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### DIPLOMA PROGRAMME

Programme Educational Objectives (PEO) – Diploma Programme
Programme Outcomes (PO) – Diploma Programme
Course Implementation - DEK
Curriculum Structure - DEK
Credit Hour and Pre-Requisite - DEK
Student Learning Time - DEK
Subject Details for Diploma Programme

### BACHELOR PROGRAMME

Programme Educational Objectives (PEO) – Bachelor Programme
Programme Outcomes (PO) – Bachelor Programme

Bachelor of Electrical Engineering (Industrial Power) – BEKP
- Course Implementation - BEKP
- Curriculum Structure - BEKP
- Credit Hour and Pre-Requisite - BEKP
- Student Learning Time (SLT) - BEKP

Bachelor of Electrical Engineering (Control, Instrumentation & Automation) - BEKC
- Course Implementation - BEKC
- Curriculum Structure - BEKC
- Credit Hour and Pre-Requisite - BEKC
- Student Learning Time (SLT) - BEKC

Bachelor of Electrical Engineering (Power Electronics & Drives) - BEKE
- Course Implementation - BEKE
- Curriculum Structure - BEKE
- Credit Hour and Pre-Requisite - BEKE
- Student Learning Time (SLT) - BEKE

Bachelor of Mechatronics Engineering - BEKM
- Course Implementation - BEKM
- Curriculum Structure - BEKM
- Credit Hour and Pre-Requisite - BEKM
- Student Learning Time (SLT) - BEKM
Subject Details for Bachelor Programme

Information of Faculty’s Staff

Facilities & Infrastructure
- Faculty’s Building Map
- Laboratory Facilities
- List of Laboratories in the Faculty

Acknowledgement
VISION

To Be One of The World’s Leading Innovative and Creative Technical Universities

MISSION

To produce highly competent professionals through quality and world class technical university education based on application-oriented teaching, learning and research with smart university-industry partnership in line with national aspirations.

MOTTO

EXCELLENCE THROUGH COMPETENCY
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 development of national wealth.

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.
All praises is due Allah, the most Gracious, and with His Mercy the Academic Handbook of Diploma and Bachelor Degree for 2011/2012 session has been successfully published by the Faculty of Electrical Engineering.

First and foremost, I would like to honour this opportunity to congratulate all new students for being accepted to pursue their tertiary education in their selected courses in this faculty. I assure you that you are at the right place since that UTeM is the ultimate university where great technical career begins.

Students are the greatest asset for the faculty to achieve the main goal in producing graduates that will not only excel in academics, equipped with technical competencies and soft skills, but will be moulded to become “first class minded” as well. It is hoped that throughout their studies, students should integrate and practice as many soft skills, apply creative and critical thinking together with the leadership quality to work with colleagues for these are the qualities that will be the cutting edges to enter the world of occupation further on.

Beginning from July 2010, the faculty had implemented a new curriculum structure where all the activities related to teaching and learning are conducted based on the Outcome Based Education concept. These improvements are based on practice and application oriented as that meets the Engineering Accreditation Council requirement.

This handbook hence provides brief information about the faculty, curriculum structure, academic advisory system, university grading system and syllabus contents applicable to students for the 2011/2012 session intake. Hopefully it will provide appropriate information required and serves its purpose to constantly guide the students to plan their studies systematically to achieve academic excellence.
Last but not least, I would like to take this opportunity to express my gratitude to all the committee members that have involved in the publication of this handbook.

Wasalam.

“Excellence Through Competency”

Assoc Prof. Dr. Zulkifilie B. Ibrahim
Dean, Faculty of Electrical Engineering
Universiti Teknikal Malaysia Melaka
The Faculty of Electrical Engineering (FKE) was established in early 2001 and officially began its operation from the 22nd of June 2001 after obtaining authorization from Malaysia’s Ministry of Education (which is now known as Malaysia’s Ministry of Higher Learning). Initially, this Faculty began its operation in a temporary campus at Taman Tasik Utama, Ayer Keroh. In April 2005, the Faculty moved and operated entirely in the main campus located at Durian Tunggal, Melaka. This Faculty is one of the key academic units in Universiti Teknikal Malaysia Melaka (UTeM). It is led by a Dean, assisted by two Deputy Deans, five Head of Departments, a Chief Assistant Registrar and an Assistant Registrar. The combination of academic staff which consist of lecturers, teaching engineers and tutors based on their fields of expertise provide the main foundation in producing graduates equipped with knowledge, technical competencies as well as soft skills.

The Electrical Engineering Faculty consist of 4 Bachelor’s Degree programmes and 1 Diploma programme under these respective departments:
1. Department of Industrial Power Engineering
2. Department of Control, Instrumentation and Automation Engineering
3. Department of Power Electronic & Drives Engineering
4. Department of Mechatronics Engineering
5. Department of Diploma Studies

Beginning from the 2001/02 Academic Year, the Faculty of Electrical Engineering has offered the Bachelor of Electrical Engineering (Industrial Power) – BEKP programme. The following Academic Year, (2002/03), the Electrical Engineering Diploma – DEK programme is offered. After that, in the 2003/04 Academic Year, two more programmes were offered which are the Bachelor of Electrical Engineering (Control, Instrumentation & Automation) – BEKC programme and the Bachelor of Electrical Engineering (Power Electronic & Drives) – BEKE programme. Starting from the 2005/06 Academic Year, another programme was introduced which is the Bachelor of Mechatronics Engineering – BEKM.

The faculty also offers Post Graduate Programmes such as Masters of Science (M.Sc.) and Doctor of Philosophy (Ph.D) through research in various Electrical Engineering and Mechatronics Engineering fields. Both of these courses can be followed either by part-time or full-time. There are also 3 Post-Graduate programs for Masters of Electrical Engineering through mixed mode that have been approved starting from the 2009/2010 Academic Session. The programmes are:
1. Masters of Electrical Engineering (Industrial Power)
2. Masters of Electrical Engineering (Electronics Power & Drives)
3. Masters of Electrical Engineering (Control & Industrial Automations)
Apart from that, beginning from this 2011/2012 Academic Year, the Faculty is also offering an Engineering Doctorate Programme (EngD) in Electrical Engineering. The Engineering Doctorate programme offers an opportunity for outstanding engineers to enhance their qualification through a mix of broadly based technical and professional training while completing an industry based research project. Successful researchers will not only graduate with the title Doctor of Engineering (Electrical Engineering), but also will obtain the important mix of professional skills, technical knowledge and research experience that will enable them to progress to senior positions within the industry at an accelerated rate.
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.

TOWARDS ACADEMIC EXCELLENCE

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.
During the first year, the student will be equipped with fundamental subjects such as mathematics, science and computer programming to provide the foundation for learning engineering subjects. After that, during the second year, the student will be introduced to Electrical and Electronic Engineering subjects. At the end of this second year, students are required to undergo an Industrial Training for 10 weeks. Finally, during the third year, the students shall continue learning programme core subjects.

During the first year, the student will be introduced to fundamental subjects that would provide the basis of studying electrical engineering. This include, among others, subjects such as Algebra and Calculus, Engineering Mathematics, Electrical Circuit I and Computer Programming. Coming into the second year, the student will continue learning subjects that will further strengthen their basic electrical engineering knowledge. Student are required to undergo an internal industrial training during semester break after Semester 4 completed.

Beginning with the third year, the students will start to learn core programme courses such Control, Instrumentation & Automation Engineering, Industrial Power Engineering, Power Electronics & Drive Engineering or Mechatronics Engineering which include the areas of specialization. After Semester 6 has been completed student are required to undergo industrial training during the long semester break. During the fourth year, almost all the courses in this year are core programmes. In addition to this, the students are also required to undertake the Final Year Project for two semesters which should relate to the students field of study. Students are encouraged to do a project based on industrial problems that have been identified during their industrial training.

The University’s Compulsory subjects are distributed in each semester throughout the 4 years of study. Apart from core courses operated in the form of practice and application, students are also provided with engineering management skills, entrepreneurship, communication skills, co-curricular activities and personality development to produce engineers who are competent and able to work independently with a positive attitude.
## ADMISSION REQUIREMENTS

**MINIMUM REQUIREMENTS TO REGISTER IN DIPLOMA PROGRAMME**

<table>
<thead>
<tr>
<th>FOR SPM HOLDERS</th>
</tr>
</thead>
</table>
| **General Requirements** | 1. Citizen of Malaysia; and  
2. A pass in Sijil Pelajaran Malaysia or its equivalent with at least **FIVE (5)** credits including **Bahasa Melayu/Malaysia** |
| **Programme Specific Requirements** | 1. Fulfilled the Universities General Requirements with **FOUR (4)** credits (**Gred C**) in the following subjects:  
- Mathematics  
- Additional Mathematics  
- Physics  
And either one (1) of the following subjects:  
- Additional Science/ Applied Science  
- Science  
- Chemistry  
- Biology  
- Engineering Technology  
- Principle of Electrical and Electronic  
- Application of Electrical and Electronic  
- Engineering Technology or Mechanical or Electrical & Electronics Engineering Studies  
- Electrical Automation and Diesel  
- Computerize Machine  
- Engineering Drawing  
- Visual Arts or Invention and  
2. A pass at least (**Gred E**) in English Language and  
3. The applicant must not be colour blind or physically disabled such as to impair completing practical assignments. |
### FOR DIPLOMA/EQUIVALENT HOLDERS

| Universities General Requirements | A pass in Sijil Pelajaran Malaysia (SPM) / equivalent with a credit in Bahasa Melayu/Bahasa Malaysia or Bahasa Melayu/Bahasa Malaysia July paper and A Diploma or other qualification recognised as equivalent by the Government of Malaysia and approved by the University’s Senate or A pass in Sijil Tinggi Persekolahan Malaysia (STPM) 2009/ previous examination with at least:  
- C Grade (NGMP 2.00) in General Studies; and  
- C Grade (NGMP 2.00) in two(2) other subjects or A pass in Matriculation 2009 or previous examination with at least a CGPA of 2.00 and Obtained at least Band 1 in the Malaysian University English Test (MUET). |

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**Note:**

- A pass in Sijil Pelajaran Malaysia (SPM) / equivalent with a credit in Bahasa Melayu/Bahasa Malaysia or Bahasa Melayu/Bahasa Malaysia July paper and A Diploma or other qualification recognised as equivalent by the Government of Malaysia and approved by the University’s Senate or A pass in Sijil Tinggi Persekolahan Malaysia (STPM) 2009/ previous examination with at least:
  - C Grade (NGMP 2.00) in General Studies; and
  - C Grade (NGMP 2.00) in two(2) other subjects or A pass in Matriculation 2009 or previous examination with at least a CGPA of 2.00 and Obtained at least Band 1 in the Malaysian University English Test (MUET).
## Programme Specific Requirements

