRONICS				BMKG 2432 INTRODUCTION TO MECHANICAL ENGINEERING	
	BELU 1123 ELECTRICAL CIRCUIT 1		BELG 1233 PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT		BELU 2333 ELECTRICAL CIRCUIT II		BELG 2433 ELECTRICAL SYSTEMS	
	BMKG 1132 ENGINEERING GRAPHICS AND CAD		BELE 1233 ELECTRONICS DEVICES		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	12		13		13		15	
ELECTIVE (E)								
UNIVERSITY REQUIREMENTS (W)	BKKX 1XX1 CO-CURRICULUM I		BKKX 1XX1 CO-CURRICULUM II		BLLW 2152 ACADEMIC WRITING		#BLHW 2772 APPRECIATION OF ETHICS AND CIVILISATIONS	
	BLLW 1XX2 (UNIVERSITY)		BLHW 1762 PHILOSOPHY AND CURRENT ISSUES		** BKKX XXX1 CO CURRICULUM (SUKSIS)		*BLHW 2752 MALAYSIAN CULTURE	
			BLLW 1142 ENGLSIH FOR ACADEMIC PURPOSE		BLHW 2792 INTEGRITY AND ANTICORRUPTION		** BKKX XXX1 CO-CURRICULUM (SUKSIS)	
CREDIT HOUR SEMESTER	3		5		4		2	
TOTAL CREDIT HOUR SEMESTER	15		18		17		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	BMIU 3213 ENGINEERING ECONOMIC AND MANAGEMENT	BELU 3695 INDUSTRIAL TRAINING	BELU 4861 ENGINEERING SEMINAR	SEMESTER BREAK	BELU 4322 ENGINEER AND SOCIETY	
	BELC 3523 CONTROL SYSTEMS ENGINEERING		BELC 3623 CONTROL SYSTEMS DESIGN		BELU 4792 FINAL YEAR PROJECT I		BELU 4894 FINAL YEAR PROJECT II	
	BELC 3553 EMBEDDED SYSTEMS		BELP 3693 HIGH VOLTAGE ENGINEERING		BELP 4853 ENERGY UTILIZATION AND CONSERVATION		BELP 4843 - RENEWABLE ENERGY	
	BELE 3543 POWER ELECTRONICS		BELG 3661 INTEGRATED DESIGN PROJECT 1		BXXB 4763 INTEGRATED DESIGN PROJECT 2			
	BELP 3553 POWER SYSTEMS ENGINEERING		BELP 3673 POWER SYSTEM ANALYSIS					
			BELE 3653 ELECTRICAL DRIVES					
			BELU3551 ELETRICAL ENGINEERING LABORATORY II					
CREDIT HOUR SEMESTER	15		17	5	9		9	
ELECTIVE(E)					BELX 4XX3 ELECTIVE I (PROGRAMME)			
					BELX XXX3 ELECTIVE II (PROGRAM)		BELX XXX3 ELECTIVE III (PROGRAM)	
CREDIT HOUR SEMESTER					6		3	
UNIVERSITY REQUIREMENTS (W)	BLLW 3162 ENGLISH FOR PROFESSIONAL INTERACTION						BTMW4012 TECHNOLOGY ENTREPRENEURSHIP	
CREDIT HOURSEMESTER	2						2	
TOTAL CREDIT HOUR SEMESTER	17		17	5	15		14	135

	i. CHOOSE THREE (3) COURSES FROM ELECTIVE PROGRAMME ii. CHOOSE ONE (1) COURSE FROM THIRD LANGUAGE						
ELECTIVE PROGRAMME	INDUSTRIAL POWER	BELP 3683 DISTRIBUTION SYSTEM DESIGN	BELP 4873 POWER SYSTEM PROTECTION				
	CONTROL, INSTRUMENTATION & AUTOMATION	BELC 3673 INDUSTRIAL CONTROL AND AUTOMATION	BELC 4683 DIGITAL CONTROL SYSTEMS	BELC 4743 INTELLIGENT CONTROL SYSTEMS	BELM 4863 INDUSTRIAL ROBOTICS	BELC 4883 PLC AND INDUSTRIAL AUTOMATION	
	POWER ELECTRONICS & DRIVES	BELE 3663 POWER ELECTRONICS SYSTEM	BELE 3673 INDUSTRIAL POWER ELECTRONICS	BELE 4763 SPECIAL MACHINES	BELE 4873 ELECTRIC MACHINE DESIGN		
	BACHELOR'S-MASTER'S INTEGRATION	BELP 5123 ELECTRICAL POWER SYSTEM	BELP 5153 INSULATION COORDINATION & DIAGNOSTIC TESTING	BELP 5233 SUSTAINABLE ENERGY AND DISTRIBUTED GENERATION	BELE 5163 ENERGY CONVERSION	BELE 5143 ADVANCED ELECTRICAL MACHINES AND DRIVES	BELC 5133 MODERN CONTROL DESIGN
THIRD LANGUAGE	THIRD LANGUAGE	BLLW 1222 MANDARIN LANGUAGE 1	BLLW 1242 KOREAN LANGUAGE 1	BLLW 1212 ARABIC LANGUAGE 1	BLLW 1252 GERMAN LANGUAGE 1	BLLW 1312 JAPANESE LANGUAGE 1	

PROGRAMME IMPLEMENTATION - BELG (PART TIME)

This programme requires 5.5 years to complete, including short or special semesters. The curriculum structure is identical to the full-time program and consists of at least 135 credit hours. Lectures are scheduled to take place on weekends, providing flexibility for individuals who wish to pursue higher education in Electrical Engineering while managing other commitments. The composition of the credits in this program is as follows:

<table>
<tr><th colspan="2">COMPONENTS</th><th>CREDIT HOURS</th><th>PERCENTAGE</th></tr>
<tr><td colspan="2">Compulsory University Course (W)</td><td>16</td><td>11.85%</td></tr>
<tr><td colspan="2">Co-Curriculum (W)</td><td>2</td><td>1.48%</td></tr>
<tr><td rowspan="4">Core Course (P)</td><td>Programme</td><td>96</td><td>71.11%</td></tr>
<tr><td>EngineeringSeminar</td><td>1</td><td>0.74%</td></tr>
<tr><td>Industrial Training</td><td>5</td><td>3.70%</td></tr>
<tr><td>Final Year Project</td><td>6</td><td>4.44%</td></tr>
<tr><td>Elective (E)</td><td>Programme</td><td>9</td><td>6.67%</td></tr>
<tr><td colspan="2">Total</td><td>135</td><td>100%</td></tr>
</table>

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 (PART TIME)

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

TYPE COURSE	YEAR 1 SEMESTER 1		YEAR 1 SEMESTER 2		YEAR 1 SEMESTER 3/ SHORT SEMESTER	
COMMON CORE & PROGRAM CORE (P)	BMIG 1313 ENGINEERING MATHEMATICS 1	SEMESTER BREAK	BMKC 1013 DIFFERENTIAL EQUATIONS	SEMESTER BREAK	BELG 2443 ENGINEERING MATHEMATICS 2	SEMESTER BREAK
	BELU 1123 ELECTRICAL CIRCUIT I		BELE 1233 ELECTRONICS DEVICES		BELG 1413 DIGITAL ELECTRONICS	
			BELU 1131 ENGINEERING PRACTICE I			
CREDIT HOUR SEMESTER	6		7		6	
ELECTIVE (E)						
UNIVERSITY REQUIREMENTS (W)	BLHW 1762 PHILOSOPHY AND CURRENT ISSUES		BKKX 1XX1 CO-CURRICULUM I			
	BLLW 1142 ENGLISH FOR ACADEMIC PURPOSE		BLHL 1XX2 THIRD LANGUAGE			
CREDIT HOUR SEMESTER	4		3			
TOTAL CREDIT HOUR SEMESTER	10		10		6	

TYPE COURSE	YEAR 2 SEMESTER 1		YEAR 2 SEMESTER 2		YEAR 2 SEMESTER 3/ SHORT SEMESTER	
COMMON CORE & PROGRAM CORE (P)	BELU 2333 ELECTRICAL CIRCUIT II	SEMESTER BREAK	BITG 1233 COMPUTER PROGRAMMING	SEMESTER BREAK	BELG 1233 PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT	SEMESTER BREAK
	BELG 2433 ELECTRICAL SYSTEMS		BELE 2333 ANALOGUE ELECTRONICS		BELP 2453 ELECTROMAGNETIC THEORY	
	BMKG 1132 ENGINEERING GRAPHICS AND COMPUTER AIDED DESIGN		BMKG 2432 INTRODUCTION TO MECHANICAL ENGINEERING			
	BELU 1231 ENGINEERING PRACTICE II					
CREDIT HOUR SEMESTER	9		8		6	
ELECTIVE (E)						
UNIVERSITY REQUIREMENTS (W)	BLHW2772 APPRECIATION OF ETHICS AND CIVILISATIONS		BKKX 1XX1 CO-CURRICULUM II			
			BLLW 2152 ACADEMIC WRITING			
CREDIT HOUR SEMESTER	2		3			
TOTAL CREDIT HOUR SEMESTER	11		11		6	

TYPE COURSE	YEAR 3 SEMESTER 1		YEAR 3 SEMESTER 2		YEAR 3 SEMESTER 3/ SHORT SEMESTER	
COMMON CORE & PROGRAM CORE (P)	BELC 2433 SIGNALS & SYSTEMS	SEMESTER BREAK	BELC 2453 COMMUNICATION SYSTEMS	SEMESTER BREAK	BELC 3683 CONTROL SYSTEM DESIGN	SEMESTER BREAK
	BELE 3533 ELECTRICAL MACHINES		BELC 3523 CONTROL SYSTEMS ENGINEERING		BELE 3543 POWER ELECTRONICS	
	BELU 2331 ELECTRICAL ENGINEERING LABORATORY I		BELP 3553 POWER SYSTEM ENGINEERING			
CREDIT HOUR SEMESTER	7		9		6	
ELECTIVE (E)						
	2					
UNIVERSITY REQUIREMENTS (W)	BLHW 2792 INTEGRITY AND ANTICORRUPTION		BLLW 3162 ENGLISH FOR PROFESSIONAL INTERACTION			
CREDIT HOUR SEMESTER			2			
TOTAL CREDIT HOUR SEMESTER	9		11		6	

TYPE COURSE	YEAR 4 SEMESTER 1		YEAR 4 SEMESTER 2		YEAR 4 SEMESTER 3/ SHORT SEMESTER	
COMMON CORE & PROGRAM CORE (P)	BERN 2143 ENGINEERING STATISTICS	SEMESTER BREAK	BELP 4853 ENERGY UTILIZATION AND CONSERVATION	SEMESTER BREAK	BELU 3695 INDUSTRIAL TRAINING	SEMESTER BREAK
	BELC 3553 EMBEDDED SYSTEM		BELE 3653 ELECTRICAL DRIVES			
	BELP 3673 POWER SYSTEMS ANALYSIS		BMIU 3213 ENGINEERING ECONOMY AND MANAGEMENT			
	BELU 2431 ELECTRICAL ENGINEERING LABORATORY II		BELG 3661 INTEGRATED DESIGN PROJECT 1			
CREDIT HOUR SEMESTER	10		10		5	
ELECTIVE (E)						
UNIVERSITY REQUIREMENTS (W)						
CREDIT HOUR SEMESTER						
TOTAL CREDIT HOUR SEMESTER	10		10		5	

TYPE COURSE	YEAR 5					
	SEMESTER 1	SEMESTER BREAK	SEMESTER 2	SEMESTER BREAK	SEMESTER 3/ SHORT SEMESTER	SEMESTER BREAK
COMMON CORE & PROGRAM CORE (P)	BELU 4861 ENGINEERING SEMINAR		BELU 4792 FINAL YEAR PROJECT I		BELP 4843 RENEWABLE ENERGY	
	BELP 3693 HIGH VOLTAGE ENGINEERING		BELU4322 ENGINEER AND SOCIETY			
	BELG 4763 INTEGRATED DESIGN PROJECT II					
	BELU 3551 ELECTRICAL ENGINEERING LABORATORY III					
CREDIT HOUR SEMESTER	8		7		3	
ELECTIVE (E)			BELX XXX3 ELECTIVE I (PROGRAM)		BELX XXX3 ELECTIVE II (PROGRAM)	
					3	
UNIVERSITY REQUIREMENTS (W)	BTMW 4012 TECHNOLOGY ENTERPRENEURSHIP					
CREDIT HOUR SEMESTER	2					
TOTAL CREDIT HOUR SEMESTER	10		7		6	

TYPE COURSE	YEAR 6	
	SEMESTER 1	
COMMON CORE & PROGRAM CORE (P)	BELU 4894 FINAL YEAR PROJECT II	
CREDIT HOUR SEMESTER	4	
ELECTIVE (E)	BELX XXX3 ELECTIVE III (PROGRAM)	
	3	
UNIVERSITY REQUIREMENTS (W)		
CREDIT HOUR SEMESTER		
TOTAL CREDIT HOUR SEMESTER	7	135

LIST OF ELECTIVE COURSES (PROGRAMME AND UNIVERSITY)

i. CHOOSE THREE (3) COURSES FROM ELECTIVE PROGRAMME ii. CHOOSE ONE (1) COURSE FROM THIRD LANGUAGE						
ELECTIVE PROGRAMME	INDUSTRIAL POWER	BELP 3683 DISTRIBUTION SYSTEM DESIGN	BELP 4873 POWER SYSTEM PROTECTION			
	CONTROL, INSTRUMENTATION & AUTOMATION	BELC 3673 INDUSTRIAL CONTROL AND AUTOMATION	BELC 4683 DIGITAL CONTROL SYSTEMS	BELC 4743 INTELLIGENT CONTROL SYSTEMS	BELM 4863 INDUSTRIAL ROBOTICS	BELC 4883 PLC AND INDUSTRIAL AUTOMATION
	POWER ELECTRONICS & DRIVES	BELE 3663 POWER ELECTRONICS SYSTEM	BELE 3673 INDUSTRIAL POWER ELECTRONICS	BELE 4763 SPECIAL MACHINES	BELE 4873 ELECTRIC MACHINE DESIGN	
THIRD LANGUAGE	THIRD LANGUAGE	BLLW 1222 MANDARIN LANGUAGE 1	BLLW 1242 KOREAN LANGUAGE 1	BLLW 1212 ARABIC LANGUAGE 1	BLLW 1252 GERMAN LANGUAGE 1	BLLW 1312 JAPANESE LANGUAGE 1