<table>
<thead>
<tr>
<th>FOR DIPLOMA/EQUIVALENT HOLDERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A pass in <strong>Diploma</strong> with at least a <strong>CGPA of 3.00</strong> in a related field from a recognised institution and approved by the University’s Senate; and</td>
</tr>
<tr>
<td>Credit exemption is subject to the discretion and approval by the Faculty and</td>
</tr>
<tr>
<td>Passed/ completed studies at Diploma level before the commencement of academic session or</td>
</tr>
<tr>
<td>A pass in Sijil Tinggi Persekolahan Malaysia (STPM) year 2009 or previous examination with at least <strong>C Grades (NGMP 2.00)</strong> in all of the following subjects:</td>
</tr>
<tr>
<td>• General Studies</td>
</tr>
<tr>
<td>• Physics /Biology</td>
</tr>
<tr>
<td>• Mathematics T/Further Mathematics T/ Mathematics S</td>
</tr>
<tr>
<td>• Chemistry</td>
</tr>
<tr>
<td>The applicant who did not take Physics at STPM level must has a pass in Sijil Pelajaran Malaysia (SPM)/ equivalent with at least <strong>4B</strong> in Physics, or</td>
</tr>
<tr>
<td>A pass in <strong>MOE Matriculation/ UM Foundation/ UiTM Foundation</strong> year 2009 or previous examination with at least <strong>C Grades (NGMP 2.00)</strong> in all of the following subjects:</td>
</tr>
<tr>
<td>• Physics / Engineering Physics/Biology</td>
</tr>
<tr>
<td>• Mathematics T/Further Mathematics</td>
</tr>
<tr>
<td>• Chemistry / Engineering Chemistry</td>
</tr>
<tr>
<td>The applicant who did not take Physics at STPM level must has a pass in Sijil Pelajaran Malaysia (SPM)/ equivalent with at least <strong>4B</strong> in Physics and</td>
</tr>
<tr>
<td>The applicant must not be colour blind or physically disabled such as to impair completing practical assignments.</td>
</tr>
</tbody>
</table>
**FOR MATRICULATION HOLDERS**

<table>
<thead>
<tr>
<th>Universities General Requirements</th>
<th>A pass in <em>Sijil Pelajaran Malaysia (SPM)</em> / equivalent with a credit in Bahasa Melayu/Bahasa Malaysia or Bahasa Melayu/Bahasa Malaysia July Paper; and</th>
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<tbody>
<tr>
<td></td>
<td>A pass in MOE Matriculation/ UM Science Foundation/ UiTM Foundation <strong>with CGPA of at least 2.00</strong>; and</td>
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<tr>
<td></td>
<td>Obtained at least <strong>Band 1</strong> in the Malaysian University English Test (MUET).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Programme Specific Requirements</th>
<th>Obtained at least <strong>C Grade</strong> (NGMP 2.00) in MOE Matriculation/ UM Science Foundation/ UiTM Foundation in <strong>all</strong> of the following subjects:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Mathematics / Engineering Mathematics</td>
</tr>
<tr>
<td></td>
<td>• Chemistry / Engineering Chemistry / Engineering Science</td>
</tr>
<tr>
<td></td>
<td>• Physics / Engineering Physics / Biology / Electrical and Electronic Engineering Studies</td>
</tr>
<tr>
<td></td>
<td>and</td>
</tr>
<tr>
<td></td>
<td>The applicant who did not take Physics at STPM level must has a pass in Sijil Pelajaran Malaysia (SPM)/ equivalent with at least <strong>4B</strong> in Physics.</td>
</tr>
<tr>
<td></td>
<td>and</td>
</tr>
<tr>
<td></td>
<td>The applicant must not be colour blind or physically disabled such as to impair completing practical assignments</td>
</tr>
</tbody>
</table>
### FOR STPM HOLDERS

| Universities General Requirements | A pass in Sijil Pelajaran Malaysia (SPM) / equivalent with a credit in Bahasa Melayu / Bahasa Malaysia or a credit in Bahasa Melayu / Bahasa Malaysia July Paper;  
A pass in Sijil Tinggi Persekolahan Malaysia (STPM) with CGPA of at least 2.00 and obtained at least:  
- C Grade (NGMP 2.00) in General Studies; and  
- C Grade (NGMP 2.00) in two (2) other subjects, and  
Obtained at least Band 1 in the Malaysian University English Test (MUET). |
| Programme Specific Requirements | A pass in Sijil Tinggi Persekolahan Malaysia (STPM) with at least C Grade (NGMP 2.00) in all of the following subjects:  
- Mathematics T/Further Mathematics T/ Mathematics S  
- Chemistry  
- Physics/Biology  
and  
The applicant who did not take Physics at STPM level must has a pass in Sijil Pelajaran Malaysia (SPM)/ equivalent with at least 4B in Physics.  
and  
The applicant must not be colour blind and not physically disabled such as to impair completing practical assignments. |
Student’s performance in every subject is evaluated based on the grade obtained. Grading system is shown in Table 1.

Generally, minimum passing grade for a subject 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 subject only once.

Table 1: Grading System and Point

<table>
<thead>
<tr>
<th>Grade (Achievement)</th>
<th>Relations between Marks Percentage and Grade Point</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Marks Percentages</td>
</tr>
<tr>
<td>A (Excellent)</td>
<td>80 – 100</td>
</tr>
<tr>
<td>A- (Excellent)</td>
<td>75 – 79</td>
</tr>
<tr>
<td>B+ (Honours)</td>
<td>70 – 74</td>
</tr>
<tr>
<td>B (Honours)</td>
<td>65 – 69</td>
</tr>
<tr>
<td>B- (Pass)</td>
<td>60 – 64</td>
</tr>
<tr>
<td>C+ (Pass)</td>
<td>55 – 59</td>
</tr>
<tr>
<td>C (Pass)</td>
<td>50 – 54</td>
</tr>
<tr>
<td>C- (Conditional Pass)</td>
<td>47 – 49</td>
</tr>
<tr>
<td>D+ (Conditional Pass)</td>
<td>44 – 46</td>
</tr>
<tr>
<td>D (Conditional Pass)</td>
<td>40 – 43</td>
</tr>
<tr>
<td>E (Fail)</td>
<td>0 - 39</td>
</tr>
</tbody>
</table>
### GRADUATION REQUIREMENT

<table>
<thead>
<tr>
<th>PROGRAMME</th>
<th>GRADUATION REQUIREMENT</th>
</tr>
</thead>
</table>
| 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. Passed all subjects required for curriculum requirements:  
    - Minimum credit hour requirements for the award of a Diploma is 99 credits which consists of 79 credits of Core Program (P) subjects and 20 credits of Compulsory University (W) subjects.  
  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 | 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 subjects required for curriculum requirements:  
    - Minimum credit hour requirements for the award of a Degree is 138 credits hour which consists of 86 credits of Core Program (P) subjects, 30 credits of Core Courses (K) subjects and 22 credits of Compulsory University (W) subjects.  
  iii. Has applied for the award, recommended by the faculty and approved by the Senate.  
  iv. Passed MUET with a band set by the university.  
  v. Other requirements set by the university. |
| Bachelor of Mechatronics Engineering | 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 subjects required for curriculum requirements:  
    - Minimum credit hour requirements for the award of a Degree is 139 credits which consists of 111 credits of Core Program (P) subjects, 6 credits of Core Courses (K) subjects and 22 credits of Compulsory University (W) subjects.  
  iii. Has applied for the award, recommended by the faculty and approved by the Senate.  
  iv. Passed MUET with a band set by the university.  
  v. Other requirements set by the university. |
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.

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.
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
2. Creative Thinking and Problem Solving Skills
3. Teamwork Skills
4. Continual Learning and Information Management
5. Entrepreneurship Skills
6. Professional Ethics and Moral Values
7. Leadership Skills.

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

1. Soft Skills Development via Formal Teaching and Learning Activities:
   - Stand Alone Subject Model
   - Embedded Model
   - Combination of Embedded Model & Stand Alone Subject 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
In UTeM students are free to take subjects 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 subjects offered in each semester based on their ability and conditions of subject selection determined by the faculty and university’s academics regulations.

- Students should plan programs of study and learning appropriate which will needs the advices from academic adviser during the studies.

The Importance of an Academic Advisor (PA)

- Students need to be given a proper advice in term of subjects taken under the semester system, where they are free to determine the number of subjects 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 subjects 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 subjects 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 in the Academic Advisory System are as follow:

<table>
<thead>
<tr>
<th>Roles/Responsibilities of Academic Advisor</th>
<th>Roles/Responsibilities of Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Conduct a meeting with the students at least two times for every semester.</td>
<td>• Always be open minded when meeting with the Academic Advisor.</td>
</tr>
<tr>
<td>• Make sure to student understand the academic system in UTeM.</td>
<td>• Conduct a meeting with the Academic Advisor at least two times for every semester.</td>
</tr>
<tr>
<td>• Provide an advice and make sure student’s subjects registration is based on his/her current academic result.</td>
<td>• Make the Academic Advisor as a mentor and always get an advice on the academic matter.</td>
</tr>
<tr>
<td>• Supervise the student study progress and provide a guidance in making a good study planning.</td>
<td>• Make sure to have a good understanding on the academic system.</td>
</tr>
<tr>
<td>• Provide student to always be motivated in their study etc.</td>
<td>• Provide a copy of examination result to the Academic Advisor at each semester.</td>
</tr>
<tr>
<td>• Supervise the student record and file to be always updated – make sure no subject is missed to fulfil the requirement for degree award.</td>
<td>• Get the certification of registration form, copy of certificates and reference letter from the Academic Advisor.</td>
</tr>
<tr>
<td>• Refer the student to the certain department/centre for further action if necessary.</td>
<td>• Always keep a record on all subjects that already been taken during the period of study to prevent missed subject and fulfil the requirement for degree award.</td>
</tr>
</tbody>
</table>
# Lists of the Faculty’s External Examiner, Visiting Professor, Adjunct Professor and Industrial Advisory Panel

<table>
<thead>
<tr>
<th>EXTERNAL EXAMINER</th>
<th>QUALIFICATIONS</th>
<th>POSITION</th>
<th>APPOINTMENT PERIOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Dr. Mohd Marzuki Bin Mustafa</td>
<td>B.Eng, University of Tasmania Master, Univ. of Manchester Inst. of Science &amp; Technology (UMIST) Ph.D, University of Salford</td>
<td>Professor, Department of Electrical, Electronic and Systems Engineering, Faculty of Engineering, UKM</td>
<td>1 January 2010 – 31 December 2011</td>
</tr>
<tr>
<td>Prof. Dr. Atsuo Kawamura</td>
<td>B.Sc. in Electrical Engineering, University of Tokyo M.Sc. in Electrical Engineering, University of Tokyo Ph.D in Electrical Engineering, University of Tokyo</td>
<td>Professor Department of Electrical &amp; Computer Engineering Yokohama National University</td>
<td>1 January 2010 – 31 December 2011</td>
</tr>
<tr>
<td>Professor Dr. Momoh-Jimoh Eyiomika Salami</td>
<td>B.Sc. Electronics and Electrical Engineering, Univ of Ile-Ife, Nigeria PG. Dip, Philips Int. Institute for Technological Studies, Holland Ph.D in Electrical Engineering, University of Calgary</td>
<td>Professor, Department of Mechatronics Engineering Deputy Dean Postgraduate &amp; Research, Faculty of Engineering, IIUM</td>
<td>1 August 2009 – 31 July 2011</td>
</tr>
<tr>
<td>Prof. Ir. Dr. Abdul Halim Mohamed Yatim</td>
<td>B.Sc. Electrical &amp; Electronic Engineering, Portsmouth Poly, UK, M.Sc. , Ph.D Power Electronics, Bradford University, UK.</td>
<td>Professor, Dean, Faculty of Electrical Engineering, UTM</td>
<td>1 June 2010 – 30 June 2012</td>
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<td>Prof. Dr. Nasrudin Abd. Rahim</td>
<td>B.Sc (Hons), University of Strathclyde Glasgow, U.K</td>
<td>Professor, Head of Department (Electrical Engineering) Faculty of Engineering Universiti Malaya</td>
<td>1 January 2009 – 31 December 2010</td>
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<td>M.Sc (Power Engineering), University of Strathclyde, Glasgow, U.K</td>
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<td>Ph.D, Heriot-watt University Edinburgh, U.K</td>
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<td>Prof. Dr. Mohd. Zaid Abdullah</td>
<td>B.App.Sc (Hons) USM M.Sc., Ph.D. UMIST C.Eng., MIEE, UK</td>
<td>Professor, Dean, School of Electrical &amp; Electronic Engineering, Universiti Sains Malaysia</td>
<td>1 June 2010 – 30 June 2012</td>
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<td>Prof. Dr. Faz Rahman</td>
<td>B.Sc. in Electrical Engineering, Bangladesh University of Engineering and Technology M.Sc. in Power Electronics &amp; Systems, UMIST Ph.D. in Electrical Engineering, UMIST</td>
<td>Professor, School of Electrical Engineering &amp; Telecommunications, University of New South Wales</td>
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<td>Dr Ab. Halim Abu Bakar</td>
<td>B.Sc in Electrical Engineering, Southampton University, UK M.Sc, Ph.D. UTM</td>
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<td>Ir. Sh. Jaafar bin Sh. Isma</td>
<td>Principal (Electrical), Menara Teknik Sdn Bhd.</td>
<td>1 March 2011 – 28 February 2013</td>
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<td>Ir. Abd Aziz bin Mohd Yusof</td>
<td>Makhosetia Sdn Bhd</td>
<td>1 March 2011 – 28 February 2013</td>
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<td>Ir. Abdul Wahid Paijo</td>
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<td>1 March 2011 – 28 February 2013</td>
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<tr>
<td>Ir. Hj. Rosman bin Ismail</td>
<td>Head of Factory Service, Proton</td>
<td>1 August 2010 – 31 July 2012</td>
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<tr>
<td>Ir. Guntur Tobeng</td>
<td>Managing Director, Gading Kencana Sdn Bhd</td>
<td>1 March 2011 – 28 February 2013</td>
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<tr>
<td>Ir. Abdul Halim bin Baharudin</td>
<td>State Manager - Pahang Asset Maintenance, TNB Transmission</td>
<td>1 March 2011 – 28 February 2013</td>
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DIPLOMA PROGRAMME
**DIPLOMA IN ELECTRICAL ENGINEERING**