LIST OF UNIVERSITY COMPULSORY COURSES FOR INTERNATIONAL STUDENTS ONLY

CODE	COURSE	CATEGORY	CREDIT HOUR	PRE- REQUISITE	ATTEMPT
BLLW 1172	COMMUNICATIVE MALAY LANGUAGE I	W	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	W	2		SEMESTER 2
BTMW4012	TECHNOLOGY ENTREPRENEURSHIP	W	2		SEMESTER 8
TOTAL CREDITS			18	18(W)	

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	(UNIVERSITY)	W	2		
	BKKX 1XX1	CO-CURRICULUM I	W	1		
	BMIG 1313	ENGINEERING MATHEMATICS 1	P	3		
	BELU 1123	ELECTRICAL CIRCUIT I	P	3		
	BITG 1233	COMPUTER PROGRAMMING	P	3		
	BMKG 1132	ENGINEERING GRAPHICS ND CAD	P	2		
	BELU 1131	ENGINEERING PRACTICE I	P	1		
			TOTAL	15		
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		
	BELG 1413	DIGITAL ELECTRONICS	P	3		
	BELG 1233	PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT	P	3		
	BELE 1233	ELECTRONICS DEVICES	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		
	BLHW 2792	INTEGRITY AND ANTI-CORRUPTION	W	2		
	BELU 2333	ELECTRICAL CIRCUIT II	P	3		BELU 1123
	BELE 2333	ANALOGUE ELECTRONICS	P	3		BELE 1123
	BELC 2433	SIGNALS & SYSTEMS	P	3		
	BELU 2331	ELECTRICAL ENGINEERING LABORATORY I	P	1		
			TOTAL	17		
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		
	BMKG 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 3553	EMBEDDED SYSTEMS	P	3		
	BELE 3543	POWER ELECTRONICS	P	3		
	BELP 3553	POWER SYSTEMS ENGINEERING	P	3		
			TOTAL	17		
SEMESTER 6	BELP 3673	POWER SYSTEM ANALYSIS	W	3		BELP 3553
	BELE 3653	ELECTRICAL DRIVES	P	3		BELE 3533
	BELC 3623	CONTROL SYSTEMS DESIGN	P	3		
	BELP 3693	HIGH VOLTAGE ENGINEERING	P	3		
	BELG 3661	INTEGRATED DESIGN PROJECT 1	P	1		
	BELU 3551	ELECTRICAL ENGINEERING LABORATORY III	P	1		
	BMIU 3213	ENGINEERING ECONOMIC AND MANAGEMENT	P	3		
			TOTAL	17		
SPECIAL SEMESTER	BELU 3695	INDUSTRIAL TRAINING	P	5		
			TOTAL	5		
SEMESTER 7	BELP 4853	ENERGY UTILIZATION AND CONSERVATION	P	3		
	BELU 4861	ENGINEERING SEMINAR	P	1		
	BELU 4792	FINAL YEAR PROJECT I	P	2		
	BXXB 4763	INTEGRATED DESIGN PROJECT 2	P	3		BELG 3661
	BELX 4XX3	ELECTIVE I (PROGRAMME)	E	3		
	BELX XXX3	ELECTIVE II (PROGRAM)	E	3		
			TOTAL	15		
SEMESTER 8	BTMW4012	TECHNOLOGY ENTREPRENEURSHIP	W	2		
	BELU 4322	ENGINEER AND SOCIETY	P	2		
	BELU 4894	FINAL YEAR PROJECT II	P	4		BELU 4792
	BELP 4843	RENEWABLE ENERGY	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		
		BELC 4883	PLC AND INDUSTRIAL AUTOMATION	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		
	BACHELOR'S-MASTER'S INTEGRATION	BELP 5123	ELECTRICAL POWER SYSTEM	3		
		BELP 5153	INSULATION COORDINATION & DIAGNOSTIC TESTING	3		
		BELP 5233	SUSTAINABLE ENERGY AND DISTRIBUTED GENERATION	3		
		BELE 5163	ENERGY CONVERSION	3		
		BELE 5143	ADVANCED ELECTRICAL MACHINES AND DRIVES	3		
		BELC 5133	MODERN CONTROL DESIGN	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		

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
	BELU 1123	ELCTRICALCIRCUIT I	42	5.5			67.5	5	120
	BMKG 1132	ENGINEERING GRAPHICS AND CAD	28	3.25			45.25	3.5	80
	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
	BELG 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
	BELE 1233	ELECTRONICS DEVICES	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
	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
	BLHW 2792	INTEGRITY AND ANTI-CORRUPTION	22	3		6	45.5	3.5	80

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
	BMKG 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 3553	EMBEDDED SYSTEMS	36	5.5	6		67.5	5	120
	BELE 3543	POWER ELECTRONICS	42	5.5			67.5	5	120
	BELP 3553	POWER SYSTEMS ENGINEERING	42	5.5			67.5	5	120
6	BELP 3673	POWER SYSTEM ANALYSIS	42	5.5			67.5	5	120
	BELE 3653	ELECTRICAL DRIVES	33	5.5		9	67.5	5	120
	BELC 3623	CONTROL SYSTEMS DESIGN	42	5.5			67.5	5	120
	BELP 3693	HIGH VOLTAGE ENGINEERING	42	5.5			67.5	5	120
	BELG 3661	INTEGRATED DESIGN PROJECT 1					35	5	40
	BELU 3551	ELECTRICAL ENGINEERING LABORATORY III			20		18	2	40
	BMIU 3213	ENGINEERING ECONOMIC AND MANAGEMENT							
Special Semester	BELU 3695	INDUSTRIAL TRAINING					200		200
7	BELP 4853	ENERGY UTILIZATION AND CONSERVATION	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
	BXXB 4763	INTEGRATED DESIGN PROJECT	1			41	73	5	120
	BELX 4XX3	ELECTIVE I (PROGRAMME)	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
	BELU 4322	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 4843	RENEWABLE ENERGY	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.

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
The primary goal of this course is to familiarize students with the fundamental principles of signal and system analysis in both, time and frequency domains. The course covers various topics, including the basic properties of continuous-time and discrete-time signals, signal processing through linear time-invariant (LTI) systems, convolution techniques, Fourier series, Fourier transform and z-transform. Importantly, this course will assist as a foundational element for students pursuing studies across various engineering disciplines, such as control systems, digital signal processing, communications, circuit design, and etc.

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 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 3553
EMBEDDED SYSTEM

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the architecture of microprocessor-based systems, including their operation, interfacing circuitry, and supporting components.
2. Apply the microprocessor instruction set operation using any suitable programming language.
3. Design memory and peripheral device interface.
4. Design and develop, simulate and construct an embedded system solution and analyze the overall design performances.
5. Present in oral and the technical report for the microprocessor-based system project.
6. Demonstrate the ability to work in a team for the microprocessor-based system project.

Synopsis
This course focuses on hardware and microprocessor handling, types of microprocessor systems, system handlers, and timing diagrams. The curriculum covers the concepts of microprocessor software architecture, programming, programming languages, basic instructions, data transfer instructions, program control, subroutines, arithmetic and logic operations. Emphasis is placed on programming techniques, designing a microcomputer system, and interfacing with memory and I/O devices. Students will experience a Problem-Based Learning (PBL) approach in this course, introducing them to a Problem Statement for Project-Based Learning (PO-PBL).

References

1. Donald Norris, Programming with STM32: Getting Started with the Nucleo Board and C/C++, McGraw-Hill Education TAB, 2018.
2. Dogan Ibrahim, “Nucleo Boards Programming with the STM32CubeIDE”, Elektor, 2020
3. Muhammad Ali Mazidi, “STM32 Arm Programming for Embedded Systems ”, MicroDigitalEd, 2018.
4. John Catsoulis, “Embedded Systems Vol 2: Real-Time Interfacing to ARM Cortex-M Microcontroller-4th ed.”, Jonathan W. Valvano, 2014
5. Jason D. Bakos, “Embedded System: ARM programming and Optimization”, Morgan Kaufmann Publication, 2016

BELC 3683
CONTROL SYSTEMS DESIGN

Learning Outcomes

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

1. Design controllers/compensators for control systems in time domain.
2. Design controllers/compensators for control systems in frequency domain.
3. Design a controller and observer for a state variable feedback systems.

Synopsis

The course commences by introducing the simplest gain controller through root locus techniques (time domain), highlighting this controller’s constraints. Subsequently, PI, PD, PID, lag, lead, and lag-lead compensators are presented to address the limitations of the gain controller in improving steady-state and transient response using root locus design techniques. The effectiveness of these compensators is demonstrated through MATLAB and physical realization. Other than using the root locus design techniques, students will also be familiarized with alternative design approaches such as Ziegler-Nichols for PID controller and Bode plot technique (frequency domain) for lag-lead compensators. The effectiveness of these compensators is demonstrated through MATLAB and physical realization. In state variable feedback systems, students will explore into the examination of controllability and observability of LTI systems in state space form. The design process involves constructing a state feedback controller with a full-state feedback observer, utilizing the pole placement approach. To reinforce comprehension, various case studies illustrating the practical applications of controllers will be explored.

References

1. Dorf, R.C., Bishop R.H., Modern Control Systems, 12th Edition, Pearson, 2014.
2. Ogata, K., Modern Control Engineering, 5th Edition, Pearson, 2010.

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.

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.

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 equipment 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.

BELE 1233
ELECTRONIC DEVICES

Learning Outcomes

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

1. Describe the material classification, atomic structures and the properties of semiconductor materials.
2. Apply the basic operation of diode and its applications as rectifier, clipper and clamper circuits.
3. Analyse the common biasing circuits for BJT and FET applications for linear operation.
4. Analyze the operation of open loop and closed loop op-amp applications.

Synopsis

This course develops the basic concepts necessary to understand the fundamentals of semiconductor materials and devices. The course starts with the introduction to semiconductor materials such as atomic structure, covalent bonding, ionization, conduction in semiconductor, p-n-type and p-n junction biasing. It will emphasis on semiconductor-based devices and applications such as diode (rectifier, clipper, clamper), BJT (common base, common collector and common emitter configurations), FET (JFET and MOSFET characteristics and biasing) and op-amp (comparator, inverting, non-inverting, summing, differential, integral and voltage regulators).

References

1. Robert Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson, 11th Ed. (2014)
2. Thomas L. Floyd, Electronic Devices, Pearson, 9th Ed. (2014)
3. Jimmie J. Cathey, Schaum's Outline of Electronic Devices and Circuits, McGraw-Hill, 2nd. Ed. (2002)

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 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 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 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 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 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 begins 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 Fundamental. Eleventh Edition, Prentice Hall, 2015.

2. Tocci, Ronald; Widmer, Neal; Moss, Greg. Digital Systems, Global Edition, 2017.
3. Roger L. Tokheim. Digital Electronics, Principles and Applications. Eighth Edition, Mc Graw-Hill, 2013.

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.

BELG 3661
INTEGRATED DESIGN PROJECT I

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Conceptualize design solutions of an electrical engineering design to a defined end state.
2. Evaluate sustainability development impact towards the context of engineers and the world.
3. Function effectively as an individual, and as a team member or a leader.
4. Communicate effectively on complex electrical engineering activities through reports and presentation.
5. Implement project management and/or economic feasibility study, as well as sustainability impact of the proposed design solution.
6. Engage in independent and lifelong learning.

Synopsis
This course introduces, educate and develop students to integrate their technical knowledge and generic skills gained in their first two years of study. It consists of knowledge and flow of a design project from sketching, design in necessary software. The translation of the idea into a professional drawing is also covered in this course. In the end of sessions, students are expected to be able to identify the complex problem to be solved, plan the solution for the problem and eventually execute the project. The course includes complex electrical and electronics engineering problems and proposal of design systems, components or processes that integrate core areas. Students will be divided into small groups of three or four members to conduct project that integrates multi-disciplinary areas. Students are required to produce product which considers environmental safety and sustainability.

References
1. Dieter, G.E. & Schmidt, L.C., Engineering Design, 5th Edition, McGraw Hill, 2013.
2. Ulrich, K.T. & Eppinger, S.D., Product Design and Development, 4th Edition, McGraw Hill, 2008.
3. John P. Bentley, Principles of Measurement Systems, 4th Ed., Prentice Hall, 2005.
4. Cross, Nigel, Engineering Design Methods, Wiley, 2010.
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.

BELG 4763
INTEGRATED DESIGN PROJECT II

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Perform technical investigation and analysis of the proposed design.
2. Conduct investigation using research methods.
3. Utilize modern engineering and IT tools in facilitating solution to complex electrical engineering problems with an understanding of the limitations.
4. Evaluate sustainability development impact towards the context of engineers and the world.
5. Apply ethical principles, standard and professional engineering code of ethics.
6. Function effectively as an individual, and as a team member or a leader.

7. Communicate effectively on complex electrical engineering activities through reports and presentation.
8. Implement project management and/or economic feasibility study, as well as sustainability impact of the proposed design solution.
9. Engage in independent and lifelong learning.

Synopsis
Electrical Engineering Project is Integrated 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 subject 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 disciplines such as (but not limited to) circuit analysis and design, 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 disciplines of electrical engineering knowledge.

References
1. Dieter, G.E. & Schmidt, L.C., Engineering Design, 5th Edition, McGraw Hill, 2013.
2. Ulrich, K.T. & Eppinger, S.D., Product Design and Development, 4th Edition, McGraw Hill, 2008.
3. John P. Bentley, Principles of Measurement Systems, 4th Ed., Prentice Hall, 2005.
4. Cross, Nigel, Engineering Design Methods, Wiley, 2010.
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 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.

BELP 3553
POWER SYSTEMS ENGINEERING

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe energy source and analyse synchronous generation model.
2. Analyse the steady state operation of transmission line design.
3. Examine the load characteristics for the electrical distribution system.
4. Apply the principles of system protection in electrical distribution system.

Synopsis
This course covers the generation model, transmission line model, high voltage substation, and power protection systems as a fundamental understanding of electrical power systems. The course intends to give the students the required knowledge regarding power generation and transmission. It focuses on the common types of generation system, power plants economics and generation cost analysis. It also covers power generation control, transmission line steady-state operation as well as equipment design, and substation technology including protection system.

References
1. Hadi Saadat, Power System Analysis, International 3rd ed, McGraw Hill, 2011.

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

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, International3rd 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 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.

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 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.

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 4332
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 the environment.

Synopsis

This course will discuss issues that are related to the engineering profession. It will cover topics such as personal ethics, professional ethics, code of ethics, ethics dealing with human relations, professionalism, BEM, IEM, regulations on professional conduct, route to professional status, engineers as an employee or employer, decision making, ethical considerations, competence of practicing engineering, safety issues, and related laws, health issues in the profession, safety and health management systems, accountability, general liability, engineer's legal liability specified in contract law, the environment, sustainability, etc. These issues will be examined and applied on daily contextual situations based on the existing laws, manuals, guidelines and case studies.

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.

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.

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.

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 (FTKM)
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.

BMKG 1132
ENGINEERING GRAPHICS AND COMPUTER AIDED DESIGN

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Acquire and apply different mechanical engineering drawing format and types.
2. Produce mechanical engineering drawings using Computer Aided Design (CAD) software based on given problem.
3. Communicate effectively through the applications of mechanical engineering drawing.

Synopsis
The course will provide students with an understanding of the importance of engineering drawing as a communication tool among engineers. Student will be exposed to the engineering drawing fundamentals of manual sketching, geometric dimensioning and tolerances, projection theory, section views and engineering drawings. Students will develop visualization skills by constructing technical drawings using manual sketches and computer aided Design (cad) software. The course consists of both lecture and practical session where students will be guided in presenting and interpreting engineering drawings correctly.

References
1. Shamsul Anuar Shamsudin et. al, Asas Lukisan Kejuruteraan & CAD, Penerbit Universiti Teknikal Malaysia Melaka, Melaka, 2020.
2. Mohd Rizal Alkahari Et. Al., Modul Lukisan Berbantu Komputer, Penerbit Universiti Teknikal Malaysia Melaka, 2009.
3. Earle H.,J, Graphics Technology, Addison-Wesley Publication Company Inc., 1995.
4. Khairul Anuar Hanafiah, Lukisan Berbantu Komputer, Penerbit Universiti Teknologi Malaysia, 1999.
5. Giesecke, F. E. Et. Al., Technical Drawing, 11th Ed., Prentice Hall, New York, 1999.

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.

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 ENTERPRENEURSHIP

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.

BLLW 1142
ENGLISH FOR ACADEMIC PURPOSE

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.

Synopsis

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

References

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

BLLW 2152
ACADEMIC WRITING

Learning Outcomes

Upon completion of this course, the student 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.
Pre-requisite: BLLW 1142

References
1. De Chazal, E., & Rogers, L., 2012, Oxford EAP: A Course In English For Academic Purposes. Oxford: Oxford University Press.
2. Hancock, M. & McDonald, A., 2010, English Result Upper-Intermediate. 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
LEARNING OUTCOMES

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Understand extended speech, lectures and follow even complex lines of argument in academic and professional contexts.
2. Interact spontaneously in discussions using communication strategies.
3. Present clear, detailed descriptions and viewpoints on a wide range of issues.

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 129 with relevant examples in public speaking and online assessments. They are also exposed to the rudiments of grammar implicitly via the communicative activities.
Pre-requisite: BLLW 2152

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.

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'S - MASTER'S INTEGRATION

BELC 5133
MODERN CONTROL DESIGN

Learning Outcomes

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

1. Analyse the responses of a system in the time and frequency domains and the design of a classical control system.
2. Design the state-variable feedback controllers and observers.
3. Formulate the optimal control system.
4. Perform the system sensitivity test and design a robust control system.

Synopsis

This course begins with a review of classical control theory that covers the time-domain and frequency-domain analysis and classical controller design. Then, the design of the state feedback controllers and observers is introduced. In optimal control design, the optimal control problem is formulated at the beginning, and then the student is taught about typical types of optimal control performance. As the last chapter of this course, the robust control system is introduced. The system sensitivity and analysis of the robust control system are explained. Then the design of robust control system, robust PID-controlled system, and pseudo-quantitative feedback control system are designed and compared. Each of the chapters ends with the design examples that were solved by using Matlab and Simulink.

References

1. Katshuhiko Ogata, Modern Control Engineering, Prentice Hall, Fifth Ed., 2010.
2. Richard C. Dorf, Robert H. Bishop, Modern Control Systems, Prentice Hall, Thirteen Ed., 2017.
3. F. Golnaraghi, B. C. Kuo, Automatic Control System, Prentice Hall, Ninth Ed., 2010.
4. Graham C. Goodwin, Stefan F. Graebe, Mario E. Salqado, Control System Design, Prentice Hall, 2001.
5. Nise, S. Norman, Control Systems Engineering, 6th Ed., Wiley 2015.

BELE 5163
ENERGY CONVERSION

Learning Outcomes

1. Assess the concept of rectifiers, DC-DC converters and inverters in industrial applications.
2. Analyze the operation and evaluate the performance of rectifiers, DC-DC converters and inverters.
3. Simulate rectifiers, DC-DC converters and inverters circuits using engineering simulation software tools.

Synopsis

Power electronics circuits are increasingly becoming an important component in various application from machine and drives, renewable energy and distributed generation systems. In this course, the use of power electronics devices such as rectifier, dc/dc converter and inverter for energy conversion which includes the device topology, modelling, control and switching technique, as well as power quality improvement are investigated. Students are also exposed to the use of engineering tool such as Matlab Simulink to analyze and evaluate the energy conversion system performance.

References

1. M.H.Rashid, Power Electronics Circuits, Devices And Applications, Fourth Edition, Pearson Ed. International, 2013.
2. Bimal K. Bose, Power Electronics in Renewable Energy Systems and Smart Grid: Technology and Applications, John Wiley & Sons, 2019.

3. Andrzej M.Trzynadlowski, Introduction To Modern Power Electronics, Third Edition, Wiley, 2016.
4. Teuvo Suntio, Tuomas Messo, Power Electronics In Renewable Energy Systems, MDPI, 2019.
5. Issa Batarseh, Ahmad Harb, "Power Electronics, Circuit Analysis and Design", 2nd Ed., Springer, 2017. 6. Jean Pollefliet,"Power Electronics, Switches and Converters", Academic Press, 2018

BELE 5143
ADVANCED ELECTRICAL MACHINE & DRIVE

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Assess the characteristics and dynamic modelling of electrical machine and drives.
2. Design and modify control strategy to obtain high AC drive performances.
3. Analyze and evaluate some performance parameters of AC drives.

Synopsis
This course will discuss the construction and design of ac machines, development of dynamic model of AC motors, e.g. induction motor and BLDC motor, e.g. Field Oriented Control (FOC) and Direct Torque Control (DTC). Students will be exposed to learn and analyse using modern controller board, control design some control strategies for high performances of AC motor drives

References
1. Bose, Bimal K. Modern Power Electronics and AC Drives. 1st ed., Prentice Hall, 2002.
2. Haitham Abu-Rud, Atif Iqbal, Jaroslaw Guzinski, High Performance Control of AC Drives with MATLAB/Simulink Models, 2nd. Ed., 2012, Wiley
3. Vas, Peter. Sensorless Vector and Direct Torque Control. 1st ed., Oxford Science Publications, 1998.
4. Trzynadlowski, Andrzej M. The Field Orientation Principle of Motors. 1st ed., Kluwer Academic Publishers, 1994.
5. Hughes, Austin, and Bill Drury. Electric Motors and Drives: Fundamentals, Types and Applications. 5th ed., Newnes, 2019.

BELP 5123
ELECTRICAL POWER SYSTEM

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Utilize transmission line and load models to evaluate the performance of electrical power system.
2. Evaluate the economic load dispatch and unit commitment in electrical power system.
3. Analyze the concept of stability studies in power system e.g. dynamic stability and transient stability.

Synopsis
This subject covers the current overview of power system network, calculation of parameters for long transmission line model, modelling of power system loads and power flow analysis. Fundamental principles of unit commitment and economic load dispatch operations also are discussed. The course also covers the basic principles of power system stability such as power system steady-state, and dynamic stability.

References
1. Allen J. Wood, Bruce F. Wollenberg, Power Generation, Operation and Control, 3rd Ed. Wiley, 2014.
2. John J. Grainger, W.D. Stevenson, Power System Analysis, Mcgraw-Hill, 2016. 5.0
3. H. Saadat, Power System Analysis: PSA Publishing, 2010.

4. Jd. Glover, T. Overbye, And M. S. Sarma, Power System Analysis and Design: Cengage Learning, 2016.
5. Kothari, D. P. and Nagrath, I. J., Modern Power Systems Analysis, Mcgraw-Hill, 3rd Ed. 2003.

BELP 5153
INSULATION COORDINATION AND DIAGNOSTIC TESTING

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyse and discuss the conduction and breakdown theory in gas, solid and liquid dielectrics.
2. Evaluate the insulation performance of material and electrical apparatus based on high voltage testing and diagnostic techniques.
3. Analyze the overvoltage phenomenon in electric power system and appraise the insulation performance using insulation coordination approaches.

Synopsis
This course is intended 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, High Voltage Engineering, 6th Ed, Mc Grawhill 2013.
2. E. Kuffel, W.S Zaeng & J. Kuffel, High Voltage Engineering Fundamentals, Newnes, 2000.
3. Dieter Kind & Kurt Faser, High Voltage Test Techniques, Newnes, 2001.
4. A. Ravindra, M. Wolfgang, High voltage and electrical insulation engineering, Wiley, 2011.
5. A. Kchler, High Voltage Engineering Fundamentals, Technology, Applications, Springer 2013.

BELP 5233
SUSTAINABLE ENERGY AND DISTRIBUTED GENERATION

Learning Outcomes
1. Elaborate on the evolving sustainable energy policies towards the sustainable development goal.
2. Evaluate the fundamentals and development of sustainable energy technologies.
3. Design a comprehensive grid-connected PV system including performance analysis.
4. Investigate the impact of distributed generation and energy management to grid system and microgrid environment.

Synopsis
This subject will discuss about the evolving sustainable energy and distributed generation in conventional electrical grids and advanced grid system. The concepts behind the sustainable electricity as well as the renewable energy in low carbon network will be introduced. The latest technology of distributed generation and energy management will be explored and its impact on the integrated power system and microgrid will be analysed. Finally, comprehensive model of grid-connected PV system including performance and economic analysis will also be exposed.

References
1. Stuart Borlase, Smart Grids: Advanced Technologies and Solutions, The Electric Power Engineering Series, 2nd Ed., Crc Press 2018.

2. R.A. Ufa Et.Al, A Review On Distributed Generation Impacts On Electric Power System, International Journal Of Hydrogen Energy, Volume 47, Issue 47, 2022.
3. Ofelia, A, Icaro B. M., Carmen L. T. B. and Claudia M., Beyond Clean and Affordable Transition Pathways: A Review of Issues and Strategies to Sustainable Energy Supply, International Journal of Electrical Power & Energy Systems, Volume 155, Part A, 2024.
4. Khan, M.R.; Haider, Z.M.; Malik, F.H.; Almasoudi, F.M.; Alatawi, K.S.S.; Bhutta, M.S. A Comprehensive Review of Microgrid Energy Management Strategies Considering Electric Vehicles, Energy Storage Systems, And Ai Techniques. Processes 2024.
5. D.P Kothari, Kc Singal, Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, Prentice Hall of India, 2015.

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)		16	11.85%
Co-Curriculum (W)		2	1.50%
Core Course (P)	Programme	93	68.89%
	Engineering Seminar	1	0.74%
	Industrial Training	5	3.70%
	Final Year Project	6	4.44%
Elective (E)	Programme	12	8.89%
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

COURSE TYPE	YEAR 1			LONG SEMESTER BREAK	YEAR 2			LONG SEMESTER BREAK
	SEMESTER 1	SEMESTER BREAK	SEMESTER 2		SEMESTER 3	SEMESTER BREAK	SEMESTER 4	
COMMON CORE & PROGRAM CORE (P)	BMIG1313 ENGINEERING MATHEMATICS 1		BMKC1013 DIFFERENTIAL EQUATION		BELG2443 ENGINEERING MATHEMATICS 2		BERN2143 ENGINEERING STATISTICS	
	BELM2342 INTRODUCTION TO MECHATRONICS SYSTEMS		BMIG1213 ENGINEERING MATERIAL		BELC2453 COMMUNICATION SYSTEMS		BELC2433 SIGNAL AND SYSTEMS	
	BELM1123 STATICS & MECHANICS OF MATERIAL		BELU1123 ELECTRICAL CIRCUIT 1		BELC2342 INTRODUCTION TO EMBEDDED SYSTEM		BELU2333 ELECTRICAL CIRCUIT 2	
	BELG1413 DIGITAL ELECTRONICS		BELM1243 DYNAMICS AND VIBRATION		BELE2343 PRINCIPLE OF ANALOGUE ELECTRONICS		BELM2433 THEORY OF MACHINES AND MECHANISM	
	BITG1233 COMPUTER PROGRAMMING		BELM2321 MECHANICAL ENGINEERING LABORATORY		BELG1233 PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT		BMKU1313 ENGINEERING GRAPHICS & CAD	
					BELB1231 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY			
CREDIT HOUR SEMESTER	14		13		15		15	
ELECTIVE (E)								
CREDIT HOUR SEMESTER								
UNIVERSITY REQUIREMENT (W)	#BLLW 1XX2 ELECTIVE I (UNIVERSITY) THIRD LANGUAGE		BKKXKKK1 CO-CURRICULUM II		BLLW1762 PHILOSOPHY AND CURRENT ISSUES		BLLW2452 ACADEMIC WRITING	
	BKKXXXX1 CO-CURRICULUM I		BLLW 1142 ENGLISH FOR ACADEMIC PURPOSE					
CREDIT HOUR SEMESTER	3		3		2		2	
TOTAL CREDIT HOUR	17		16		17		17	

COURSE TYPE	YEAR 3				YEAR 4			
	SEMESTER 5	SEMESTER BREAK	SEMESTER 6	SPECIAL SEMESTER	SEMESTER 7	SEMESTER BREAK	SEMESTER 8	
COMMON CORE & PROGRAM CORE (P)	BMIG3213 ENGINEERING ECONOMY AND MANAGEMENT		BELM3653 INTEGRATED DESIGN PROJECT	BELU3695 INDUSTRIAL TRAINING	BELU4792 FINAL YEAR PROJECT 1		BELU4894 FINAL YEAR PROJECT 2	
	BELC3533 INTRODUCTION TO CONTROL SYSTEM		BELM3543 ELECTROMECHANICAL SYSTEM		BELU4861 ENGINEERING SEMINAR		BELU4322 ENGINEER AND SOCIETY	
	BELM3453 MICROCONTROLLER TECHNOLOGY		BELM3643 THERMOFLUID		BELM4723 HYDRAULIC AND PNEUMATIC SYSTEMS			
	BELG2433 ELECTRICAL SYSTEMS		BELC4753 PLC AND AUTOMATION		BELM4763 ROBOTICS			
	BELM3562 MECHATRONICS SYSTEM DESIGN				BELM4741 MECHATRONICS ENINEERING LABORATORY			
	BELC2421 CONTROL SYSTEM ENGINEERING LABORATORY							
CREDIT HOUR SEMESTER	15		12	5	10		6	105
ELECTIVE (E)			BXXX XXX3 ELECTIVE I (PROGRAM)		BXXX XXX3 ELECTIVE II (PROGRAM)		BXXX XXX3 ELECTIVE III (PROGRAM)	
							BXXX XXX3 ELECTIVE IV (PROGRAM)	
CREDIT HOUR SEMESTER			3		3		6	12
UNIVERSITY REQUIREMENT (W)	BLLW3462 ENGLISH FOR PROFESSIONAL INTERACTION		# BLHW2772 APPRECIATION OF ETHICS AND CIVILISATION OR *BLHW2752 MALAYSIAN CULTURE		BLHW2792 INTEGRITY AND ANTI CORRUPTION		BTMW4012 TECHNOLOGY ENTREPRENEURSHIP	
CREDIT HOUR SEMESTER	2		2		2		2	18
TOTAL CREDIT HOUR	17		17	5	15		14	135