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 within 4 to 6 years of graduation. Below are the PEO for the Faculty of Electrical Engineering’s Diploma Programme.

<table>
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<tr>
<th>NO</th>
<th>PROGRAMME EDUCATIONAL OBJECTIVES (PEO)</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>Three to five years after completing their studies, the graduates will be Assistant Engineers who are able to carry out the job effectively and recognized by their employer.</td>
</tr>
<tr>
<td>2.</td>
<td>Three to five years after completing their studies, the graduates will be competent Assistant Engineers, able to solve technical problems properly.</td>
</tr>
<tr>
<td>3.</td>
<td>Three to five years after completing their studies, the graduates will be Assistant Engineers that hold to the good values in providing quality services.</td>
</tr>
<tr>
<td>4.</td>
<td>Three to five years after completing their studies, the graduates will be Assistant Engineers who have vision in developing their self and career through lifelong learning process.</td>
</tr>
<tr>
<td>5.</td>
<td>Three to five years after completing their studies, the graduates will be a creative and innovative Assistant Engineer in technical fields and applies it in the techno-entrepreneurs sector.</td>
</tr>
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</table>
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 Engineering’s Diploma Programme:

<table>
<thead>
<tr>
<th>NO</th>
<th>PROGRAMME OUTCOMES (PO)</th>
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<tbody>
<tr>
<td>1.</td>
<td>Ability to apply fundamental knowledge of mathematics, sciences and engineering in field of electrical engineering.</td>
</tr>
<tr>
<td>2.</td>
<td>Ability to identify, analyze and solve well-defined electrical engineering problems based on provided information.</td>
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<tr>
<td>3.</td>
<td>Ability to use appropriate engineering tools to perform related jobs through engineering practices.</td>
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<tr>
<td>4.</td>
<td>Ability to communicate and deliver ideas using appropriate method effectively.</td>
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<tr>
<td>5.</td>
<td>Ability to comply the professional ethics and responsibility.</td>
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<tr>
<td>6.</td>
<td>Ability to work as a team effectively and exhibit good leadership skills toward achieving goal.</td>
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<tr>
<td>7.</td>
<td>Ability to undertake lifelong learning process.</td>
</tr>
<tr>
<td>8.</td>
<td>Ability to have basic entrepreneurship knowledge and skills in the related field.</td>
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<tr>
<td>9.</td>
<td>Ability to apply social skills and fulfil the relevant responsibilities towards society.</td>
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</table>
The number of credits required to be awarded a Diploma is **99** credits.

This course will take three (3) years minimum which emphasis on the latest technology and up to date skills.

The composition of the credits is as follows:

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<th>Course Type</th>
<th>Credit Hours</th>
<th>Percentage</th>
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<td>Core Program Courses</td>
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<td>Engineering (65 Credit Hours)</td>
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<td>Science and Mathematics (14 Credit Hours)</td>
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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.
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<th>Type of Course</th>
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<th>Year 2</th>
<th>Year 3</th>
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NOTE: Subjects arranged based on alphabetical order.

DEKA 1212
ALGEBRA

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Explain the concept of basic mathematics.
2. Use the knowledge of basic mathematics to enhance their advanced mathematics such as calculus, Engineering Mathematics and Differential Equation.
3. Apply the knowledge of mathematics in physical and electrical engineering fields.

Synopsis
This subject consists 7 chapters: Real number system, Complex number, Matrices, Geometric-Coordinate, Function and graph, Trigonometry and Polynomials.

References

DEKA 1213
PHYSICS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Explain basic concept in physics, covering aspect such as mechanics, electric and thermodynamics.
2. Apply the laws and the concepts systematically to solve problems.
3. Handle laboratory equipment based on correct procedures.
4. Make accurate measurement and present the results in a proper scientific report.
5. Apply physics knowledge in the engineering field.

Synopsis
The topics covers in this subject are: Forces, Acceleration and Newton’s Second Law of Motion, Motion with a Changing Velocity, Circular Motion, Conservation of Energy, Linear Momentum, Fluids, Heat, Temperature, Electric Forces and Fields, Capacitor, Electric Current and Circuits, Reflection and Refraction of Light. Experiments are categorized into 2 types; computer aided and manual. Topics covered include Mechanics, Thermal Physics, and Electricity and Optics.

References

DEKA 1222
CALCULUS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Find limits and continuity of functions.
2. Find derivatives of algebraic, trigonometric, logarithmic, and exponential functions.
3. Find integrals of some algebraic and exponential functions.
4. Use derivative and integrals to solve engineering problems.

Synopsis
This course will discuss about Limits and continuity, Differentiation and Application of Differentiation, Integration and Application of Integration.

References

DEKA 2332
DIFFERENTIAL EQUATIONS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Define the terminologies which are commonly used in differential equations.
2. Verify that the given function is a solution of the given differential equation.
4. Find the Fourier Series of a given function
5. Apply the knowledge of differential equations in order to solve engineering problems.

Synopsis
This subject discusses about the basic concepts of Differential Equation; First Order Differential Equation; Second Order Linear Differential Equation with constant coefficients; Laplace Transforms and Fourier series. The syllabuses are developed to expose the learner’s on the fundamental concept of differential equations.

References

DEKA 2342
ENGINEERING MATHEMATICS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Sketch the contour map and graph for a certain function.
2. Use partial derivatives to find the approximation and extreme for certain functions.
3. Evaluate the double and triple integrals of functions using various techniques.
4. Use the techniques of integration to calculate the area and volume of the region.
5. Use vector-valued function to calculate curvature and torsion for certain functions.

Synopsis
This subject consists of three chapters: Functions of Several Variables, Multiple Integrals and Vector-valued Functions. The syllabus is extended from Calculus taken by student in Semester 2 Year 1. Its emphasize on the concepts of the functions with severable variables, double and triple integrations and also vector-valued function, followed by learning various techniques in solving the problems.
References

DEKC 1513
MEASUREMENTS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Identify electrical quantities related to various measurement standards.
2. Calculate errors in measurement through statistical analysis.
3. Describe the application of PMMC instrument for DC ammeter and DC voltmeter.
4. Explain full and half wave rectifier in AC voltmeter design.
5. Construct and demonstrate Wheatstone bridge through experiments.

Synopsis
Prior to the lecture session, this course will be discussing on unit, dimension and standards in measurement. It touches most on the Measurement System as well as measurement instruments such as galvanometers, ammeters and voltmeters. A DC and AC Wheatstone Bridge, Potentiometers and Energy/Power measurements/Wattmeters also to be taught in this course.

References
2. Fatimah Sham Ismail, Anita Ahmad; Pengukuran dan Instrumentasi; UTM; 2002.

DEKC 2323
INSTRUMENTATION

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Define the basic concept of instrumentation.
2. Demonstrate experiment on the bridge, oscilloscope and signal conditioning circuitry.
3. Apply several types of sensors and transducers in instrumentation systems.
4. Describe data acquisition process for data collection purpose in instrumentation systems.
5. Design a simple application of PIC or PLC with combination of several sensors and switches.

Synopsis
This subject will discuss about the concepts of transducer such as movement, position, force, pressure, temperature, flow and light; bridge including Wheatstone, Schering and Maxwell; Signal conditioning circuit such as ADC/DAC and Data Acquisition System.

References
3. Instek GOS-6xxG Dual trace oscilloscope user manual.

DEKC 3433
COMMUNICATIONS ENGINEERING

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Explain a basic knowledge on the communication engineering.
2. Define and analyze noise in communication system.
3. Describe the modulation and demodulation techniques of AM and FM.
4. Explain the transmission and reception process of AM & FM.
5. Identify the concept of analogue and digital pulse modulation.

Synopsis
Communication systems – definitions, needs and development of communications system, types of communications system, the elements of communications system, introduction of multiplexing. Amplitude Modulation – signal analysis, modulation index, frequency spectrum, AM transmission – DSBSC, SSB, VSB transmission system. AM receiver – DSB & SSB detector, envelope detector, superhetrodyne receiver, automatic gain control. Frequency modulation – frequency deviation, modulation index, Bessel function. FM transmission – modulator circuits. FM receiver – Foster Seeley, ratio detector. External noise, internal noise, noise calculation, noise factor. Comparison between AM and FM.

References

DEKC 3453
MICROPROCESSOR

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Describe the concept of microprocessor and computer system.
2. Write and debug programs using assembly language for microprocessor applications.
3. Construct microprocessor system with memory and peripheral device interfaces.

4. Interface and program the peripheral device to communicate with the microprocessor.
5. Demonstrate the practical competence using MC68000 microprocessor for software and hardware development.

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

References

DEKC 3643
AUTOMATION

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. State the concept of automation, Programmable Logic Controller (PLC) and their components.
2. Apply digital system knowledge such as number system, codes and logic function in PLC base application.
3. Identify external I/O devices of PLC system, draw PLC I/O connection diagram and carry out their wiring in terms of their symbol and connection.
4. Construct PLC ladder diagram and mnemonic codes generation for small and basic application using programming console.
5. Describe and built pneumatic and hydraulic systems for fluid power actuation solution.
6. Recite robotic technology in term of motion axes and geometry.

Synopsis
This subject will introduce a fundamental of the automation and manufacturing, their components such as actuators, sensors as well linear and rotary transportation devices. It will also covers on the automation control system, either using servo system, analogue or digital systems, electronic logic controlled and programmable logic controller (PLC). Computer based controlled systems such as automation work-cell and computer integrated manufacturing systems (CIMS) will also be included.

References

DEKC 3813
CONTROL SYSTEM ENGINEERING

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Recognize differences between open and closed loop system and also to understand how to develop differential equation models of physical system in order to obtain the transfer function.
2. Analyze control systems in time and frequency domain.
3. Identify the effectiveness of a feedback control systems using transient and steady state responses.
4. Determine steady state error using Routh Hurtwitz criterion.
5. Demonstrate experiments of control systems as well as to analyze and interpret data.