ELECTIVE (PROGRAM) CHOOSE FOUR (4) COURSES FROM ANY CLUSTER WITH EXCEPTON IN ISMS				
INTEGRASI SARJANA MUDA - SARJANA (ISMS)	**AUTOMATION**	**INTELLIGENCE**	**CONNECTIVITY**	**TECHNOPRENEURSHIP**
BELM 5233 SYSTEM DYNAMICS	BELC 4643 SMART MANUFACTURING	BELC 4653 MODERN CONTROL ENGINEERING	BELC 4633 INDUSTRIAL CONTROL NETWORK	BTMT 3323 CONTEMPORARY BUSINESS MANAGEMENT
BELC 5133 MODERN CONTROL DESIGN	BELM 4743 AUTONOMOUS MOBILITY	BELC 4673 ARTIFICIAL INTELLIGENCE FOR ENGINEERS	BELM 4733 TELEROBOTIC	BTMT 3263 BUSINESS FINANCE
BELE 5143 ADVANCED ELECTRICAL MACHINE & DRIVE	BELC 4843 ADVANCED INDUSTRIAL AUTOMATION	BELM 4733 DIGITAL IMAGE PROCESSING	BELC 4833 ADVANCED SENSORS	BTMP 3383 HIGH TECHNOLOGY MARKETING STRATEGY
BELM 5113 ADVANCED MECHATRONICS SYSTEM DESIGN	BELM 4843 THERMAL & FLUID MACHINERY	BELM 4753 BIO MECHATRONICS	BITI 2513 INTRODUCTION TO DATA SCIENCE	BTMP 2243 STRATEGIC INNOVATION MANAGEMENT
BELM 5123 APPLIED SYSTEM MODELING AND SIMULATION	BELM 4853 INDUSTRIAL ROBOTICS	BELC 4683 DIGITAL CONTROL SYSTEM	BELM 4883 INDUSTRIAL MACHINE VISION	

ELECTIVE (UNIVERSITY) CHOOSE ONE (1) COURSE FROM ANY OF THIRD LANGUAGE COURSES			
THIRD LANGUAGE	BLLW 1222 BAHASA MANDARIN 1	BLLW 1242 BAHASA KOREA 1	BLLW 1212 BAHASA ARAB 1
	BLLW 1232 BAHASA JEPUN 1	*BLLW 1172 BAHASA MELAYU KOMUNIKASI 1	BLLW 1252 BAHASA JERMAN 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 NAME	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 1	BLLW1XX2	THIRD LANGUAGE / MALAY COMMUNICATION*	W	2	
	BKKXXXX1	CO-CURRICULUM I	W	1	
	BMIG1313	ENGINEERING MATHEMATICS I	P	3	
	BELM2342	INTRODUCTION TO MECHATRONICS SYSTEM	P	2	
	BELG 1413	DIGITAL ELECTRONICS	P	3	
	BELM 1123	STATICS & MECHANICS OF MATERIAL	P	3	
	BITG 1233	COMPUTER PROGRAMMING	P	3	
			TOTAL	**17**	
SEMESTER 2	BKKXXXX1	CO-CURRICULUM II	W	1	
	BLLW1142	ENGLISH FOR ACADEMIC PURPOSE	W	2	
	BMKC1013	DIFFERENTIAL EQUATIONS	P	3	
	BELM1243	DYNAMICS AND VIBRATION	P	3	BELM 1123
	BELU1123	ELECTRIC CIRCUIT I	P	3	
	BMIG1213	ENGINEERING MATERIALS	P	3	
	BELM2321	MECHANICAL ENGINEERING LABORATORY	P	1	
			TOTAL	**16**	
SEMESTER 3	BLLW1762	PHILOSOPHY AND CURRENT ISSUES	W	2	
	BELG2443	ENGINEERING MATHEMATICS II	P	3	
	BELC2453	COMMUNICATION SYSTEM	P	3	
	BELC2342	INTRODUCTION TO EMBEDDED SYSTEM	P	2	
	BELG1233	PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT	P	3	
	BELE2343	PRINCIPLE OF ANALOGUE ELECTRONICS	P	3	
	BELB1231	ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY	P	1	
			TOTAL	**17**	
SEMESTER 4	BLLW2452	ACADEMIC WRITING	W	2	BLLW 1142
	BERN2143	ENGINEERING STATISTICS	P	3	
	BELC2433	SIGNAL AND SYSTEMS	P	3	
	BELM2433	THEORY OF MACHINES AND MECHANISM	P	3	BELM1123
	BELU2333	ELECTRIC CIRCUIT II	P	3	BELU 1123
	BMKU 1313	ENGINEERING GRAPHICS AND CAD	P	3	
			TOTAL	**17**	

SEMESTER	CODE	COURSE NAME	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 5	BLLW3462	ENGLISH FOR PROFESSIONAL INTERACTION	W	2	BLLW 3462
	BMIG3212	ENGINEERING ECONOMY AND MANAGEMENT	P	3	
	BELM3562	MECHATRONICS SYSTEM DESIGN	P	2	
	BELM3453	MICROCONTROLLER TECHNOLOGY	P	3	
	BELG2433	ELECTRICAL SYSTEMS	P	3	
	BELC3533	INTRODUCTION TO CONTROL SYSTEM	P	3	
	BELC2421	CONTROL SYSTEM ENGINEERINGS LABORATORY	P	1	
			TOTAL	**17**	
SEMESTER 6	#BLHW 2772 OR	APPRECIATION OF ETHICS AND CIVILISATIONS OR	W	2	
	BELM3653	INTEGRATED DESIGN PROJECT	P	3	BELM 3562
	BELM3543	ELECTROMECHANICAL SYSTEMS	P	3	
	BELM3643	THERMOFLUIDS	P	3	
	BELC4753	PLC AND AUTOMATION	P	3	
	BXXX4XX3	ELECTIVE I (PROGRAM)	E	3	
			TOTAL	**17**	
SPECIAL SEMESTER	BELU3695	INDUSTRIAL TRAINING	P	5	
			TOTAL	**5**	
SEMESTER 7	BLLW2792	INTERGRITY AND ANTI CORRUPTION	W	2	
	BELU4861	ENGINEERING SEMINAR	P	1	
	BELU4792	FINAL YEAR PROJECT I	P	2	
	BELM4763	ROBOTICS	P	3	
	BELM4723	HYDRAULIC AND PNEUMATIC SYSTEMS	P	3	
	BELM4741	MECHATRONIC SYSTEM ENGINEERING LABORATORY	P	1	
	BXXXXXX3	ELECTIVE II (PROGRAM)	E	3	
			TOTAL	**15**	
SEMESTER 8	BTMW4012	TECHNOPRENEURSHIP	W	2	
	BELU4822	ENGINEER AND SOCIETY	P	2	
	BELU4894	FINAL YEAR PROJECT II	P	4	BELU 4792
	BXXXXXX3	ELECTIVE III (PROGRAM)	E	3	
	BXXXXXX3	ELECTIVE IV (PROGRAM)	E	3	
			TOTAL	**14**	

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

STUDENT LEARNING TIME (SLT) - BELM

SEMESTER	CODE	COURSE NAME	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	BLLW1XX2	THIRD LANGUAGE / MALAY COMMUNICATION*	22	3		6	45.5	3.5	80
	BKKXXXX1	CO-CURRICULUM I				16	22	2	40
	BMIG1313	ENGINEERING MATHEMATICS I	42	5.5			67.5	5	120
	BELM2342	INTRODUCTION TO MECHATRONICS SYSTEM	22	3		6	45.5	3.5	80
	BELG1413	DIGITAL ELECTRONICS	36	5.5		6	67.5	5	120
	BELM 1123	STATICS & MECHANICS OF MATERIAL	42	5.5			67.5	5	120
	BITG 1233	COMPUTER PROGRAMMING	28		28		59	5	120
2	BKKXXXX1	CO-CURRICULUM II				16	22	2	40
	BLLW1142	ENGLISH FOR ACADEMIC PURPOSE	22	3		6	45.5	3.5	80
	BMKC1013	DIFFERENTIAL EQUATIONS	42	5.5			67.5	5	120
	BELM1243	DYNAMICS AND VIBRATION	42	5.5			67.5	5	120
	BELU1123	ELECTRIC CIRCUIT I	42	5.5			67.5	5	120
	BMIG1213	ENGINEERING MATERIALS	42	5.5			67.5	5	120
	BELM2321	MECHANICAL ENGINEERING LABORATORY			20		18	2	40
3	BLLW1762	PHILOSOPHY AND CURRENT ISSUES	22	3		6	45.5	3.5	80
	BELG2443	ENGINEERING MATHEMATICS II	42	5.5			67.5	5	120
	BELC2453	COMMUNICATION SYSTEM	42	5.5			67.5	5	120
	BELC2342	INTRODUCTION TO EMBEDDED SYSTEM	22	3		6	45.5	3.5	80
	BELG1233	PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT	42	5.5			67.5	5	120
	BELE2343	PRINCIPLE OF ANALOGUE ELECTRONICS	42	5.5			67.5	5	120
	BELB1231	ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY			20		18	2	40

SEMESTER	CODE	COURSE NAME	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			
4	BLLW2452	ACADEMIC WRITING	22	3		6	45.5	3.5	80
	BERN2143	ENGINEERING STATISTICS	42	5.5			67.5	5	120
	BELC2433	SIGNAL AND SYSTEMS	42	5.5			67.5	5	120
	BELM2433	THEORY OF MACHINES AND MECHANISM	42	5.5			67.5	5	120
	BELU2333	ELECTRIC CIRCUIT II	42	5.5			67.5	5	120
	BMKU 1313	ENGINEERING GRAPHICS AND CAD	28		28		59	5	120
5	BLLW3462	ENGLISH FOR PROFESSIONAL INTERACTION	22	3		6	45.5	3.5	80
	BMIG3212	ENGINEERING ECONOMY AND MANAGEMENT	42	5.5		9	67.5	5	129
	BELM3562	MECHATRONICS SYSTEM DESIGN	22	5			48	5	80
	BELM3453	MICROCONTROLLER TECHNOLOGY	36	5.5		6	67.5	5	120
	BELG2433	ELECTRICAL SYSTEMS	42	5.5			67.5	5	120
	BELC3533	INTRODUCTION TO CONTROL SYSTEM	42	5.5			67.5	5	120
	BELC2421	CONTROL SYSTEM ENGINEERING LABORATORY			20		18	2	40
6	#BLHW 2772 OR *BLHW 2752	APPRECIATION OF ETHICS AND CIVILISATIONS OR MALAYSIAN CULTURE	22	3		6	45.5	3.5	80
	BELM3653	INTEGRATED DESIGN PROJECT	39		27	20	29	5	120
	BELM3543	ELECTROMECHANICAL SYSTEMS	42	5.5			67.5	5	120
	BELM3643	THERMOFLUIDS	42	5.5			67.5	5	120
	BELC4753	PLC AND AUTOMATION	36	5.5		6	67.5	5	120
	BXXX4XX3	ELECTIVE I (PROGRAM)	42	5.5			67.5	5	120
SPECIAL SEMESTER	BELU3695	INDUSTRIAL TRAINING					200		200

SEMESTER	CODE	COURSE NAME	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			
7	BLLW2792	INTERGRITY AND ANTI CORRUPTION	22	3		6	45.5	3.5	80
	BELU4861	ENGINEERING SEMINAR	14	6			18	2	40
	BELU4792	FINAL YEAR PROJECT I	3			6.5	67	3.5	80
	BELM4763	ROBOTICS	42	5.5			67.5	5	120
	BELM4723	HYDRAULIC AND PNEUMATIC SYSTEMS	36	5.5		6	67.5	5	120
	BELM4741	MECHATRONIC SYSTEM ENGINEERING LABORATORY			20		18	2	40
	BXXXXXX3	ELECTIVE II (PROGRAM)	42	5.5			67.5	5	120
8	BTMW4012	TECHNOLOGY ENTREPRENEURSHIP	22	3		6	45.5	3.5	80
	BELU4322	ENGINEER AND SOCIETY	22	3		6	45.5	3.5	80
	BELU4894	FINAL YEAR PROJECT II	4			7	141.75	7.25	160
	BXXXXXX3	ELECTIVE III (PROGRAM)	42	5.5			67.5	5	120
	BXXXXXX3	ELECTIVE IV (PROGRAM)	42	5.5			67.5	5	120

COURSE DETAILS FOR BACHELOR PROGRAMME (BELM)

PROGRAMME COURSES

SEMESTER 1

BMIG 1313
ENGINEERING MATHEMATICS 1
*Service course (FTKIP)

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. (PO1, WK2)
2. Solve mathematical problems that involve matrices, eigenvalues and eigenvector, complex numbers, interpolation, differentiation, integration, and vector- valued functions by using an appropriate technique. (PO1, WK2)
3. Apply the knowledge of engineering mathematics to deal with engineering problems. (PO1, WK2)

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 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.

BELM 2342
INTRODUCTION TO MECHATRONICS SYSTEM

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Explain basic concept and working principle of mechatronic systems. (PO1, WK4)
2. Demonstrate basic concept and working principles of mechatronic systems. (PO2, WK4)
3. Design basic mechatronic systems by selecting appropriate sensors, actuators, and control strategies, and integrating them effectively. (PO3, WK5)
4. Apply appropriate modern mechatronics tools with an understanding of the limitations. (PO5, WK2, WK6)

Synopsis
This course introduces the concept of mechatronic 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 meachanical 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 swtiches, solid-state switches, solenoids, D.C. motors, A.C. motors, stepper motors. Mathematical models, machanical 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, 7th ed., Prentice-Hall, 2018.
2. Dieter, G.E. & Schmidt, L.C., Engineering Design, 5th Edition, McGraw Hill, 2013.
3. Medriam, J.L., Engineering Mechanics: Static, 5th edition, John Wiley & Sons, 2003.
4. Saeed B. Niku, Introduction to Robotics, Prentice-Hall, 2001.
5. Devdas, S., Richard, A.K., Mechatronics System Designs, PWS, 1997.
6. Katsuhiko Ogata Modern Control Engineering, Prentice-Hall, 1996
7. Robert L. Norton, Machine Design an Integrated Approach 3rd Edition, Pearson Prentice Hall, 2006
8. Auslander, D.M., Mechatronics: Mechanical System Interfacing, 1996.

BELM 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 materials mechanics. (PO1, WK3)
2. Identify the force and stress on a mechanical system. (PO1, WK3)
3. Analyze the force and stress on a mechanical system. (PO2, WK3)

Synopsis

Statics - introduction to basic concepts in statics and mechanics as a study of physical sciences, system of units, scalars andvectors, free body diagram, forces system resultants and moments, equilibrium of a particle, equilibrium of a rigid body andstructural analysis.

Material Mechanics - introduction to various type of structures, type of supports, concepts and definition of stress, strains, theory on axial loading, shear stress, torsion and pure bending.

References

1. Hibbeler R. C., 2014, Static and Mechanics of Materials, Fourth SI Edition, Pearson Prentice Hall, Singapore.
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.

BELG 1413
DIGITAL ELECTRONICS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the basic concept of digital circuits that form complex electronic systems. (PO1, WK3)
2. Analyze the basic digital circuits based on combinational and sequential components. (PO1, WK3)

Synopsis
The outcome of this course is to deliver knowledge, understanding and application of digital electronic circuits. This course comprises several topics such as number systems and codes, logic gates and booleanalgebra, combinational logic circuits, MSI logic circuits and flip flops, and integrated circuit logic families. Students also will be exposed to design integrated circuits for the project assignment. This course will also expose the students to current applications in the industry such as a Metal Oxide Semiconductor Field Effect Transistor (MOSFET), Complementary Metal Oxide Semiconductor (CMOS) technology and Integrated Circuit Packaging.

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 l. Tokheim. Digital Electronics, Principles and Applications. McGraw-Hill, 2013.

BITG 1233
COMPUTER PROGRAMMING
*Service course (FTMK)

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. (PO1, WK3)
2. Practice program codes in problem solving and programming techniques to solve given problems. (PO1, WK3)
3. Construct computer program codes by applying suitable programming structures and techniques. (PO5, WK2, WK6)

Synopsis
This course covers 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 cours.

References
1. Gaddis, T., (2018), “Starting Out with C++: 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.

SEMESTER 2

BMKC 1013
DIFFERENTIAL EQUATIONS
*Service course (FTKM)

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. (PO1, WK2)
2. Select an appropriate technique to solve problems involving differential equations. (PO1, WK2)
3. Apply the concept of differential equations in solving engineering problems. (PO1, WK2)

Synopsis

This course provides introductory knowledge of differential equations and its applications. The students are introduced to the first order differential equations and solve them using analytical methods of separable variable and linear equations and 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.
2. (2018). Module 2: Differential Equations, Penerbit UTeM.
3. Khoo, C.F., Syed Ahmad, S.S., Othman, Z. & Lok, Y.Y. ((2009). Numerical Methods Third Edition. Pearson Prentice Hall.

BELM 1243
DYNAMICS & VIBRATION

Learning Outcomes

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

1. Describe the fundamentals of engineering dynamics (PO1, WK1)
2. Solve the kinematics problem related to particles and rigid body (PO1, WK1)
3. Implement the principle of force and acceleration, work and energy, and impulse and momentum to particles and rigid bodies. (PO2, WK3)
4. Apply the fundamental principles of vibration on one degree of freedom system in engineering practise. (PO2, WK3)

Synopsis

This course introduces the principle of kinematics and kinetics of particles and rigid bodies. The lessons cover the concept of position, velocity and acceleration of particles; and application of Newton's second law, Principle of Work and Energy, Principle of Impulse and Momentum for both particles and rigid bodies, zundamental of vibration, one-degree-of-freedom system: free vibration of an undamped and damped systems.

References

1. Hibbeler, R. C., Engineering Mechanics, Dynamics, 15th Edition, Pearson Prentice Hall, (2021).
2. Beer, F. P., Vector Mechanics for Engineers, Dynamics SI Units, 11th Edition, McGraw-Hill, (2018).
3. S.S.Rao, Mechanical Vibration, 6th Edition, Pearson Prentice Hall, (2016).

BELU 1123
ELECTRICAL CIRCUIT 1

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyze electrical circuits using Ohm's Law and Kirchoff's Laws. (PO1, WK3)
2. Apply Mesh and Nodal methods for DC and AC circuit analysis. (PO1, WK3)
3. Analyze DC and AC circuits using Superposition, Thevenin, Norton and Maximum Power Transfer Theorems. (PO2, WK3)

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, Alexander and Sadiku, 6th Edition, McGraw-Hill.
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.

BMIG 1213
ENGINEERING MATERIALS
**Service course (FTKIP)

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. (PO1, WK1)
2. Analyze the properties of engineering materials based on their structure. (PO2, WK3)
3. Describe the processing methods for engineering materials. (PO1, WK3)

Synopsis
This course introduces basic concepts of engineering materials that cover introduction to engineering materials, interatomic bonding, crystalline structure and imperfections and diffusion in solid. Introduction to the binary phase diagrams is 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.

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 include statics, mechanics of material, dynamics, and fluid mechanics correctly using mechanical resources. (PO5, WK2, WK6)
2. Analyze data gathered during experiments using software tools. (PO2, WK3)
3. Communicate effectively through technical report writing. (PO9)
4. Demonstrate practical competence and ability to work in teams. (PO8)

Synopsis
The mechanical laboratory experiments will cover three courses, Statics and Mechanics of Material, Dynamics and Vibration, and Fluid Mechanics. The experiments include but are not limited to axially loaded test, shear and torsion tests, accelerated rotational movement, belt drives and gear efficiency, Pascal law and volume flowrate.

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.

SEMESTER 3

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. (PO1, WK2)
2. Solve the mathematical problems that involve the function of several variables, multiple integrals and vector calculus. (PO1, WK2)
3. Apply the knowledge of advanced engineering mathematics to deal with engineering problems. (PO1, WK2)

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

BELC 2453
COMMUNICATION SYSTEM

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. (PO1, WK3)
2. Analyse the analogue and digital communication techniques that are typically used in communication systems. (PO2, WK3)
3. Explain the concept of computer system network. (PO1, WK3)

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 2342
INTRODUCTION TO EMBEDDED SYSTEM

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe microprocessor-based system architecture, its operation, interfacing circuitry and its supporting components. (PO1, WK3)
2. Apply microprocessor instruction set operation in assembly language. (PO3, WK3)
3. Develop and construct a microprocessor-based system in solving any related problems. (PO5, WK2, WK6)
4. Demonstrate the ability to work in a team for a microprocessor-based system project. (PO8)
5. Present and prepare the technical report for the microprocessor-based system project. (PO9)

Synopsis
This course is about hardware and microprocessor handling, type of microprocessor systems, system handler and timing diagrams. The course covers the concept of 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 the PBL approach in this course where a PO-PBL will be introduced to the student.

References

1. Spasov, P., Microcontroller Technology: The 68HC11 and 68HC12 5th edition, Prentice Hall, 2004.
2. Tocci, R. J., Digital Systems: Principles and Applications 9th edition, Prentice Hall, 2004.

BELE 2343
PRINCIPLE OF ANALOGUE ELECTRONICS

Learning Outcomes

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

1. Apply the knowledge of electrical and electronics principles to Semiconductor, Diode, BJT amplifier, Operational Amplifier, Active filter, oscillator and voltage regulator. (PO1, WK3)
2. Analyze the semiconductor, diode, BJT amplifier, operational amplifier, active filter, oscillator, and voltage regulator with respect to gain, efficiency, and stability. (PO2, WK3)
3. Design the analogue circuit system for different application of signal amplification. (PO3, WK5)

Synopsis

This course contains the concepts of semiconductors, diodes, amplifier, BJT as the devices that usually used in amplifiers, small signal amplifier, oscillators, active filters and voltage regulators. The course covers application of electronic analogue devices in solving electrical engineering problems.

References

1. Bolysted, R., Nashelsky, L., Electronic Devices and Circuit Theory, 11th 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.

BELG 1233
PRINCIPLE 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. (PO1, WK3)
2. Explain the principle of measurement devices. (PO1, WK3)
3. Apply suitable bridge techniques to measure component values such as resistance, inductance and capacitance. (PO1, WK3)
4. Explain the operation, function and applications of the transducers/sensors. (PO1, WK3)

Synopsis

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

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.

BELB 1231
ELECTRICAL AND 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. (PO5, WK2, WK6)
2. Construct the combination of logic circuit and ICs using suitable and appropriate components. (PO5, WK2, WK6)
3. Perform simulations of RLC circuits to study their characteristics. (PO2, WK3)
4. Exhibit good communication skills through technical writing. (PO9)
5. Demonstrate leadership and ability to work in teams. (PO8)

Synopsis
This course will expose students to perform experiments to support the theory such as observing the capacitor charge and discharge process, building 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 students will conduct experiments with logic circuit integration, ics and flip- flops circuits.

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, 2010.

SEMESTER 4

BERN 2143
ENGINEERING STATISTICS
*Service course (FTKEK)

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. (PO1, WK2)
2. Analyze engineering data using descriptive statistics. (PO2, WK2)
3. Deduce statistical inference for engineering problems by using the techniques of estimation, hypothesis testing and regression. (PO2, WK2)

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.

BELC 2433
SIGNAL 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. (PO1, WK3)
2. Analyze the linear time-invariant (LTI) systems in time- domain and frequency-domain. (PO2, WK3)
3. Analyze the LTI systems using Z-Transform method. (PO2, WK3)

Synopsis

This course will discuss 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).

BELM 2433
THEORY OF MACHINES AND MECHANISM

Learning Outcomes

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

1. Apply the related techniques in analyzing mechanical power transmission system and other mechanical machines. (PO1, WK4)
2. Analyze the motion charasteristics of mechanical mechanism according to motion requirement analytically or graphically. (PO2, WK4)
3. Synthesize mechanisms using graphical and analytical methods to achieve certain objectives of mechanism design. (PO3, WK5)

Synopsis

This course introduces the topics on Theory of Machines and Mechanism. Theory of Machinees will cover the topics of power transmission system, gyroscope, governors, and dynamic system balancing. In Mechanism, the topics involve with the principles of designing mechanisms, as well as to investigate the kinematics and dynamics of mechanisms. Other topics include fundamentals of linkage kinematics and design and the design of other mechanisms.

References

1. Gupta, B.V.R., 2011, Theory of Machines: Kinematics and Dynamics, I.K. International Publishing House Pvt. Ltd.
2. Myzka, D., 2013, Machine & mechanism: applied kinematics anaysis, Pearson Prentice Hall.

BELU 2333
ELECTRICAL CIRCUIT 2

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. (PO2, WK3)
2. Apply Laplace transforms method and its frequency response in electrical circuit analysis. (PO1, WK3)
3. Analyze the frequency response of RLC circuits and the characteristics of RLC filters. (PO2, WK3)
4. Analyze various topology of two-port network in electrical circuit analysis. (PO2, WK3)

Synopsis
This course exposes students 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 circuits.

References
1. Charles K. Alexander, Matthew Sadiku, Fundamentals of Electrical Circuits, 6th Ed., 2017 Mcgraw Hill.
2. James W. Nilsson & Susan Riedel, Electric Circuits, 10th Ed.,2015, Pearson.
3. Robbins & Miller, Circuit Analysis Theory and Practice, 5th Ed.,2013, Thomson & Delmar.
4. Floyd, Electric Circuits Fundamentals, 8th Ed., 2010, Pearson.

BMKU 1313
ENGINEERING GRAPHICS & CAD
*Service course (FTKM)

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Explain the engineering graphics fundamentals. (PO1, WK3)
2. Construct technical drawing using manual sketching and computer aided design. (PO5, WK2, WK6)
3. Communicate by using engineering drawings. (PO9)

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.

SEMESTER 5

BMIG 3213
ENGINEERING ECONOMY AND MANAGEMENT
*Service course (FTKIP)

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, principles 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 or 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.

BELM 3562
MECHATRONICS SYSTEM DESIGN

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyze complex mechatronics engineering problems that require integration of multiple disciplines with holistic considerations for sustainable development. (PO2, WK4)
2. Identify various aspects of project under investigation including technical, financial, ethical, environmental, and societal aspects. (PO3, WK5)
3. Demonstrate engineering management skills and present the scientific findings effectively through written and oral modes with the aid of multimedia tools. (PO9)
4. Apply project management and financial knowledge effectively in completing the mechatronics design project. (PO10)

Synopsis
This course is designed to provide students with an in-depth understanding of the design principles and project management methodologies that are essential for creating effective and innovative mechatronic systems. The students will learn about the integration of mechanical components, electronic circuits, sensors, actuators, and control systems,

understand how these elements interact, and how to optimise their performance within the context of the project's goals. The course guides students through the process of taking a conceptual idea and turning it into a well-defined and detailed design. This includes selecting appropriate components, determining their specifications, designing interfaces and connections, and addressing potential challenges that may arise during implementation. By the end of the Engineering Design course, students should be well-equipped to tackle complex mechatronic challenges. They will have a solid grasp of the principles of design, project management, and the integration of different engineering disciplines.

References

1. Dieter, G.E. & Schmidt, L.C.(2013). Engineering Design, 5th Edition, McGraw Hill.
2. O'Connor, P.D.T., Newton, D., & Bromley, R. (2002). Practical reliability engineering, 4th edition. John Wiley and Sons.
3. Shetty, D. & Kolk, R.A. (2011). Mechatronics System Design (2nd ed.), Global Engineering, USA.
4. Robert L. N. (2004), Design of Machinery, An Introduction to the Synthesis and Analysis of Mechanisms and Machines. (3rd ed.) Mc Graw-Hill.
5. Mahalik N. P, (2004), Mechatronics: Principles, Concepts and Application. McGraw-Hill.
6. Cross, Nigel, (2010) Engineering Design Methods, Wiley.

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. (PO1, WK4)
2. Analyze Control Direct Current (DC), servo and stepper motors using microcontroller and relevant driver circuit. (PO2, WK4)
3. Design the application of Analog to Digital Converter with LCD display / Keypad / R2323 / EEPROM Modules. (PO3, WK5)
4. Utilize the microcontroller-based system application software or hardware for Problem Based Learning Design. (PO5, WK2, WK6)
5. Exhibit technical writing and explain the design of the Problem Based Learning application. (PO9)

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.
4. Lovine, 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.