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

References

DEKE 2333
DIGITAL ELECTRONICS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Describe the basic numbering system including the decimal, binary, octal and hexadecimal.
2. Simulate basic combinational logic circuit.
3. Apply basic gates and flip-flops used in digital circuit.
4. Identify types of logic gates family within the integrated circuit (IC).
5. Describe the function of counters and adders in the digital circuits.
6. Develop the skill of critical thinking and problem solving in the engineering application as well as communication skill and teamwork spirit.

Synopsis
This course will equip students with basic principle, techniques and conventions used in digital electronic circuit design.
References

DEKE 2433
ANALOGUE ELECTRONICS I

Learning Outcomes
Upon completion this subject, the students should be able to:
1. Explain the characteristics and operation of semiconductor, diode, BJT and FET.
2. Explore the applications of diode, BJT and FET.
3. Analyze the operation and characteristics of diode, BJT and FET.
4. demonstrate practical competence on diode and BJT application circuits.
5. Explain the operation and characteristics of power amplifier

Synopsis
Semiconductor theories - introduction, atomic structure, covalent bonding, majority and minority carrier, p-n junction. Diode - introduction, characteristics & parameters of diode, diode equivalent circuit, types of diode, analysis and application. Bipolar junction transistor (BJT) - introduction, dc analysis, construction, transistor operation, shape and symbol, configuration, limit of operation, transistor specification, dc biasing, bias stabilization. BJT-introduction, ac analysis, hybrid equivalent circuit, equivalent circuit for all biasing, amplification circuit with Rs and Re, two port system. FET - introduction, structure, characteristics, types of bias, transfer characteristics curve, small signal analysis, frequency response and amplifier multi stage. Power Amplifier - Introduction to amplifier classes, circuit & operation difference for each classes, distortion within the amplifier and power transistor heat sinking.

References

DEKE 2443
ANALOGUE ELECTRONICS II

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Explain the operation of operational amplifier, voltage regulator, feedback circuit, oscillator and active filter.
2. Analyze the operational amplifier, voltage regulator, feedback circuit, oscillator and active filter characteristics and application
3. Apply the operational amplifier, voltage regulator, feedback circuit, oscillator and active filter for industrial electronics application
4. Conduct and demonstrates practical experiments of operational amplifier, voltage regulator, feedback circuit, oscillator and active filter.
5. Simulates the operation of operational amplifier, voltage regulator, feedback circuit, oscillator and active filter by using the simulation software (PSpice).

Synopsis
DEK 3443
POWER ELECTRONICS

Learning Outcomes
Upon completion this subject, the students should be able to:
1. Describe the principle and operation of power electronics, power semiconductor devices and converters
2. Explain the semiconductor power switches application in industrial practices.
3. Analyze the characteristics and performance of rectifiers, choppers and inverters.
4. Demonstrate practical competence on power electronics converters.
5. Apply the power electronics devices for switching power supplies.

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

References

DEKM 2343
INTRODUCTION TO MECHATRONICS SYSTEM

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Identify and explain the basic concept and the engineering applications of Mechatronics systems.
2. Describe and relate the basic Mechatronics system with engineering application.
3. Identify the characteristics of Mechatronics system.
4. Relate machine and mechanism design with Mechatronics system.
5. Solve and analysis simple Mechatronics engineering problem.

Synopsis


References
DEKM 3753
ELECTRICAL MACHINES

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Explain the types, physical construction and equivalent circuit diagrams of electrical machines.
2. Distinguish the characteristics of electrical machines.
3. Demonstrate the performance of electrical machines.
4. Choose suitable types of electrical machines for different applications.

Synopsis
This subject covers an introduction to three-phase transformer, DC and AC type of electrical machines which involve physical construction, equivalent electrical circuit diagrams. The machine performances like torque, speed and efficiency are distinguished for each electrical machine type. Introduction to the starting methods and speed control techniques are also demonstrated so that better machine selection for an appropriate application.

References

DEKP 1121
ELECTRICAL WORKSHOP I

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Identify basic electrical components for domestic wiring installation.
2. Construct and demonstrate relay control circuits.
3. Describe basic electronic components and perform soldering process.
4. Apply the fundamental techniques of domestic wiring; relay control circuit wiring and PCB wiring processes.

Synopsis
This subject will expose students to basic domestic wiring, relay control, basic electronic components, and installation. Concentration is given on the safety aspects and quality of works.

References
1. Abdul Samad, Amalan Pemasangan Elektrik, DBP.
2. Mohd Nazi, Teknologi Pemasangan Elektrik, DBP.
5. Acceptability of Electronic Assemblies (Revision C, 2000).

DEKP 1213
ELECTRICAL CIRCUIT I

Learning Outcome
Upon completion of this subject, the student should be able to:
1. Calculate current, voltage and power across any elements in a circuit accurately.
2. Apply circuit’s laws and theorems in analyzing electrical circuits.
3. Differentiate direct current (DC) circuit and alternating current (AC) circuit precisely.
4. Analyze AC circuit parameters properly.
5. Analyze circuits using CAD and analysis tools (PSpice) accordingly.

Synopsis

References

DEKP 1323
ELECTRICAL CIRCUIT II

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Differentiate single phase AC circuit and three phase AC circuit.
2. Determine parameters in single phase and three phase circuit.
3. Describe the transient analysis of first and second order circuit.
4. Analyse the circuit in frequency response.
5. Recognize the parameters of two port network.

Synopsis
Single phase AC circuit: Series & parallel circuit, power, power factor & power resonance in single phase AC circuit.
Three phase AC circuit: Basic three phase system generator, power and analysis in three phase circuit.
Transient analysis: 1st order & 2nd order circuit.

References

DEKP 2242
ELECTRICAL WORKSHOP II

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Install the basic electrical domestic wiring circuit.
2. Build the basic electrical domestic wiring.
3. Make the costing calculation for electrical wiring.
4. Apply the workshop safety rules and regulation in the electrical wiring installation.
5. Apply the computer aided drawing software AUTOCAD in the basic engineering drawing.

Synopsis
Introduction to the basic domestic wiring system. Safety practice. Cable type and size of domestic cables. Testing and troubleshooting domestic wiring. Tools and testing equipments. Introduction to the AutoCAD for 2D basic engineering drawing. Creating, editing and plotting using computer aided drawing software.

References
1. Abdul Samad, Amalan Pemasangan Elektrik, DBP.
2. Mohd Nazi, Teknologi Pemasangan Elektrik, DBP.
6. Wiring System & Motor Starter Modul 2, UTeM.

DEKP 2333
INTRODUCTION TO ELECTRICAL TECHNOLOGY

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Identify and recognise the basic electrical system components.
2. Apply and implement magnetic field's laws such on magnetic force.
3. Investigate and explain the electromagnetic properties and laws.
4. Determines and analyze the magnetic circuits.
5. Apply and analyze the electromagnetic concepts for electrical transformer.

Synopsis
This subject introduces students to the Introduction of Electrical System, Electric & Magnetic Field, Electromagnetic, Magnetics Circuits and application of
Topics include:

- Introduction to Electrical System - basic electrical system, electric charges, electrons, electric field & electric potential, Gauss & Coulomb's law.
- Magnetic Field - magnetic force, torque & moment, Ampere's law, Biot-Savart's law.
- Electromagnetic - Magnetic flux, Faraday & Lenz Law, self induction of inductor, induces EMF.
- Magnetic circuit - series & parallel magnetic circuit, back emf in dc motor.
- Electrical transformers - single phase transformer, equivalent circuit, open & short circuit test, efficiency, voltage regulation.

References


Learning Outcomes

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

1. Manipulate and use all of their knowledge and skills to finish the project.
2. Think objectively, critically and analytically in determining and solving problems systematically.
3. Manage time, cost and equipment skilfully.
4. Convert results from the project into oral and written form.

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 based on project achievement, presentation and project report.

References

References depend on the project title.
DEKP 3763  
POWER SYSTEM

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Describe the basic concept of power system and their components.
2. Describe the basic principle and requirements for transmission and distribution system.
3. Calculate voltages, currents, power factors and efficiency of the transmission lines.
4. Calculate the fault level and short circuit current for symmetrical fault and asymmetrical faults.
5. Explain the basic principle and requirements for overhead lines and underground cable, type of insulation, testing and commissioning, condition monitoring and maintenance.

Synopsis
The purpose of this subject is to introduce students with basic concept of power system; components of power system such as synchronize machines, automatic voltage regulator, overhead lines, transformer, switching and protection equipments. Explain theories of symmetrical components for fault analysis, voltage control and reactance power, overhead lines and underground cables analysis. Besides, students will be exposing to the requirement of condition monitoring and maintenance.

References

DEKU 2363  
INDUSTRIAL TRAINING

Learning Outcomes
Upon completion this subject, the student should be able to:
1. Acquire an early stage working experience that is related to electrical engineering.
2. Develop and practice the positive attitude and be prepared for a real working environment.
3. Enhance and apply professional skills and knowledge that are highly relevant to the needs of today’s workforce and industry.
4. Contribute creative ideas in solving engineering problems.
5. Present a report in oral and written about working experiences.

Synopsis
Industrial training is compulsory to students of Diploma in Electrical Engineering to graduate. Students will undergo industrial training after semester 4 of studies for a 10-week period of training at respective industrial companies. During the training period, the students will be continuously supervised by the industrial supervisor as well as supervision by the lecturers from Faculty. Students are required to record their daily activities in the logbook that been provided by Faculty. After completing the industrial training, students have to submit a formal report following the Faculty’s format. Evaluation will based on companies supervisor report, logbook and final report is the component for industrial evaluation for the grade either pass or fail.

References

DITG 1112  
COMPUTER SKILLS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Learn the parts and types of computers.
2. Learn assembly of hardware and troubleshooting.
3. Learn how to create partition, format a computer, and install and operating system.
4. Learn and construct simple programming using C++.
5. Learn to use application software to process words, electronic display, presentation and database.
Synopsis
To give students exposure and knowledge about basic things in the field of ICT such as basic computer components, operating systems, application software, system development life cycle, network and internet. Introduction to computer: history, evolution and specification, exposure to computer hardware. Introduction to software system, operation and application (word processing, electronic display, presentation, network), programming and combining system methodology. Exposure regarding data communication, networking and internet.

References

References

DMCG 1323
INTRODUCTION TO MECHANICAL SYSTEM

Learning Outcomes
Upon completion of this subject, 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 dynamics and 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
SERVICE SUBJECTS
(FPTT, PBPI & CO-CURRICULUM UNIT)

- DKKX 2XX1
  CO-CURRICULUM I & II

- DLHW 1012
  FOUNDATION ENGLISH

- DLHW 1702
  TAMADUN ISLAM DAN TAMADUN ASIA (TITAS)

- DLHW 1722
  SCIENCE & TECHNOLOGY PHILOSOPHY
  OR
  DLHW 1732
  SOCIO-ECONOMIC DEVELOPMENT

- DLHW 2402
  TECHNICAL COMMUNICATION I

- DLHW 2712
  ETHNIC RELATIONS

- DLHC 3012
  NEGOTIATION SKILLS
  OR
  DLHC 3022
  CRITICAL & CREATIVE THINKING

- DLHW 3402
  TECHNICAL COMMUNICATION II

Please refer to the Faculty of Technology Management & Technopreneurship (FPTT) handbook for further information on the offered subjects.