BELG 2433
ELECTRICAL SYSTEM
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). (PO1, WK3)
2. Calculate the AC voltage and current characteristics in AC circuits. (PO1, WK3)
3. Analyze the single and three phase circuits by emphasizing complex power and power factor correction. (PO2, WK3)
4. Analyze the magnetic, single-phase transformer and three phase transformer equivalent circuits. (PO2, WK3)

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 circuits, construction, and operation of transformers 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

BELC 3533
INTRODUCTION TO CONTROL SYSTEM

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Derive the mathematical model of linear time-invariant (LTI) systems in time and frequency domains. (PO1, WK2)
2. Analyse the dynamic, frequency response and stability of LTI system. (PO2, WK3)
3. Design a controller and compensator for feedback control systems via root locus and frequency response techniques. (PO3, WK5)

Synopsis
This course introduces the fundamental ideas and definitions of control systems, open loop and close loop control systems, transfer functions and transient and steady state responses. Students will be taught how to obtain mathematical models of actual physical systems such as electrical, mechanical, and electromechanical systems in the transfer function form and state space representation. The students will also be exposed to techniques of analysing dynamic response and stability in time and frequency domains. Finally, the students will be introduced to the controller and compensator design via root locus and frequency response techniques using MATLAB.

References
1. Nise, S Norman, Control Systems Engineering, 6th Edition, John Wiley & Sons Inc., 2011.
2. Bishop, Dorf, Modern Control Systems, 12th Edition, Prentice Hall, 2010.
3. Ogata Katsuhiko, Modern Control Engineering, 5th Edition, Prentice Hall, 2010.

BELC 2421
CONTROL SYSTEM ENGINEERING LABORATORY

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyze and interpret data and synthesize information related to Control and Instrumentation System Engineering experiments. (PO2, WK3)
2. Demonstrate practical competence in using Control and Instrumentation System Engineering software and apparatus. (PO5, WK2, WK6)
3. Demonstrate leadership and ability to work in teams. (PO8)
4. Report the findings in a way that is appropriate to the target 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 BEKM 2433 (Signal & System), FKE, UTeM, (2012).
2. Course File BEKC 3533 (Introduction to Control System), FKE, UTeM, (2012).
3. Course File BEKM 2453 (Instrumentation Systems), FKE, UTeM, (2012).

SEMESTER 6

Learning Outcomes
Upon completing this subject, the student should be able to:
1. Design solutions by synthesizing mechatronics engineering knowledge that will solve complex mechatronics engineering problems with appropriate consideration for public health and safety, whole-life cost, net zero carbon as well as resource, cultural, societal, and environmental requirement. (PO3, WK5)
2. Utilize modern engineering and IT tools in facilitating solutions to complex mechatronics engineering problems with an understanding of the limitations. (PO5, WK2, WK6)
3. Evaluate the sustainability and impact of professional engineering work in the solutions of complex mechatronics engineering problems in societal, economical, health and safety, and environmental contexts. (PO6, WK1, WK5, WK7)
4. Demonstrate effective teamwork skills in completing the mechatronics design project. (PO8)
5. Demonstrate effective communication skill in presenting the scientific findings effectively through written and oral modes with the aid of multimedia tools. (PO9)
6. Apply project management and financial knowledge effectively in completing the mechatronics design project. (PO10)

Synopsis
The integrated design project provides students with the platform to apply what they have learned in engineering design to solve the solution of complex engineering problems, through team-based project experience. They are expected to apply their knowledge and skills to gain significant experience in designing, developing, analysing, prototyping, and verifying their design, together with a basic bussiness plan. Each engineering design project is executed by

a group and supervised by a faculty supervisor. The project will be evaluated by an industrial panel.

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. Shetty, D. & Kolk, R.A. (2011). Mechatronics System Design (2nd ed.), Global Engineering, USA.
4. Cross, Nigel, (2010) Engineering Design Methods, Wiley.
5. OpenModelica Manual, 2010
6. Kutz, Myer, Mechanical Engineers Handbook - Manufacturing and Management, 3rd ed., John Wiley 2006.

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. (PO1, WK4)
2. Investigate and analyze the torque speed characteristics of electric motors and their corresponding drive requirements. (PO2, WK4)
3. Design the drive for electrical motors according to application requirements and appropriate mechanical model. (PO3, WK5)

Synopsis
This course focuses on the applications of electrical machines as primary movers for mechanical systems. Students are introduced to the basic principle of electromagnetics and the construction 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 3643
THERMOFLUID

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Apply the basic concepts of fluid mechanics to solve engineering problems. (PO1, WK4)
2. Identify the thermodynamics properties of pure substances by using the table of properties data. (PO1, WK4)
3. Apply the thermodynamic First Law, Second Law and heat transfer mechanisms to determine the performance of thermal systems. (PO2, WK4)

Synopsis
The course is given to introduce the student to the basic engineering of thermodynamics that involved study on the energy transformation, working fluids, theory and application of first and second laws of thermodynamics and heat transfer. The other phase of this course is to introduce the students to the basic of fluid mechanics. The course covers the study of the fluid static and dynamic analysis, buoyancy and stability, Bernoulli equation, and flow behavior in pipe.

References
1. Cengel, Y.A., Turner, R.H., Cimbala, J.M., (2019), 5th Edition in SI Units, "Fundamentals of Thermal-Fluid Sciences", McGraw Hill, New York.
2. Kaminsky, D.A., Jensen, M.K., (2005), "Introduction to Thermal and Fluid Engineering", John Wiley & Sons, Inc.
3. Cengel, Y.A., Michael, A.B., (2017), 4th Edition, "Thermodynamics, An Engineering Approach", McGraw Hill, New York.

BELC 4753
PLC AND 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. (PO1, WK4)
2. Use tools and equipments for PLC programming that is related to industrial applications. (PO5, WK2, WK6)
3. Design a basic automated PLC based system with consideration for specific needs. (PO3, WK5)
4. Demonstrate communication skills through teamwork activities effectively. (PO9)

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, 5th Ed., McGraw Hill, 2016.
2. Mikell P. Groover, Automation, Production Systems & Computer-Integrated Manufacturing, 4th Ed., 2015.
3. Hugh Jack, Automating Manufacturing Systems with PLCs, 7th Ed., 2007.
4. L. A. Bryan & E. A. Bryan, Programmable Controller: Theory and Implementation, 2nd Ed., 2010.

SPECIAL SEMESTER

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 are relevant for student field of study. (PO1, WK4)
2. Demonstrate the ability to adapt to a working environment and practice working efficiently and ethically. (PO7, WK9)
3. Demonstrate soft skills, especially communication skills at all levels. (PO9)
4. Work effectively as an individual, team members and as a leader as well. (PO8, WK9)
5. Acquire new knowledge, life-long learning and be aware of new technology. (PO11, WK8)

Synopsis
All bachelor's degree students are required to undergo industrial training as part of their curiculum to complete their four (4) years course for the Bachelor of Electrical Engineering (BELG) and Bachelor of Mechatronic Engineering (BELM). It is compulsory for all students to undergo the Industrial Training Programme. In general, the aim of industrial training is to give exposure, experience, and professional skills to various aspects of engineering discipline, in electrical/mechatronics engineering related

industries. The students are also expected to be familiarized with efficient, accountable, and ethical conduct as they will be supervised directly by 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

SEMESTER 7

BELU 4861
ENGINEERING SEMINAR

Learning Outcomes

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

1. Identify professional engineering knowledge, practices and responsibilities. (PO7, WK9)
2. Collect and sort relevant information about the technical talk given. (PO6, WK1, WK5, WK7)
3. Discuss current engineering issues and practices that impact engineering professionals. (PO7, WK9)

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 industry and academia, students will be exposed to topics such as professional engineering bodies and knowledge of contemporary issues in related engineering fields. Presentations 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 surveys and identify the problems, objectives and scope of project clearly. (PO2, WK4)
2. Select, plan and execute a proper methodology in problem solving. (PO4, WK8)
3. Present the project proposal in written and in oral format effectively. (PO9)
4. Work systematically and commit to professional ethics. (PO7)
5. Apply project management and financial knowledge effectively in completing the project. (PO10)

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, students(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. A session for oral presentation is also held to measure student's level of understanding and capability on carrying specified project.

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. (PO1, WK4)
2. Analyse the effects of controller gains on the motion of a robotics system. (PO2, WK4)
3. Design robot trajectories based on safety and environmental needs. (PO3, WK5)

Synopsis
This subject introduces robotic fundamentals including kinematics (forward, inverse, jacobian, singularity), dynamics and trajectory generation. In addition, trajectories for robot motion and a robotic control problem. fundamental mathematics, scientific and mechatronics engineering knowledge will be applied of complex robotic problems.

References
1. John J. Craig, Introduction to Robotics: Mechanics and Control, 4th Edition, Pearson, 2017.
2. Stadler, W., Analytical Robotics and Mechatronics, Mcgraw Hill, 1995.
3. Fuller, J. L., Robotics: Introduction, Programming and Projects, 2nd Ed., Prentice Hall, 2005.

BELM 4723
HYDRAULIC AND PNEUMATIC SYSTEMS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Explain the fundamental principles and common components of hydraulic and pneumatic. (PO1, WK4)
2. Analyze mathematical models of hydraulic and pneumatic circuits to study performance of the system. (PO2, WK2)
3. Formulate the hydraulic and pneumatic circuit and their electrical circuit. (PO2, WK4)
4. Demonstrate the basic concept of fluid mechanics through knowledge transfer (SULAM) to the local community (PO6, WK1, WK5, WK7)

Synopsis
This course covers the introduction of the hydraulic and pneumatic systems, types of pump, compressor and their working principles, types of valve, actuator and their usage, performance of the fluid power system, others fluid power system ancillaries and sensors, fluid power circuit design and analysis with manual control and electrical control, fluid power symbols, the usage of computer software to design and simulate the fluid power circuit, the usage of programmable logic controller in fluid power circuit design and the application of fluid power in robotic and mobile hydraulic. This course is also embedded with a SULAM project that requires students to transfer the knowledge learned to secondary students taking Physics subject.

References
1. Esposito A. 2013. Fluid Power with Applications .7th Ed. Pearson, India.
2. Ilango S. 2011. Introduction to Hydraulics and Pneumatics. 2nd Ed Prentice Hall-India. New Delhi.
3. Johnson, J.L. 2002. Introduction to Fluid Power. Delmar. New York.
4. M. Galal Rabie, Fluid Power Engineering, McGraw-Hill, New York.

BELM 3641
MECHATRONICS ENGINEERING LABORATORY

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

1. Design and analyze a controller for mechatronics system by using PLC. (PO4, WK8)
2. Design and demonstrate the appropriate solution to actuate a mechatronic system by using pneumatic and hydraulic circuits. (PO5, WK2, WK6)
3. Evaluate the accuracy of the integrated PLC and electropneumatic system performance by using statistical methods. (PO5, WK2, WK6)
4. Demonstrate effective teamwork skills in completing the experiments. (PO8)
5. Exhibit technical writing to report solutions for complex problems. (PO9)

Synopsis
In these lab sessions, 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 integration of pneumatics and control programming using PLC.

References

1. James A Rehg, Glenn J. Sartori. Programmable logic controllers, 2009.
2. Igor Lazar Krivts. German V. Krejnin. Pneumatic actuating systems for automatic equipment: structure and design, 2006.
3. Equipments user manual.

<u>SEMESTER 8</u>

BELU 4894
FINAL YEAR PROJECT 2

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

1. Identify, formulate, research literature and analyze problems. (PO2, WK4)
2. Conduct investigation using research-based knowledge and methods. (PO4, WK8)
3. Apply ethical principles in project implementation. (PO7, WK9)
4. Present the results in written and in oral format effectively. (PO9)
5. Apply reasoning informed by contextual knowledge. (PO6, WK1, WK5, WK7)
6. Engage in independent and lifelong learning. (PO11)

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

BELU 4322
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. (PO7)
2. Apply reasoning informed by contextual knowledge to assess health, safety and legal issues and its subsequent responsibilities, relevant to professional practice. (PO6, WK1, WK5, WK7)
3. Understand the needs for sustainable development and the impact of engineering solutions on society and environment. (PO6, WK1, WK5, WK7)

Synopsis
This course will discuss:
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.

<u>ELECTIVE COURSES</u>

BELC 5233
SYSTEM DYNAMICS
(INTEGRASI SARJANA MUDA-SARJANA)

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Derive mathematical modelling of dynamic systems using conservation of energy method.
2. Formulate mathematical modelling of dynamic Systems in time domain.
3. Analyse the dynamic system performance for first and second order systems in time and frequency domains.

Synopsis
This subject will discuss the basic terminology of system dynamics, the two systems of units, methods for parameter estimation, rigid-body dynamics, solution methods for linear ordinary differential equations, Laplace transform and transfer function models,modeling of mechanical systems having stiffness and damping, state-variable model, modeling of electric circuits, operational amplifiers, electromechanical devices, sensors, and electroacoustic devices, analysis methods in the frequency domain and the time, analyzing a system's frequency response.

References
1. W. J. Palm, System Dynamics, 3rd edition, 2013, Wiley.
2. K. Ogata, System Dynamics, 4th edition, 2004, Pearson.
3. N. Lobontiu, System Dynamics for Engineering Students, 2010 Elsevier.

BELC 5133
MODERN CONTROL DESIGN
(INTEGRASI SARJANA MUDA-SARJANA)

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyse the responses of a system in time and frequency domain, and the design of classical control system.
2. Design the state variable feedback controllers and observers.
3. Formulate the optimal control system.
4. Perform the system sensitivity and design the robust control systems

Synopsis
This course begins with the review of classical control theory that covers the time-domain and frequency-domain analysis and classical controller design. Then, the design of the state feedback controllers and observers are introduced. In optimal control design, the optimal control problem is formulated at the beginning, and then the student is taught about typical types of optimal control performance. As the last chapter of this course, the robust control system is introduced. The system sensitivity and analysis of robust control system is explained. Then the design of robust control system, robust PID-Controlled system, and Pseudo-Quantitative feedback control system are designed and compared. Each of the chapters is ended with the design examples that solved by using the MATLAB and Simulink.

References
1. Katshuhiko Ogata, “Modern Control Engineering”, Prentice Hall, Fifth Ed., 2010.
2. Richard C. Dorf, Robert H. Bishop, “Modern Control Systems”, Prentice Hall, Thirteen Ed., 2016.
3. K. P. Mohandas, “Modern Control Engineering”, Sanguine Technical Publishers, 2006.
4. F. Golnaraghi, B. C. Kuo, “Automatic Control System”, Prentice Hall, Ninth Ed., 2010.
5. Graham C. Goodwin, Stefan F. Graebe, Mario E. Salqado, “Control System Design’, Prentice Hall, 2001.

BELE 5143
ADVANCED ELECTRICAL MACHINE AND DRIVE
(INTEGRASI SARJANA MUDA-SARJANA)

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Assess the characteristics and dynamic modelling of electrical machine and drives.
2. Design and modify control strategy to drive the machines for optimum performances.
3. Analyze the performance parameters of the drives.

Synopsis
This subject will discuss the construction and design of ac machines, development of dynamic model of AC motors, e.g., induction motor and BLDC motor, various control algorithms in improving dynamic control performances, e.g., Torque Hysteresis Control (THC) and Field Oriented Control (FOC). Students will experience PBL based on hands on approach, i.e., the AC control algorithm will be developed using modern engineering tools to verify the effectiveness and dynamic control improvements.

1. Bimal K. Bose, Modern Power Electronics and AC Drives, Prentice Hall, 2002.
2. Haitham Abu-Rud, Atif Iqbal, Jaroslaw Guzinski, High Performance Control of AC Drives with Matlab/Simulink ModelS, 2012.
3. Peter Vas, Sensorless Vector and Direct Torque Control, Oxford Science Publications, 1998.

4. Andrzej M. Tryzynadlowski, The Field Orientation Principle in Control of Induction Motors, Kluwer Academic Publishers, 1994.

BELM 5113
ADVANCED MECHATRONIC SYSTEM DESIGN (INTEGRASI SARJANA MUDA-SARJANA)

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyse complex system using advanced mechatronics engineering knowledge.
2. Design advanced mechatronics solution using system engineering principles.
3. Demonstrate appropriate consideration for public health and safety, cultural, societal, environmental and sustainability factors.

Synopsis
Mechatronics system design is a subject where students must design a mechatronics engineering project, including project management, project planning, project feasibility study, design selection, design costing and sizing, analysis and evaluation. The subject 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 mechatronics design, students are also required to integrate their knowledge of other engineering disciplines such as (but not limited to) control systems engineering, sensors and actuators, structural analysis and design, including material selection and mechanical properties.

References
1. Dieter, G.E. & Schmidt, L.C. (2021). Engineering Design, 6th Edition, McGraw Hill.
2. Ulrich, K.T. & Eppinger, S.D. (2016). Product Design and Development, 6th Edition, McGraw Hill.
3. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, W. Bolton, 2018, 7th Edition, Pearson Education Limited.
4. The Internet of Things: What Everyone Needs to Know, Scott J. Shackelford, 2020, Oxford University Press Inc.

BELM 5123
APLLIED SYSTEM MODELLING AND SIMULATION (INTEGRASI SARJANA MUDA-SARJANA)

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Identify practical engineering systems and develop mathematical models which represent the systems.
2. Solve mathematical models using appropriate modelling and simulation techniques.
3. Validate the model, analyze the simulation results and interpret the findings.

Synopsis
The course provides students with the skills to design and analyze systems using modelling and simulation techniques using a range of mathematical formulations. There are many modelling techniques to describe system characteristics. Students will learn to develop typical mathematical models. Case studies and software applications such as MATLAB and SPSS are used to illustrate a variety of modelling techniques. Once the models are validated, it can be utilised to predict the behaviour of engineering systems including mechanical, electrical, civil, environmental, fluid, magnetic, thermal and transport. At the end of the course, students will be capable to identify practical situations where simulation modelling can be helpful and how they would undertake such a

project, develop and validate a model, analyze the simulation results and report thru findings. Students complete a project in groups of two or three, write a concise summary of what they have done and report their findings to the class. The project report at the end of this course should be a substantial document that is a record of a student's practical ability in simulation modelling, which can also become part of a portfolio or CV.

References

1. Larry B. Rainey, Andreas Tolk "Modeling and Simulation Support for System of Systems Engineering Application", 2015.
2. Xin-She Yang, "Mathematical Modeling with Multidisciplinary Applications" Wiley, 2013.
3. Abdelwahab Kjarab, Ronald B. Guenther, "An Introduction to Numerical Methods A MATLAB Approach", Chapman & Hall, 2012.
4. Douglas C. Montgomery, George C. Runger, Applied Statistics and Probability for Engineers, 3rd Edition, John Wiley.

BELC 4643
SMART MANUFACTURING

Learning Outcomes

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

1. Analyze various types of manufacturing operations using related models and metrices.
2. Design a solution for manufacturing systems which is applicable to industries.
3. Evaluate critically technical writings related to advance manufacturing system.

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 a production system. Finally, students are introduced to smart manufacturing based on Industrial Revolution 4.0.

References

1. Groover, M. P., "Automation, Production Systems, and Computer-Integrated Manufacturing", 3rd Ed., Prentice Hall, 2008.
2. Industry 4WRD: National Policy on Industry 4.0, Ministry of International Trade and Industry, 2018.
3. Guidline Industri 4.0 - Guiding principles for the implementation of Industrie 4.0 in small and medium sized businesses, VDMA Industrie 4.0 Forum, 2015.

BELM 4743
AUTONOMOUS MOBILITY

Learning Outcomes

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

1. Explain locomotion concept of mobile robot.
2. Analyze mobile robot localization in various applications.
3. Design autonomous mobile robot system for specific tasks, considering perception.
4. Apply appropriate planning techniques for autonomous mobile robot with an understanding of the limitations.

Synopsis

This subject presents an introduction to the fundamentals of mobile robotics, spanning across the perceptions, localization, SLAM, and decision making (planning) to make the robot autonomous. Students will be exposed to the sensory of mobile robot system, drive actuation, localization techniques, and robot planning under pertubations.

References

1. Roland Siegwart, Illah R. Nourbakhsh, and Davide Scaramuzza, Introduction to Autonomous Mobile Robots, 2nd Edition, The MIT Press, 2011.

BELM 4843
ADVANCED INDUSTRIAL AUTOMATION

Learning Outcomes

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

1. Demonstrate an understanding of advanced methods for industrial automation and process control systems.
2. Evaluate different system integration strategies for interfacing PLC with various devices and interfaces.
3. Design an IoT and data analytics solution related to industrial revolution 4.0 application.

Synopsis

This subject will discuss the principle, design and practical of advanced automation system in industry such as automated flow line, numerical control, control theory, process controls, computer integrated manufacturing (CIM) and flexible manufacturing system. The students also will be exposed to advanced electro-pneumatic system and advanced electro-hydraulic system design for industrial applications. To make the automation run in optimal way, the metaheuristic optimization algorithm technique will be used as advanced methode to optimize the process control and industrial applications. Additionally, students will be introduced to cyber-physical system frameworks and industrial revolution 4.0 applications. Standard communication protocols and networking techniques for IEC-61131 based PLC will also be introduced under system integration topics.

References

1. S. Jeschke, C. Brecher, H. Song, D.B. Rawat, Industrial Internet of Things: Cybermanufacturing Systems, Springer, 2017.
2. Mikell P Groover, Automation, Production Systems, And Computer-Integrated Manufacturing, 5th Edition, Pearson 2019.
3. T.A. Weedon, Instrumentation and Process Control Workbook Sixth Edition, Elsevier, 2014.
4. B.R. Mehta, Y.J. Reddy, Fundamentals of Industrial Instrumentation and Process Control, Elsevier, 2015.

BELM 4843
THERMAL & FLUID MACHINERY

Learning Outcomes

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

1. Describe the fundamental characteristics and configuration of selected thermal and fluid machinery.
2. Solve the problem related to thermal and fluid machinery.
3. Analyze the performance of thermal and fluid machinery, espacially in pumps, compressors, turbines, and engines.

Synopsis

The course covers the important thermodynamics and fluid mechanics applications, with a focus on those used in heating, ventilation and air conditioning systems, energy generation, marine and aerospace engineering, and propulsion systems. The goal of the course is to provide adequate and critical knowledge of thermal engineering and fluid machinery, with a focus on understanding the concepts of internal combustion engines, turbines, compressors, and pumps.

References

1. Michael J. Moran, Howard N. Shapiro, Bruce R. Munson and David P. DeWitt. Introduction to Thermal Systems Engineering: Thermodynamics, Fluid Mechanics, and Heat Transfer, John Wiley & Sons, 2002.

BELM 4863
INDUSTRIAL ROBOTICS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Explain fundamental principles of industrial robotics, including kinematics, dynamics, motion planning and programming.
2. Analyze robot trajectories, paths, and motion sequences in various applications.
3. Design industrial robot systems for specific tasks, considering safety and efficiency.
4. Apply appropriate techniques, resources, and modern robotics tools, to complex industrial robotics problems, with an understanding of the limitations.

Synopsis
The Industrial Robotics course is designed to provide students with a comprehensive understanding of robotic systems used in industrial applications. The course covers fundamental concepts, practical skills, and advanced techniques related to industrial robotics. Through a combination of lectures, hands-on lab sessions, and projects, students will gain the knowledge and skills necessary to design, program, and operate industrial robotic systems efficiently and safely.

References
1. Craig, J. J. (2004). Introduction to Robotics: Mechanics and Control (3rd ed.). Pearson. ISBN: 978-0201543612.
2. Granosik, G., & Hohol, M. (2020). Collaborative Robots: from Design to Implementation. Springer. ISBN: 978-3030392686.

BELC 4653
MODERN CONTROL ENGINEERING

Learning Outcomes
Upon completion of this course, the student should be able to:
5. Design and analyse the state-space controller according to the desired performances.
6. Design and analyse the optimal control using the LQR techniques.
7. Design and analyse the nonlinear control based on modified PID.

Synopsis
This course covers the introduction of state space representation, sensitivity, and robustness. It also includes the control system design in state space using the state feedback control, integral control, and observer control. In addition, the optimal control and nonlinear control based on modified PID will also be discussed.

References
1. Dorf, R. D., and Bishop, R. H., (2011). Modern Control Systems, (12th ed.), Prentice Hall.
2. Gopal, M., (2010), Digital Control and State Variable Methods, Conventional and Intelligent control Systems, McGraw-Hill International.
3. Slotine, J-J. & Li, W. (1991). Applied Nonlinear Control, Prentice Hall.
4. Nise, S Norman, Control Systems Engineering, 6th Edition, John Wiley & Sons Inc., 2011.

Ogata Katsuhiko, Modern Control Engineering, 5th Edition, Prentice Hall, 2010.

BELC 4663
ARTIFICIAL INTELLIGENCE FOR ENGINEERS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Explain the essential concepts, principles and theories relating to Artificial Intelligence (AI) in general, and for machine learning, fuzzy logic, neural networks, and deep learning.
2. Design basic AI based systems (machine learning/ fuzzy logic/neural networks/deep learning) according to the engineering problem.
3. Demonstrate and analyze the performance of AI based systems using modern tools such as Simulink/MATLAB, Python, Scikit-learn, Tensorflow or other specified tools.
4. Describe the latest technology and current issues of AI related to engineering systems.

Synopsis
Artificial Intelligence (AI) is a field of study concerned with allowing machines to imitate human thinking or behaviour. By applying AI techniques, machines would be able to solve complex engineering problems such as predicting numbers of defective products in the factory, optimizing a water tank system, classifying patients based on symtomps of a disease etc. In this course students will be exposed to the popular subtopics in AI which includes Machine learning, Fuzzy Logic, Neural Network and Deep Learning. Students will be exposed to the concept of AI and its implementation methods in mechatronics/electrical engineering systems using appropriate tools such as SIMULINK/MATLAB, Python, Scikit-Learn, Tensorflow and other appropriate tools.

References
1. Stuart Russel, Peter Norvig; Artificial Intelligence: A Modern Approach 4th edition, 2020.
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville; Deep Learning (Adaptive Computation and Machine Learning Series), 2016.
3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems. 2nd edition, 2019
4. S.N. Sivanandam, S. Sumathi & S.N. Deepa, Introduction to Fuzzy Logic Using MATLAB, 2007

BELC 4773
DIGITAL IMAGE PROCESSING

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Identify the application areas, restrictions, and 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 algorithm using 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 using 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 4753
BIO MECHATRONICS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the key modules required for the analysis, modelling, design, and control of a bio mechatronics systems.
2. Analyse various measurement, signal processing and machine learning techniques involve in bio mechatronics system.
3. Design biomechatronics systems for specific tasks considering safety and efficiency.
4. Demonstrate the ability to use modern tools such as MATLAB or CATIA in evaluation of performance of the bio mechatronics systems.

Synopsis
The course outlined focuses on key areas such as biofeedback, artificial actuators and control, and the underlying biomechatronic systems that enable these technologies to operate effectively and seamlessly with the human body. This course provides students with a comprehensive understanding of the fields; Biofeedback- the development of devices and systems that can sense and interpret biological signals from the body, such as heart rate, muscle activity, brain waves, and more, Artificial Actuators and Control - artificial actuators are designed to mimic the actions of human muscles or other biological systems. These actuators are often combined with sophisticated control systems to ensure precise and natural interactions between the device and the user's body, Biomechatronic Systems - To examines the hardware components and signal processing techniques that form the foundation of biomechatronic devices. This includes sensors for capturing biological signals, electronic components for signal processing, and the integration of these elements into a functional system. Overall, the course aims to equip students with the skills and knowledge needed to contribute to the development of advanced biomechatronic technologies.

References

1. José L. Pons, Wearable Robots: Biomechatronic Exoskeletons, John Wiley & Sons, 2008.
2. Raymond Tong Kaiyu, Biomechatronics in Medicine and Healthcare, Jenny Stanford Publishing, 2011.
3. Donald R. Peterson and Joseph D. Bronzino, Biomechanics: Principles and Applications, CRC Press, 2007.

BELC 4683
DIGITAL CONTROL SYSTEM

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Transform continuous-time signals into discrete-time signals and 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 4633
INDUSTRIAL CONTROL NETWORK

Learning Outcomes

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

1. Understand the principles of wireless communication, including signal propagation, network architectures OSI model, IEEE 802.x model and protocols.
2. Classify the internet protocol, network services, repeaters, bridges, routers, gateways and transmission media.
3. Identify security challenges in wireless networks, apply encryption methods, and discuss ethical implications in wireless communication.
4. Analyze emerging trends like IoT and 5G and assess their applications in diverse industries.

Synopsis

This course provides an in-depth exploration of industrial wireless communication principles and technologies. Students will study signal propagation, network architecture, security considerations, and emerging trends such as the Internet of Things and 5G. Through a combination of theoretical instruction and practical exercises, students will develop the skills needed to design and analyze wireless systems, address security challenges, and make informed decisions in the dynamic field of industrial wireless communication.

References

1. Vijay Garg (2010), Wireless Communications & Networking, Elsevier, ISBN 978-0123735805.
2. Gordon Colbach (2017), Wireless Networking: Introduction to Bluetooth and WiFi, ISBN 978-1973252115.
3. S. Haykin and M. Moher (2011), Modern Wireless Communications, Pearson, ISBN 978-8131704431.
4. David Tse, P. Viswanath (2012), Fundamentals of Wireless Communication, Cambridge University Press, ISBN 9780511807213.