- DTKW 1012
  FUNDAMENTAL OF ENTREPRENEURSHIP CULTURE

- DACA 4142
  ENTREPRENEURSHIP TECHNOLOGY

Please refer to the Pusat Bahasa & Pembangunan Insan (PBPI) handbook for further information on the offered subjects.
BACHELOR PROGRAMME
Programme Educational Objective (PEO) are specific goals describing the expected achievement of graduates in their career and professional life within 4 to 6 years of graduation. Below are the PEO for the Faculty of Electrical Engineering’s Bachelor Programme:

<table>
<thead>
<tr>
<th>NO</th>
<th>PROGRAMME EDUCATIONAL OBJECTIVES (PEO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To produce engineers who are able to apply engineering knowledge in their professional careers.</td>
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<tr>
<td>2.</td>
<td>To produce engineers who are creative and innovative in their field.</td>
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<tr>
<td>3.</td>
<td>To produce engineers who practice high standards of ethical conduct, good leadership quality and societal responsibilities.</td>
</tr>
<tr>
<td>4.</td>
<td>To produce engineers who are capable of developing their professional career through continuous education.</td>
</tr>
</tbody>
</table>
| 5. | Bachelor of Electrical Engineering (Industrial Power)  
To produce engineers who have competency in the field of Industrial Power.  

Bachelor of Electrical Engineering (Control, Instrumentation & Automation)  
To produce engineers who have competency in the field of Control, Instrumentation and Automation.  

Bachelor of Electrical Engineering (Power Electronics & Drives)  
To produce engineers who have competency in the field of Power Electronics and Drives.  

Bachelor of Mechatronics Engineering  
To produce engineers who have competency in the field of Mechatronics. |
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 Engineering’s Bachelor Programme:

<table>
<thead>
<tr>
<th>NO</th>
<th>PROGRAMME OUTCOMES (PO)</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ability to apply fundamental knowledge of mathematics, sciences, electrical and/or mechatronics engineering. (K,A)</td>
</tr>
<tr>
<td>2.</td>
<td>Ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability. (K,S,A)</td>
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<tr>
<td>3.</td>
<td>Ability to design and conduct experiments, as well as to analyze and interpret data for practice and applications. (K,S)</td>
</tr>
<tr>
<td>4.</td>
<td>Ability to identify, formulate and solve engineering problems. (K)</td>
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<tr>
<td>5.</td>
<td>Ability to use engineering tools necessary for engineering practices. (S)</td>
</tr>
<tr>
<td>6.</td>
<td>Ability to practice professional and ethical conduct. (K,A)</td>
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<tr>
<td>7.</td>
<td>Ability to communicate effectively. (A)</td>
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<tr>
<td>8.</td>
<td>Ability to function in a team effectively with the capacity to be a leader. (A)</td>
</tr>
<tr>
<td>9.</td>
<td>Ability to undertake lifelong learning. (A)</td>
</tr>
<tr>
<td>10.</td>
<td>Ability to identify fundamental entrepreneurship skills as applied in the engineering profession. (K)</td>
</tr>
<tr>
<td>11.</td>
<td>Ability to have knowledge of contemporary issues. (K)</td>
</tr>
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</table>
BACHELOR OF ELECTRICAL ENGINEERING (INDUSTRIAL POWER) - BEKP
Bachelor of Electrical Engineering (Industrial Power) involves the areas connected to the electricity system aspects such as generation, transmission, power distribution, power system protection, electrical energy, load management, including regulatory affairs and energy components such as circuit breakers, transformer control equipment and so on.

This course would take four (4) years minimum and consist of at least 138 credit hours. The course will emphasize on Electrical Engineering and specialized knowledge of Industrial Power Engineering with the composition of the credits as follows:

<table>
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<tr>
<th></th>
<th>Credit Hour</th>
<th>Percentage</th>
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<td>Core Course &amp; Elective</td>
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This course will be conducted with approximately 80% of contact hours that emphasize theory and the remainder 20% meeting hour, involving the practical / laboratory experiments, 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 one final year project based on industrial problem.
# CURRICULUM STRUCTURE - BEKP

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<tr>
<th>COURSE TYPE</th>
<th>SEMESTER 1</th>
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| TOTAL CREDIT HOUR SEMESTER | 16 | 17 | 16 | 17 | 4 |

* THE SUBJECT IS COMPULSORY FOR THE MUET WITH BAND 2 OR BELOW AS (HW)
**THE SUBJECT CAN BE TAKEN IN OTHER SEMESTER IF OFFERED
# ONLY 2 CREDIT HOURS WILL BE COUNTED FOR SUKSIS AS THE CO-CURRICULUM OPTIONS
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## Credit Hour and Pre-Requisite - BEKP

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*The SLT estimation is to be advised*
BACHELOR OF ELECTRICAL ENGINEERING
(CONTROL, INSTRUMENTATION & AUTOMATION) - BEKC
Bachelor of Electrical Engineering (Control, Instrumentation & Automation) involves wide range areas in discussing methods of production or products and equipment. Control engineering, instrumentation and automation is a combination of three areas, namely, Control Engineering, Instrumentation Engineering and Automation Engineering. The combination of these three areas will result in a complex system. It includes analysis and design of control systems, robotics, and exposure to the FMS system and automation.

This course would take four (4) years minimum and consist of at least 138 credit hours. The course will emphasize on Electrical Engineering with specialization in Control Engineering, Instrumentation & Automation with the composition of the credits are as follows:

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This course will be conducted with approximately 80% of contact hours that emphasize theory and the remainder 20% meeting hour, involving the practical / laboratory experiments, 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 one final year project based on industrial problem.
## CURRICULUM STRUCTURE - BEKC

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* THE SUBJECT IS COMPULSORY FOR THE MUET WITH BAND 2 OR BELOW AS (HW)
**THE SUBJECT CAN BE TAKEN IN OTHER SEMESTER IF OFFERED**

* ONLY 2 CREDIT HOURS WILL BE COUNTED FOR SUKSIS AS THE CO-CURRICULUM OPTIONS

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* The SLT estimation is to be advised
BACHELOR OF ELECTRICAL ENGINEERING (POWER ELECTRONIC & DRIVES) - BEKE
Bachelor of Electrical Engineering (Power Electronic & Drives) aims to produce graduates with technical knowledge and skills in the area of power electronics and drives. This field is growing rapidly in line with the development of electrical and electronic engineering technologies based on electronic power conversion technology and control techniques. This technology is used to design and produce efficient and high performance, small size and environmentally friendly product. Application of power electronics and drive technology involves several disciplines of analogue and digital systems, power converter, sensor, various types of electric motors, interfacing, computer and embedded controller program.

This course would take four (4) years minimum and consist of at least 138 credit hours. The courses will emphasize on Electrical Engineering with specialization in Power Electronics & Drives with the composition of the credits are as follows:

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<th>Courses</th>
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This course will be conducted with approximately 80% of contact hours that emphasize theory and the remainder 20% meeting hour, involving the practical / laboratory experiments, 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 one final year project based on industrial problem.
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| CREDIT HOUR SEMESTER | 16     | 17             | 16     | 17             | 17     | 4             |        |                |

*THE SUBJECT IS COMPULSORY FOR THE MUET WITH BAND 2 OR BELOW AS (HW)*

**THE SUBJECT CAN BE TAKEN IN OTHER SEMESTER IF OFFERED**

* ONLY 2 CREDIT HOURS WILL BE COUNTED FOR SUKSIS AS CO-CURRICULUM OPTION
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* The SLT estimation is to be advised
BACHELOR OF MECHATRONICS ENGINEERING - BEKM
Bachelor of Mechatronics Engineering 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.

This course would take four (4) years minimum and consist of at least 139 credit hours. The course will emphasize on Mechatronics Engineering with the composition of the credits are as follows:

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This course will be conducted with approximately 80% of contact hours that emphasize theory and the remainder 20% meeting hour, involving the practical / laboratory experiments, 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 one final year project based on industrial problem.
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* THE SUBJECT IS COMPULSORY FOR THE MUET WITH BAND 2 OR BELOW AS (HW)
**THE SUBJECT CAN BE TAKEN IN OTHER SEMESTER IF OFFERED
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* The SLT estimation is to be advised
**MATHEMATICS SUBJECT**

**BEKA 1123**

**ALGEBRA & CALCULUS**

**Learning Outcomes**
Upon completion of this subject, the student should be able to:
1. Use the properties, determinant and inverse of matrix to solve systems of linear equations.
2. Apply the properties of trigonometry function to solve trigonometry problem.
3. Apply the properties and the operations of complex numbers.
4. Solve derivatives of algebraic, logarithmic, trigonometric and exponential functions.
5. Solve integrals of algebraic, logarithmic, trigonometric and exponential functions.

**Synopsis**
This course will discuss mainly about the functions and graphs, trigonometry, matrices, complex numbers and techniques of integration and differentiation.

**References**
1. Algebra & Calculus Module, UTeM 2011
3. Tay Choo Chuan et. al, Introduction to Linear Algebra, Penerbit UTeM, 2010

**BEKA 1233**

**ENGINEERING MATHEMATICS**

**Learning Outcomes**
Upon completion of this subject, the student should be able to:
1. Identify the multivariable functions together with its domain and range.
2. Solve double and triple integrals of functions using various techniques.
3. Apply the techniques of integration to calculate the properties of solid such as volume, mass and moment of inertia.
4. Define the properties of vector and curve space.

**Synopsis**
This subject 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, double and triple integrations and also vector-valued function, followed by learning various techniques in solving the problems and its application in physical and engineering fields.

**References**
2. Maurice D. Weir, Joel Hass, George B. Thomas, Thomas' calculus, Addison-Wesley, 2010

**BEKA 2333**

**DIFFERENTIAL EQUATIONS**

**Learning Outcomes**
Upon completion of this subject, the student should be able to:
1. Solve second order linear differential equations with constant coefficients by using method of undetermined Coefficient and method of Variation of Parameters.
2. Solve linear differential equations with constant coefficients by the Laplace Transform method.
3. Construct the Fourier series of given function.
4. Solve partial differential equations using the separation of variable method.
5. Produce coherent mathematical and scientific arguments needed in solving differential equations and related application problems in science and engineering.

Synopsis
This subject consists of 5 chapters: Introduction of ordinary and partial differential equations, second order linear differential equation with constant coefficients, Laplace Transform, Fourier Series and Partial Differential Equations. The syllabuses are developed based on these three different stages which is exposing the learner’s on the fundamental concept of differential equation, various techniques to solve different type of differential equation and lastly, apply the various solving techniques to the learner’s engineering problem.

References
1. Module 2 Differential Equations, UTeM 2010
2. Dennis G. Zill, Michael R. Cullen, Differential equations with boundary-value problems, Cengage, 2009

BEKA 2453
STATISTICS & NUMERICAL METHODS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Construct probability models for a range of random phenomena, both discrete and continuous.
2. Analyze and interpret data by using statistical modeling technique to produce statistical information.
3. Apply the concept of hypothesis testing to solve engineering problems.
4. Apply numerical techniques to solve differentiation and integration.

Synopsis

References
BEKP SUBJECTS
BEKP 2323
ELECTRICAL TECHNOLOGY

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Describe the principle of ac voltage and current generation, RMS and Average values for single and three phases system.
2. Explain and analyze the phasor representation for sinusoidal quantity for ac circuits in single and three phases system.
3. Demonstrate leading, lagging and unity power-factor concepts through the resistive, inductive and capacitive elements.
4. Utilize power-triangle concept in power measurement for balanced and unbalanced load in three phase power system.
5. Apply the basic magnetic circuit properties in determining the parameters and performance of single-phase transformer.

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

BEKP 2443
INTRODUCTION TO POWER ENGINEERING

Learning Outcomes
Upon completion of this subject, students should be able to:
1. Understand and apply the basic mathematical models of electric power system.
2. Understand the modelling (static parameters) principles of power system equipments such as transformer, generator and transmission line.
3. Utilize per-unit quantities and power system model in calculating power system static/steady state parameters & modelling such as voltage, current and power.
4. understand the components and basic principle of system protection.
5. Ability to exhibit elements of soft skills such as communication skills, critical thinking and problem solving skills and spirit of teamwork.