BELC 4733
TELEROBOTIC

Learning Outcomes

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

1. Explain the concept of teleoperation and supervisory control.
2. Design a teleoperated system for a specific task in mechatronics engineering application.
3. Analyse telerobotics control system.
4. Apply typical feedback method for a teleoperaion system

Synopsis
The course covers the study in teleoperation, telerobotics, and supervisory control - a new form of technology that allows humans to work through machines in hazardous environments and control complex systems. Telerobotics denotes the technology of robotics controlled at a distance by human beings. When a task involving physical exploration, manipulation, and sampling is too dangerous or impractical to be performed directly by a human, it may be suited to a telerobot. In such a system, the human operator is physically removed from the task, sends commands to the robot over a telecommunication system, and receives information about the status of the task and its environment. Teleoperation therefore involves augmenting, supervising, or substituting artificial intelligence and control functions of the robot with the intelligence and pattern recognition abilities of the human operator.

References
1. Sheridan Thomas B. Telerobotics, Automation and Human Supervisory Control, The MIT Press, 1992.

BELC 4833
ADVANCED SENSOR

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Design creative sensor system solutions for complex problems with appropriate consideration for public health and safety, cultural, societal, or environmental requirements.
2. Analyse and evaluate impacts of sensor system to society, sustainability, health and safety, legal frameworks, or the environment.
3. Demonstrate the ability for life-long learning and critical thinking with respect to emerging sensor technologies.

Synopsis
This subject concerns not just sensors but systems of multiple sensors and other necessary components. It presents the physics and the principles of operation, ratings and performance specification, selection, necessary hardware and software for integration into an engineering system. Different types of sensors in various domains (electronic, magnetic, inductive, capacitive, resistive, piezoelectric, piezoresistive, magnetostrictive, semiconductor, optical, ultrasonic, mechanical, fluid, thermal, etc.) are discussed. The final part of this subject focuses on the technologies constituting IoT from a sensor perspective as it represents the front end of information processing.

References
1. De Silva, Clarence W. Sensor systems: Fundamentals and applications. Crc Press, 2016.
2. Postolache, Octavian Adrian, Edward Sazonov, and Subhas Chandra Mukhopadhyay. Sensors in the Age of the Internet of Things: Technologies and Applications. The Institution of Engineering and Technology (IET), 2019.

BELC 4883
INDUSTRIAL MACHINE VISION

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe and underlying the principles of common image processing techniques and the circumstances where they are applicable.
2. Describe the mathematical and geometry principles underlying the formation of images.
3. Implement the mathematical, algorithmic and control principles of industrial machine vision to implement a working vision system.
4. Demonstrate and integrate a vision system with the software/robot arm (skills) to create a functional robot/vision (system) which can

recognize the desired object and use commands to move/identify it.

Synopsis

The course is an intermediate level machine/computer vision course. It will cover the basic topics of machine vision and introduce some fundamental approaches/applications for industrial machine vision research. Through the class, the students are expected to understand in-depth the state-of-the-art approaches to the topics to be selected jointly by the students and the lecturer. The students will also develop command skills that are vital to their graduate research study. The subject will discuss the Overview of Machine Vision, Motion and Optical Flow, Camera Modeling and Calibration, Segmentation, Machine Learning for Computational Vision Applications and Visual Recognition with 3D Vision.

References

1. Simon J. D. Prince. Computer Vision: Models, Learning, and Inference, 1st Edition, Cambridge University Press, 2012.
2. Jan Erik Solem. Programming Computer Vision with Python: Tools and algorithms for analyzing images, 1st Edition, O'Reilly Media, 2012.
3. Adrian Kaehler & Gary Bradski, Learning OpenCV 3: Computer Vision in C++ with the OpenCV Library, 1st Edition, O'Relly Media, 2017.
4. Richard Szeliski, Computer Vision: Algorithms and Applications (Texts in Computer Science), 2011 Edition, Springer, 2010.
5. Ian Goodfellow. Deep Learning (Adaptive Computation and Machine Learning Series). The MIT Press, 2016.
6. De Silva, Clarence W. Sensor systems: Fundamentals and applications. Crc Press, 2016.

BITI 2513
INTRODUCTION TO DATA SCIENCE
*Service course (FTMK)

Synopsis

This course delivers an essential exposure on the fundamental concepts and techniques of data science. It is divided into two parts; Part 1 is the introductory lecture and guided practical session for the first 5 weeks. The main topics covers the five important phases in understanding data science; introduction to data science, data wrangling, exploratory data analysis, data manipulation, applied machine learning and data visualization and communication. Part 2 is a guided capstone project for another 9 weeks. The capstone project provides a platform to the students to applied their previously learn knowledge especially in Articial Intelligent, AI, statistics, analytics, project managements and data science in a real project setting. The last 3 weeks is the project presentation and technical report submission. There is no final written examination for this course.

BTMT 3323
CONTEMPORARY BUSINESS MANAGEMENT
*Service course (FPTT)

Learning Outcomes

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

1. Demonstrate an understanding of technology ventures approaches in advancing the digitisation, disruptive and converging technologies for societal and economic progress in the 4TH Industrial Revolution.
2. Critically appraise the impact of digitisation, disruptive and converging technologies on business strategies and competitive advantage in the Industry 4.0.
3. Identify strategic challenges, formulate strategic solutions, and propose new and disruptive business

models to take advantage of technologyenabled business opportunities of Industry 4.0.

Synopsis
This subject is designed to develop business talent for the future world of production. Students will be guided through the process of creating, analysing, planning and implementing disruptive and innovative business models with its operational strategies pertaining to the Industry 4.0. Students will be exposed to the theoretical and hands-on exercises of Industry 4.0 business management to enable them to apprehend the concept of the 4th Industrial Revolution. Topics discussed will include the Emergence of Business Model 4.0, 4.0 Products and Services, Industrial Internet of Things (IIoT), Cyber-Physical System, Digital Business Transformation, Digital Enterprise, Smart Factory, Intelligent Robots and Intelligent Production and Manufacturing. In the hands-on exercises, students will use visualisation software as well as stationary modules or simulators. Students are expected to acquire the skills and knowledge to utilise the Industry 4.0 model in the current and future global marketplace. These would enhance their professional career as a technopreneur, executive or consultant in the field of Industry 4.0 transformation. By the end of this course, students should be able to define, discuss, understand and apply the business strategies and tactics learnt in the context of Industry 4.0.

References

1. Klaus Schwab (2017), The Fourth Industrial Revolution. Currency.
2. Patrick Van Der Pijl, Justin Lokitz & Lisa Kay Solomon (2016), Design a Better Business: New Tools, Skills, and Mindset for Strategy and Innovation. Wiley.
3. Greg Satell (2017) Mapping Innovation: A Playbook for Navigating a Disruptive Age. McGraw-Hill Education.
4. W. Chan Kim and Renée Mauborgne (2015). Blue Ocean Strategy, Expanded Edition: How to Create Uncontested Market Space and Make the Competition Irrelevant. Harvard Business Review Press; Expanded edition.

BTMT 3263
BUSINESS FINANCE
*Service course (FPTT)

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Recognise the importance of finance in business organisations.
2. Perform financial planning and forecasting.
3. Evaluate business financing and investing opportunities and able to make sound business decisions.

Synopsis
This course discusses the importance of finance in a business organisation, the roles of finance managers, the uses of finance concepts and tools in financial management, planning, and forecasting. This course also covers the evaluation of financing needs for start-ups and other stage of a business life cycle and business investment opportunities. It addresses the capital structure, cost of capital, and management of risks associated with technopreneurs venture' returns. It discusses key questions which challenge technopreneurs: how much money could and should be raised; when it should be raised and from whom; what is reasonable valuation of the company; and how funding should be structured. Students will gain knowledge and skills in managing financial resources and practicing finance ethically that will contribute to the organisation's strategy and goals.

References

1. Haniff, M. N., Abd Samad R., and Christabel, S. (2021), Financial Management for Beginners, 5th Edition, Mc Graw Hill.

2. Keown, A. J., Martin, J. D., and Petty, J.W. (2017), Foundation of Finance, Global Edition, 9th Edition, Pearson.
3. Ahmad, N., Abd Rahman, H., and Syed Alwi, S.F. (2016), Fundamentals of Finance, Second Edition, Oxford Fajar Sdn Bhd.
4. Sudin H., and Wan Nursofiza W. A. (2009), Islamic Finance and Banking System Philosophies, Principle and Practices, Mc Graw Hill.

BTMP 3383
HIGH TECHNOLOGY MARKETING STRATEGY
*Service course (FPTT)

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the role of marketing strategy in the high-tech industry.
2. Apply appropriate methods and approaches to develop strategies in high-tech marketing.
3. Analyze high-tech marketing strategy by incorporating knowledge and skills necessary in strategic marketing decision.

Synopsis
This course will provide students with practical guides on howto make decisions in strategic high-technology marketing that considers all disciplines. Topics include strategic analysis, strategic marketing implementation and strategic control. Besides, students will be exposed to the various high-tech approaches and decision making such as pricing strategies, promotion etc. students will also learn about the concept and theories on high-tech application through problem-based learning activites, case study analysis and group project.

References
1. Hartline, M.D. (2016) Marketing Strategy; Text and Cases, Cengage Learning.
2. Palmatier R.W., Srighra S. (2017), Marketing Strategy; based on First Principles and Data Analytics, Palgrave, Macmilan Education.
3. Rao, P.M. and Klein J.A. (2013), Strategies for High-Tech Firms: Marketing, Economic and Legal Issues, M.e. Shape, London, England.
4. Mohr, S. and Slater (2014), Marketing of High-Technology Product and Innovations, 3rd edition, Pearson Education Limited.
5. Kerin. R.A. and Peterson R.A. (2013), Strategic Marketing Problem; Cases and comments, 13th Edition, Pearson.

BTMP 2243
STRATEGIC INNOVATION MANAGEMENT
*Service course (FPTT)

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Elaborate on knowledge learnt and skills acquired in innovation and management and synthesize the process through strategy-integration.
2. Illustrate skills and knowledge and develop mechanisms to create wealth.
3. Organize, formulate changes and determine problem-solving solutions relating to innovation processes and property rights.

Synopsis
This subject discusses strategic imperatives in research implementation and innovation management. Topics include developing research and innovation processes, as well as technology and innovation strategic management. Students will acquire the neccesary knolwedge and skills in innovation processes and management. The subject also discusses intellectual property rights. Case studies will be incorporated to enhance students' understanding on strategic innovation management.

References

1. Schilling, M. A., (2020), Strategic Management of Technological Innovation, 6th Edition, New York: McGraw Hill International Edition.
2. Trott, P., (2020) Innovation Management and New Product Development, 7th Edition, Netherland: Pearson Higher Ed.
3. Leitao, J., Ratten, V., (2022) Strategic Innovation: Research Perspectives on Entrepreneurship Resilience: Australia: Springer Internasional Publishing.

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

BTMW 4012
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	Teknologi Sistem Kuasa Power System Technology	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	
	BELR 3433	Robotik Industri Industrial Robotik	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	
	*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
BERC 2210	IoT Fundamentals: Connecting Things Professional
BERC 2220	IoT Fundamentals: Big Data & Analytics Professional
BERE 3100	Programmable Logic Controller (PLC) Level 1 and Level 2
BERZ 3100	SMCT MT1 – Practical Mechatronic 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	BELG 1013	Matematik Teknikal Technical Mathematics	P	3	
	BERE 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	BMIG 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	BMKG 2033	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	BERG 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 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 W	2 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 3210	Programmable Logic Controller (PLC) Level 1 and Level 2
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
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)

BELG 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.

BMIG 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.

BMKG 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.

BERG 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 Publising, 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.

BMKT 2523
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

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.

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 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				

SEMESTER	CODE	COURSE	CATEGORY	CREDIT	GRADE (TO BE FILLED IN BY STUDENTS)	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	
	BELU 1123	ELCTRICALCIRCUIT I	P	3	INSERT GRADE	0	
	BMKG 1132	ENGINEERING GRAPHICS AND CAD	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	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	
	BELG 1413	DIGITAL ELECTRONICS	P	3	INSERT GRADE	0	
	BELE 1233	ELECTRONICS DEVICES	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		**33**	**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	
	BXXX 2792	INTEGRITY AND ANTI-CORRUPTION	E	2	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		**17**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**50**	**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		**67**	**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 3553	EMBEDDED SYSTEMS	P	3	INSERT GRADE	0	
	BELP 3553	POWER SYSTEMS ENGINEERING	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		**84**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SEMESTER 6	BELP 3673	POWER SYSTEM ANALYSIS	E	3	INSERT GRADE	0	
	BELE 3653	ELECTRICAL DRIVES	P	3	INSERT GRADE	0	
	BELC 3623	CONTROL SYSTEMS DESIGN	P	3	INSERT GRADE	0	
	BELP 3693	HIGH VOLTAGE ENGINEERING	P	3	INSERT GRADE	0	
	BELG 3661	INTEGRATED DESIGN PROJECT 1	P	1	INSERT GRADE	0	
	BELU 3551	ELECTRICAL ENGINEERING LABORATORY III	P	1	INSERT GRADE	0	
		TOTAL CREDITS		**17**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**101**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SPECIAL SEMESTER	BELU 3695	INDUSTRIAL TRAINING		5	PASS/FAIL	0	
		TOTAL CREDITS		**106**	**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	
	BXXB 4763	INTEGRATED DESIGN PROJECT 2	P	3	INSERT GRADE	0	
	BELP 4853	ENERGY UTILIZATION AND CONSERVATION	P	3	INSERT GRADE	0	
	BELX 4XX3	ELECTIVE I (PROGRAMME)	E	3	INSERT GRADE	0	
	BELX XXX3	ELECTIVE II (PROGRAM)	E	3	INSERT GRADE	0	
		TOTAL CREDITS		**15**	**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	
	BELU 4322	ENGINEER AND SOCIETY	P	2	INSERT GRADE	0	
	BELU 4894	FINAL YEAR PROJECT II	P	4	INSERT GRADE	0	
	BELP 4843	RENEWABLE ENERGY	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	$N_1 = n = 8$ $PO1 = \frac{\sum_{i=1}^{n} w_i c_i p_i}{\sum_{i=1}^{n} w_i c_i}$ $PO1 = \frac{(67.46 \times 1 \times 3) + (67.46 \times 1 \times 3) \ldots + (67.46 \times 1 \times 3)}{(1 \times 3) + (0.5 \times 2) \ldots . + (0.75 \times 3)}$ $PO1 = 67.70\%$
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

Faculty of Electrical Technology and Engineering
Universiti Teknikal Malaysia Melaka,
Hang Tuah Jaya,
76100 Durian Tunggal, Melaka.

Email: ftke@utem.edu.my
Phone: +606-270 1763
Fax: +606-270 1044

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