Synopsis
This subject introduces the overall components of power system to the students. the power system components such as generator, transformer and transmission line will be modeled for analytical purposes. Other topics include in this subject are per unit quantities, transmission line parameters & models, and introduction to system protection. This subject will also include Problem Based Learning (PBL) as part of teaching approach for a certain topics.

References

BEKP 2453
ELECTROMAGNETIC THEORY

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Apply vector analysis in order to solve problems regarding electromagnetic phenomena.
2. Explain the principle of electrostatics and calculate basic & intermediate electrostatic problems.
3. Explain the principle of magnetostatics and calculate basic & intermediate magnetostatic problems.
4. Identify and utilize the Maxwell’s equation in static and dynamic electromagnetic fields.
5. Analyze the electromagnetic application in plane-wave propagation.

Synopsis
This subject 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-topic include Biot-Savart’s Law, Ampere’s Law, magnetic forces and torque, and magnetic boundary conditions. After that, the subject will examine the situations in which electric and magnetic fields are dynamic (i.e. varies with time) using Maxwell’s equations. Finally, the applications of electromagnetic theory in wave propagation, and transmission lines are studied.

References

BEKP 3631
INDUSTRIAL POWER ENGINEERING LABORATORY I

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Students are able to model a power system network in ERACS software and analyze load flow and transient stability.
2. Students are able to model a power system network in MATHLAB software and analyze symmetrical and unsymmetrical fault current and voltage.
3. Students are able to model a simple power system and analyze power flow using CAPE software.
4. Distinguish direct and indirect control of single acting cylinder
5. Investigate the transient and steady state performance of the motor speed control system under PID control appropriately.
6. Exhibit soft skills through teamwork, critical thinking and problem solving appropriately.

Synopsis
This subject will discuss about three important parts in industrial power engineering which is electrical drives, power system analysis and control system engineering. It will introduce the analysis, application, drives and actuator’s size which currently used extensively. Explore practically the electric machine drives such as electro-mechanical energy. Then, students will investigate the power networks by using power system analysis software. This activity will deals with symmetrical and asymmetrical fault analysis, basic protection requirement and also transient stability analysis. In control system, students will be trained to investigate the transient and steady state performance of the motor speed control system under PID control appropriately.

References
### BEKP 3673
**POWER SYSTEM ANALYSIS**

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

1. Use the per-unit system in order to generate impedance and reactance diagram from one-line diagram.
2. Use Newton-Raphson method for power flow analysis.
3. Able to use synchronous machines transient models to analyse a fault.
4. Apply the concept of thevenin impedance and bus impedance matrix to analyse balanced fault in power system.
5. Apply the concept of symmetrical components to analyse unbalanced faults/loads in power systems.

**Synopsis**
This course is a continuation from the course Power Engineering Fundamentals (BEKP 2443). The power system analysis covers transient/dynamic nature of power systems such as fault analysis, load flow and stability analysis. Fundamental theories and mathematical equations on transient phenomena of synchronous machines are discussed. This leads to the analysis of balanced and unbalanced faults in power systems. Solutions for unbalanced faults are approached using fundamental os symmetrical components. The course also covers the fundamental concept of the behaviour of synchronous machines after a disturbances, i.e, steady-state and transient stability.

**References**

### BEKP 4731
**INDUSTRIAL POWER ENGINEERING LABORATORY II**

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

1. Operate the generation equipment of gen-set systematically.
2. Apply the transmission line system using transmission modeling technique accurately.
3. Carry out power factor correction by using capacitor bank for energy auditing and efficiency of electrical distribution system effectively.
4. Expose to power system (distribution)

**Synopsis**
This subject intended to give the students knowledge in industrial power, which is power generation, transmission, distribution and energy efficiency. It will focus on the types of power generation and correlation of generators and interconnections. Student also will discover the way to apply the ABCD modeling technique to the transmission line system. In addition, in scope of energy efficiency, student will investigate on the subject of the power quality, harmonics and energy audit and introduction to solar system. Student will organize a visit to distribution field which related to power distribution.

**References**
BEKP 4743
POWER SYSTEM ANALYSIS & HIGH VOLTAGE

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Perform load flow analysis using Newton Raphson method and show the power flow direction on the single line diagram.
2. Calculate fault current and fault level of power system using symmetrical components for unbalance system.
3. Explain the methods to generate and measure HVAC, HVDC and impulse voltage.
4. Identify breakdown criteria for insulation properties.
5. Distinguish between different types of high voltage testing technique.
6. Exhibit soft skills such as communication skills, critical thinking and problem solving skills and spirit of teamwork.

Synopsis
This subject is classified into two parts. The first part is power system analysis. This part deals with nodal equations of power system networks and formation of bus admittance and impedance matrixes. Application of bus admittance and impedance matrixes in power system analysis such as asymmetrical fault studies, load flow and power control and transient stability are concerned. The second part is high voltage technology. This part focuses on generation of HVAC, HVDC and impulse voltage; measurement of high voltage and breakdown in gases, solid dielectrics and liquid. The students are also exposed to diagnostic testing of insulation.

References

BEKP 4753
POWER GENERATION & TRANSMISSION

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Define the types and sources of generation systems and compare among the generation sources.
2. Describe and analyze the load and frequency control along with voltage and reactive power control.
3. Conduct practical competence for the generation operation systems as well as for the of high voltage transmission line design.
4. Apply ABCD transmission modeling technique to the transmission line system.
5. Apply and solve the power plant economics and costing problems related to the real generation systems.

Synopsis
This subject is intended to give the students deep knowledge about generation and power transmission. It focuses on the generation system types and types of sources of generation systems, parallel operation of generators and interconnections, power plants economics and generation cost analysis. The load and frequency control along with voltage and reactive power control in power transmission systems as well as ABCD transmission modelling technique are also covered.

References
BEKP 4763
ENERGY EFFICIENCY

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Explain the electrical tariff structure and calculate the cost rate charged to residential, commercial and industrial consumers.
2. Determine the economic management system for electrical energy.
3. Resolve the quality improvement in power system.
4. Explain the importance of renewable energy and able to determine the size of Photovoltaic System.
5. Perform energy auditing on electrical distribution system.

Synopsis
This subject is an introductory course to energy efficiency in electrical distribution system. Material encountered in the subject includes: Tariff structure and cost rate charged to residential, commercial and industrial consumers, Economic Management System for Electrical Energy, Power Quality and Harmonics, Renewable Energy and Energy Audit. The course uses examples from current research and development.

References

BEKP 4783
DISTRIBUTION SYSTEM DESIGN

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Identify the standard and regulation related to electrical installation.
2. Differentiate the characteristic, specification of circuit breakers and cables.
3. Determine the method of earthing system and earthing arrangement.
4. Use standard design procedures to design of low voltage system.
5. Perform testing and troubleshooting on low voltage installation.

Synopsis
This subject presents the principles and design of electrical distribution system. There are various issues of distribution system that are covered; including regulations and standards related to electrical installation. Characteristics, 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.

References

BEKP 4873
POWER SYSTEM PROTECTION

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Apply the basic principles of power system protection.
2. Utilize power system components through technical and economic justification.
3. Evaluate and design coordination for IDMT, Distance and Differential Protection Relay.
4. Evaluate and carry out protection coordination on the electrical equipment based on the appropriate protection schemes.

Synopsis
This subject introduces the power system protection and devices, protection method and safety in power system analysis. Enhancement to various type of protection scheme and device such as protection relay, CTs, VTs,
short circuit current management, overcurrent protection, relay coordination, unit protection, transformer protection, busbar protection, motor protection, generator protection, control circuit and testing, operation and maintenance.

References

BEKP 4863
ELECTRICAL SYSTEM DESIGN

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Identify the standard and regulation related to electrical installation.
2. Differentiate the characteristic, specification of circuit breakers and cables.
3. Determine the method of earthing system and earthing arrangement.
4. Use standard design procedures to design of low voltage system.
5. Perform testing and troubleshooting on low voltage installation.

Synopsis
This subject presents the principles and design of electrical distribution system. There are various issues of distribution system that are covered; including regulations and standards related to electrical installation. Characteristics, 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. This subject also covers the air conditioner, lighting and common electrical equipments design requirements.

References

BEKP 4883
HIGH VOLTAGE ENGINEERING

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Define and describe the phenomena of high voltage stress on the insulation of power systems.
2. Identify conduction and breakdown criteria for insulation properties: Gas, solid and liquids.
3. Explain the methods to generate and measure HVAC, HVDC and impulse voltage.
4. Distinguish between different types of high voltage diagnostics and testing technique.
5. Explain lightning phenomena and their protection.

Synopsis
This subject is intended to give the students deep knowledge about high voltage engineering. It focuses on the phenomena of high voltage surges and insulation coordination for power systems, characteristics of conduction and breakdown of gas, liquid and solid dielectrics. Generation of high voltages, their measurement and testing technique for high voltage components. In this subject, the student are also exposed to lightning phenomena and their protection.

References
BEKC SUBJECTS
BEKC 1123
INSTRUMENTATION & MEASUREMENT

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Define various terms and standards in measurement.
2. Explain the principle of DC/AC ammeter and voltmeter.
3. Calculate the waveforms of electrical signals displayed by oscilloscope.
4. Apply the bridge techniques to measure resistance, inductance and capacitance.
5. Evaluate sensors for field measurement and applications.

Synopsis
This subject discusses about units and dimensions, standards, errors and calibration in measurement. It covers most of the measurement devices such as galvanometers, ammeters, voltmeters, wattmeter, oscilloscope and other sensing and measuring devices such as sensors for movement, position, force, pressure, temperature flow and etc. This subject also introduces to instrumentation elements.

References

BEKC 2433
SIGNAL & SYSTEMS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Differentiate the classification of basic continuous-time and discrete-time signals & systems.
2. Describe and analyze linear time-invariant (LTI) systems in time-domain by examine their inputs and outputs.
3. Describe and analyze linear time-invariant (LTI) systems in time-domain by examine their inputs and outputs.
4. Compute and determine a system output in either time / frequency given the system input and description of the system using Laplace-Transform and / or Z-Transform, as appropriate.

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

References

BEKC 3533
INTRODUCTION TO CONTROL SYSTEMS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Describe the basic features and configuration of control systems.
2. Apply appropriate techniques to perform block diagram reduction of multiple subsystems in order to obtain its transfer function.
3. Derive the mathematical model for electrical, mechanical and electromechanical linear time invariant systems in frequency domain and time domain.
4. Analyze the transient and steady state performance for first and second order systems.
5. Define and sketch root locus of a system.
6. Draw the asymptotic approximation bode plots for first order and second order form.
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, second and high order systems; Routh Hurwitz criteria for stability; steady-state error analysis; Root Locus and Bode plot.

References
4. Bishop, Dorf, Modern Control Systems, 10th Edition,
5.
6.
7.
8.

BEKC 3543
MICROPROCESSOR

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Describe the architecture and organization of a microprocessor.
2. Write and debug programs using assembly language for microprocessor applications.
3. Design microprocessor system with memory and peripheral device interfaces.
4. Use interrupts and describes its operational requirements in microprocessor system.
5. Demonstrate the practical competence using MC68000 microprocessor for software and hardware development.

Synopsis
This course is about hardware and microprocessor handling, type of microprocessor systems, system handler including interrupt and timing diagrams. The course covers the concept of MC68000 microprocessor software architecture, programming, assembly language and basic instruction, data transferring instruction, program control and subroutine, arithmetic and logic operations. It touches most on programming techniques, designing a microcomputer system, interfaces with memory and input/output devices.

References

BEKC 3563
INSTRUMENTATION

Learning Outcomes
Upon completion of this subject, students should be able to:
1. Explain the principles and elements of data acquisition system
2. Apply the right sensors/transducers for data acquisition system
3. Design signal conditioning circuit for data acquisition system
4. Evaluate the A/D and D/A techniques, interfaces standards and types of data presentation
5. Exhibit communication and critical thinking skills on specialized, reliability and economics topics in instrumentation

Synopsis
This subject emphasize 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. This subject also touches on some specialized instrumentation, reliability & economics in instrumentation
and also introduces instrumentation for industrial and process control application.

References

BEKC 3643
CONTROL SYSTEMS ENGINEERING

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Describe the design procedure for a controller
3. Analyze closed-loop frequency response of unity feedback system
5. Design a state feedback controller using pole placement to meet transient response specifications.
6. Design an observer for a system.

Synopsis
This subject will discuss about the compensator design in control systems engineering; active compensator PI, PD and PID using root locus technique; passive compensator Lag, Lead and Lag-Lead using root locus and frequency response technique; closed loop frequency response of unity feedback system; state feedback design using Pole placement technique as well as integral control and observer design.

References

BEKC 3633
COMMUNICATION SYSTEMS

Learning Outcomes
Upon completing this course, the student should be able to:
1. Explain the basic principles and components of telecommunication systems.
2. Analyze the AM & SSB modulation / demodulation techniques that are typically used in telecommunication systems.
3. Analyze the FM modulation / demodulation techniques that are typically used in telecommunication systems.
4. Classify the digital communication systems, in term of its transmission and modulation / demodulation
5. Identify the typical data communication and network for communication systems.
6. Familiarize the various types and characteristics of transmission lines used as the transmission media.

Synopsis

References

**BEKC 4753**

**PLC& AUTOMATION**

**Learning Outcomes**
Upon completion of this subject, the student should be able to:
1. Explain the PLC system operation principle.
2. Explain the principles of robotics and automation system in modern manufacturing.
3. Demonstrate PLC programming based on IEC standard and industrial application.
4. Construct an automated system based on industrial application.
5. Design a complete PLC based automation system.

**Synopsis**
This subject will expose students with knowledges and skills of PLC including its definition, main hard components, PLC programming languages, interfacing PLC with computers, integrates PLC hardware and software to design an automation system, introduction to robotics & automation system in manufacturing process, computer-integrated manufacturing (CIM) and automation work cell.

**References**

**BEKC 4763**

**INDUSTRIAL CONTROL & INSTRUMENTATION**

**Learning Outcomes**
Upon completion of this subject, the student should be able to:
1. Explain the process variables in the process control industries.
2. Distinguish the process variables, elements and instruments for pressure, temperature, level, flow and analytical process.
3. Apply an automation technologies for process control such as SCADA and DCS.
4. Analyze the control loops characteristics in the process control industries.
5. Design an appropriate controllers for process control industries.
6. Identify, analyze, and solve critically the technical problems.

**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**

**BEKC 4783**

**DIGITAL CONTROL SYSTEMS**

**Learning Outcomes**
Upon completion of this subject, the student should be able to:
1. Describe and differentiate between continuous and digital control system through sampling process and signal conversion.
2. Perform system analysis in z-domain based on pole and zero location, root locus and stability criteria of linear-time invariant systems.
3. Analyze digital systems performance based on transfer function.
4. Design and develop cascaded digital controllers using PID, lead and lag compensators.
5. Perform analysis on digital control systems using state variables.
6. Design digital control system using state variable technique.

Synopsis
This course deals with sampling process, quantization and Z transform. Modeling and analysis of ADC, DAC, ZOH devices. Analysis of linear time-invariant (LTI) systems in z-domain include system stability, pole and zero locations, root locus, convolution. System modeling using transfer function and closed loop block diagram in z-domain. Design of discrete/digital controllers (PID, Lead and Lag) for second order closed loop systems. Introduction to discrete system state variables. Design of discrete controller using state variable technique. System analysis and design using simulation software MATLAB/SIMULINK

References

BEKC 4873
ARTIFICIAL INTELLIGENCE

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Explain the essential concepts, principals and theories relating to Artificial Intelligence (AI) in general, and for fuzzy logic and neural networks in particular.
2. Construct and practise basic fuzzy logic and/or neural network systems according to the engineering problem.
3. Demonstrate through simulations of fuzzy logic and/or neural network related systems using Simulink/MATLAB or other specified tools.
4. Analyze the performance of fuzzy logic and/or neural network systems according to the given problem.

Synopsis
Introduction of intelligent systems using Artificial Intelligent system such as fuzzy logic, neural network and expert system. Focus on popular techniques of AI i.e artificial
neural networks, fuzzy logic and genetic algorithms. Development of algorithms, which have capabilities such as learning, reasoning, etc. Problem solving through expert engines and database for expert performances. Automation of data acquisition from human experience and explanation of problem solving behaviour. A series of simulations of fuzzy logic and neural network algorithms using SIMULINK/MATLAB or other software packages.

References
2. Kenji Sugawara; Artificial Intelligence; Morikita; 1997.
5. George F. Luger; Artificial Intelligence, Structures and Strategies for Complex Problem Solving; 5th Edition; Addison Wesley; 2005.

BEKC 3631
CONTROL ENGINEERING, AUTOMATION & INSTRUMENTATION LABORATORY I

Synopsis
This laboratory introduces to the students analysis, simulation, applications in communication systems and control, instrument & automation system engineering. This lab will cover the following topics:
1. closed loop system analysis
2. designed controllers for the purpose of improving the original system
3. consisting of relay, contacts, switchgears, timers, sensors, special AC/DC motors, step motors and pneumatic & electro-pneumatic applications
4. design basic principles for telecommunications system

References
BEKE SUBJECTS
BEKE 1123
ELECTRONICS DEVICES

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

1. Explain the concept of semiconductor devices such as Diode, BJT, JFET MOSFET and Op Amp.
2. Describe the operation of Diode, BJT, JFET, MOSFET and Op Amp circuit.
4. Utilize simulation tools to analyze the semiconductor device circuit

Synopsis
Semiconductor devices and pn junction like conductive characteristics, semiconductor carrier, p type, n type and pn junction biasing. Semiconductor diode characteristics, pn junction, Schottky diode, Photodiode, operation of bipolar junction transistor (BJT); common base, common collector and common emitter configurations. Transistor JFET and MOSFET characteristics and biasing. Oeprational amplifier; comparator, inverting, noninverting, summing, differential and integral. Simulation modelling of the diode, BJT, JFET using PSPICE.

References

BEKE 1243
ANALOGUE ELECTRONICS

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

1. Understand the basic concept of semiconductor devices and PN junction biasing.
2. Analyze the operation and diode characteristics of diode, BJT, FET, MOSFET and operational amplifiers.
3. Conduct experiments and analyze data for diode, BJT, FET, MOSFET and operational amplifiers.
4. Run simulation softwares to examine the functionality of semiconductor devices.

Synopsis
Semiconductor materials and pn junctions such as flow characteristics, semiconductor carrier, p-type and n-type and biasing of pn junction. Diode semiconductor characteristics, electrical features at diode pn junction, attributes of bipolar junction transistors (BJT) and biasing characteristics. model is simulated using PSPICE.

References
signal amplifier, power amplifiers (class A & class AB), oscillator, active filters, and voltage regulators (shunt and series)

References

BEKE 2422
APPLICATION OF ANALOGUE ELECTRONICS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Explain the concept of small signal amplifiers for BJT configuration, active filters, voltage regulator and power amplifier.
2. Analyze and apply the operation and characteristics of BJT, active filters, power amplifier and power supply.

Synopsis
Introduction to the basic principles of analog electronics, emphasis on the concept of amplification. This subject covers the concept of amplifiers, BJT as an amplifying device, small signal amplifiers, power amplifiers (class A and AB), active filters and voltage regulators (parallel and series).

References

BEKE 3543
POWER ELECTRONICS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Discuss the characteristic of semiconductor switches such as thyristors, bipolar devices, MOSFETs, IGBTs and choose the appropriate devices for an application.
2. Explain the operation of rectifier, non-isolated DC-DC converter and inverter, including the topology exist in each circuit.
3. Design and analyze the characteristics and performance of rectifier, isolated DC-DC converter and inverter.
4. Use simulation software such as PSpice, PSim, Matlab Simulink to analyze rectifier non-isolated DC-DC converter and inverter circuit.
5. Discuss the safety and protection issues of power switch for implementation in power electronics circuit.

Synopsis
This course is an introduction to power electronics circuit and system. It covers the basic principles of semiconductor devices, switching process and implementation of semiconductor devices as switches in power electronics circuit. Furthermore, it covers design and analysis of various power electronics converter such as uncontrolled and controlled rectifier, non isolated DC to DC converter; buck, boost, buck-boost and Cuk and also square wave and PWM single phase inverter.

References
BEKE 3533
ELECTRICAL MACHINES

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Understand basic type of electrical machines, physical construction and equivalent electrical circuit diagrams.
2. Identify the difference of physical construction and working principles between DC machines and AC machines; synchronous machines and asynchronous machines.
3. Know basic drive methods for DC and AC machines.
4. Run some specific tests for electrical and mechanical parameters determination.
5. Investigate the performance of electric machines.

Synopsis
Introduction to DC and AC type of electrical machines which cover physical construction and equivalent electrical circuit diagrams. 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

BEKE 3631
POWER ELECTRONICS ENGINEERING & DRIVES LABORATORY

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Demonstrate the operation of the three phase three pulse rectifier and inverter circuit correctly
2. Observe, analyze and write the experimental result in technical report related to controller design, power electronics system & actuator and drive correctly
3. Demonstrate the application of switches, relay, indicators, sensors, timer and electro pneumatic systems
4. Determine the characteristics of PID controller for motor speed and position in terms of percentage overshoot, peak time, settling time and rise time accurately
5. Exhibit soft skills such as communication skills, critical thinking, problem solving and teamwork

Synopsis
Students will be exposed to the experiments include observing the performance of three phase three pulse rectifier and inverter circuit, as well as the operating of switches, relay, indicators, sensors, timer and electro pneumatic systems and PID controller.

References
BEKE 3643
ELECTRICAL DRIVES & ACTUATORS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Identify power electronics conversion in DC drive
2. Model & design a DC drive system
3. Explain the principles of induction motor drive
4. Design the scalar control of induction motor drive
5. Explain the use of electrical and mechanical actuator in motor drive system.

Synopsis
This subject will introduce to the electrical, mechanical, pneumatic and hydraulic electrical actuator and drive system. This subject will discuss on the definition, symbols, system, circuits, operation and components of the pneumatic, hydraulic and mechanical actuator system. Another part of this subject will cover on the electrical drive for DC and AC motor. It focuses on the fundamentals of the electrical drive, including element, block diagram, feedback, load characteristics and motor sizing. In addition, special discussion on the four quadrant operation with chopper, fed DC drive for DC motor drive and three phase drive system.

References
1. Electric Drive – and integrative approach, Ned Mohan, MNPERE, Minneapolis.
2. Power Electronic Control of AC motors-JMD Murphy & FG Turbull, Pergamon Press.
7. Control of Electrical Drive, W Leonhard, Springer.

BEKE 3663
POWER ELECTRONICS SYSTEMS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Discuss the operation of three phase rectifier, switching DC power supply and three phase inverter.
2. Investigate and analyze the characteristics and performance parameters of three phase rectifier, switching DC power supply and three phase inverter circuit
3. Choose a suitable converter type and topology to suit its application and power conversion technique required in power electronics.
4. Design three phase rectifier, switching DC power supply and three phase inverter for practical application.
5. Use simulation software such as PSpice/PSim/ Matlab to analyze three phase rectifier, switching DC power supply and three phase inverter

Synopsis
This subject will discuss about the principles and operation of three phase rectifier and inverter as well as the switching DC power supply. It includes uncontrolled and controlled three phase rectifier, switching DC power supply; transformer representation, isolated DC-DC converter and feedback control and various types of three phase inverter; six step inverter and voltage controlled inverter.

References
BEKE 4731
POWER ELECTRONICS & DRIVES LABORATORY II

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Integrate various process control plant with industrial control devices based on design requirement
2. Perform symmetrical, asymmetrical fault and transient stability, analysis using ERACS software.
3. Analyze the performance of Power Electronics & Drive system
4. Analyze and write the experimental results in technical report related to practical and simulation implementation systematically
5. Exhibit softskills such as communication skills, critical thinking, problem solving, teamwork, and ethics by peer to peer assessment.

Synopsis
The experiment and simulation works cover the switching scheme of current control PWM, voltage source inverter, fed drive, variable speed vector control of synchronous and induction motor drive. Students will carry out the practices of PLC programming using console and CX programmer software, motor control with PLC and simple automation process control with PLC at PLC and process control laboratory. Students will be exposed to such topics include power system modelling, symmetrical components, steady state operation, fault analysis, load flow & power control, and transient stability.

References
1. Electric Drives – an integrative approach, Ned Mohan, MNPERE, Minneapolis
2. Power Electronic Control of AC Motors – JMD Murphy & FG Turbull, Pergamon Press
7. Marizan Sulaiman, Analisis SYStEM POWER, Penerbit USM, 2004

BEKE 4763
MODERN ELECTRICAL DRIVES

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Identify power electronics conversion in AC Drive
2. Represent of induction machine (dynamics) in the stator and synchronously rotation reference frame.
3. Represent of synchronous machine dynamics in the stator and rotor reference frame.
4. Analyze the performance of AC motor drive
5. Design controller for AC drive system.

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 modelling 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.

References

**BEKE 4883**
**INDUSTRIAL POWER ELECTRONICS**

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

1. Define application of power electronics in renewable energy, industrial appliance, consumer goods, transportation and power system.
2. Explain the basic operation, function and interaction between components and sub system used power electronic applications.
3. Integrate the power electronic components and system in industrial application.
4. Choose and justify the most suitable power electronics component for specified industrial application such as in renewable energy, industrial appliance, consumer goods, transportation and power system.
5. Model, analyze and develop the power electronic application system.

**Synopsis**
This course is about the principles of power generation, power application, and power quality improvement by means of power electronics devices. The basic design of power supply and gate drive will reviewed at glance. Students are required to be able to design and construct a power electronics hardware that is common in industrial application. The basic design of High Voltage Direct Current (HVDC), Flexible AC Transmission Systems (FACTS), Electric Hybrid Electric Vehicles and Active Filter will be exposed to the students.

**References**
BEKM SUBJECTS

BEKM 1121
BASIC ENGINEERING LABORATORY

Learning Outcomes
Upon completion of this laboratory subject, the student should be able to:
1. Describe the concept of electric and electronic engineering.
2. Measure voltage and current using basic engineering tools.
3. Construct a basic mechatronic/robotic engineering system.
4. Apply good ethical conduct and safety measures in engineering practice.
5. Design the mechatronic/robotic system by considering sustainable technology.

Synopsis
This subject will cover the introduction to teamwork, laboratory organization and laboratory safety and rules. Introduction to laboratory title, data measurement and analysis, report writing, discussion and presentation skills. Execute the experiments which includes the famous principles of science (Ohm’s Law, Newton’s Law and Hooke’s Law). Execute the experiments of parallel and series, measurement of voltage current and resistance. Execute the experiments of transistor as switch and diode. Construct the Light Seeking Robot (LSR). Operate the electrical devices such as oscilloscope and digital multimeter.

References
3. Subject file BEKE1133
4. Subject file BEKU 1123

BEKM 2321
MECHANICAL ENGINEERING LABORATORY

Learning Outcomes
Upon completion of this laboratory subject, the student should be able to:
1. Apply the knowledge learnt from the mechanical courses which include statics and mechanics of material, dynamics and mechanisms and fluid mechanics correctly.
2. Analyze the results obtained from the experiment accurately.
3. Write and present technical report related systematically.

Synopsis
This laboratory includes experiments/practical application for subjects of Material Statics & Mechanics, Dynamic & Mechanism and Engineering Materials.

References

BEKM 2342
INTRODUCTION TO MECHATRONICS SYSTEMS

Learning Outcomes
Upon completing this subject, the student should be able to:
1. Identify and explain the basic concept and the engineering applications of Mechatronics systems.
2. Describe and relate the basic Mechatronics system with to engineering application.
3. Identify the characteristics of Mechatronics system.
4. Relate machine and mechanism design with Mechatronic system.
5. Solve and analysis simple Mechatronics engineering problem.
Synopsis
Mechatronics system and instrumentation

Machine and Mechanism

References

BEKC 2421
CONTROL SYSTEM LABORATORY

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Identify and apply the appropriate tool and software during the laboratory session.
2. Investigate and analyze using scientific methods to solve Control System Engineering related experiments.
3. Demonstrate practical competence on control system apparatus such as Temperature Process Control Trainer.
4. Write an effective report.

Synopsis
The experiments are conducted in Control System Laboratory and Control System Simulation Laboratory. Students will carry out experiments and modeling of open loop and closed loop system by using Lab-Volt Temperature Process Control Trainer and Modular Servo System. Practical Application involving Real-time implementation and/or simulation and laboratories relatively to controller design, analysis of system stabilities, problem-based learning design using MATLAB, SIMULINK, Control System Toolbox and others toolboxes.

BEKM 2453
INSTRUMENTATION SYSTEMS

Learning Outcomes
Upon completion of this subject, students should be able to:
1. Identify numerous quantities and electrical units for measurements and instrumentation.
2. Design an AC/DC ammeter and voltmeter using PMMC technique
3. Design AC voltmeter rectifier for full-wave and half-wave.
4. Use oscilloscope for electrical waveform display and calculation.
5. Use the bridge technique to measure resistance, inductance and capacitance.
6. Differentiate and choose various functions of sensors and transducers in instrumentation application.

Synopsis
Measurement and error analysis. Analogue and digital instrumentation. AC and DC bridges. Oscilloscope and transducers. Analogue to digital and digital to analogue converters (ADC and DAC). Signal conditioning circuit and
processing. Data acquisition control. Technique and instrument to identify problems. Smart instruments. Telemetry systems.

References


BEKM 3531
MECHATRONICS ENGINEERING LABORATORY I

Learning Outcomes

Upon completion of this laboratory subject, the student should be able to:
6. Identify and describe basic characteristics and operation of sensors and electromechanical devices clearly.
7. Draw and simulate mechatronic systems that control electromechanical actuator and others output with feedback from sensors using a micro controller system correctly.
8. Construct mechatronic systems that control electromechanical actuator and others output with feedback from sensors using a micro controller system correctly.
10. Write effective technical report systematically and comparatively.

Synopsis

In this lab application, students are exposed to the lab works on using the motor drives for both DC and AC motors. It includes the design of the circuit for the motors and complete with the simulation based on the software selected. In addition, students are able to learn in software programming in microcontroller section in order to control the application of the DC and AC motors. At the end of the lab, students are going to involved in a mini project assignment based on the knowledge retain to design a simple electromechanical system from simulation until the implementation.

References

3. Subject file BEKM3553
4. Subject file BEKM3543
7. Refer FKM for BMCG 3643
8. Subject file BEK 4753
9. Subject file BEKC 4753

BEKM 3543
ELECTRO-MECHANICAL SYSTEM

Learning Outcomes

Upon completion of this subject, students should be able to:
1. Explain the type, construction, operation and application of electrical machines.
2. Explain the AC and DC drives of electrical machines.
3. Analyse the characteristics of electrical machines.
4. Analyse the performance of electrical machines.

Synopsis

This subject discusses the operation, construction, equivalent circuit and application of electrical machines such as DC, induction and synchronous machines. The parameters, characteristics, efficiency, control technique and performance of these electrical machines are analyzed. The AC and DC drives of electrical machines are also introduced.

References


**BEKM 3553**  
**MICROCONTROLLER TECHNOLOGY**

**Learning Outcomes**  
Upon completion of this subject, the student should be able to:
1. Explain the operations of a microcontroller.
2. Write, simulate and verify programs for a microcontroller. Use different function of a microcontroller such as timer, interrupt, pulse width modulation, analogue to digital converter and controlling input and output.
3. Use a microcontroller to control various sensors and actuators.

**Synopsis**  
Basic microcontroller concepts and its difference compared to microprocessors. Microcontroller mind map, assembler, programming language and programming software. Stacking, sub-routines, interrupt and reset. Hardware, programming concept, programming application with dc motor hardware, step motor, sensor. Students will do microcontroller application using a simple mechatronic system.

**References**  

**BEKC 3563**  
**INSTRUMENTATION**

**Learning Outcomes**  
Upon completion of this subject, students should be able to:
1. Explain the fundamentals of measurement such as systems of units, the use of statistics and error analysis.
2. Explain the use of different type of transducer such as position and speed, stress and strain and temperature.
3. Explain signal conditioning circuitries and processes in a measurement system such as filter, amplifier and A/D converter.
4. Explain the process of recording.
5. Design a basic measurement system.

**Synopsis**  
A fundamental part of a mechatronic system is a measurement system. This subject discusses the fundamentals, circuitry and processes of a measurement system. The main contents are subdivided into three basic parts of a measurement system i.e. transducers, signal processing (or conditioning) and recording of data for subsequent processing.

**References**  
5. Tony R. Kuphaldt, Lessons In Industrial Instrumentation, Creative Commons, 2009.

**BEKM 3631**  
**MECHATRONICS ENGINEERING LABORATORY II**

**Learning Outcomes**  
Upon completion of this laboratory subject, the student should be able to:
1. Design the actuation of a mechatronic system using pneumatic and hydraulic circuits.
2. Design the control of a mechatronic system using PLC.
3. Analyze and troubleshoot a mechatronic system.
4. Present ideas effectively.
5. Discover the knowledge from different resources.

Synopsis
Operation of a single-acting and double-acting cylinder, application of electro-hydraulic control, electro-pneumatic control technology, application of pressure relief valve and flow control valve, “AND” and “OR” operation, ladder diagram, console programming and mnemonic code, timer and counter application, pneumatic and hydraulic control using PLC

References
3. Refer FKM for BMCG 3643
4. Subject file BEKC 4753
5. Subject file BMCG 3643

BEKM 4741
MECHATRONICS ENGINEERING LABORATORY III

Learning Outcomes
Upon completion of this laboratory subject, the student should be able to:
1. Identify and describe robot specification and workspace properly.
2. Manipulate robot by using teach pendant/console and computer thru either offline or online programming method correctly.
3. Draw and simulate mechatronic/robotic system using modeling and simulation software correctly.
4. Measure performance such as accuracy and reliability of mechatronic/robotic system correctly.
5. Develop mechatronic/robotic system using modeling and simulation software properly.
6. Identify factors such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability when designing a mechatronic system properly.

Synopsis
This course will discuss Mechatronics teamwork project, prototype design using engineering tools such as CAD, MATLAB and 20 SIM, integration of sensor, controller and actuator, performance analysis, product realization

References
5. Subject file BEKM 4763
6. Subject file BEKM 4773
7. Subject file BEKM 4783
8. Subject file BEKC 4883

**BEKM 4793**
**MECHATRONICS SYSTEMS DESIGN**

**Learning Outcomes**
Upon completing this subject, the student should be able to:
1. Describe the principles of Mechatronics product system design and development.
2. Design the product through the principles of product design and development.
3. Analyze problems and synthesis solutions in design process.
4. Demonstrate ability to develop Mechatronics prototype through CAD tools.

**Synopsis**
Mechatronics team work design which cover design, mechanical, electric, electronic and software. Provides the students with an appreciation of industrial practice and for the roles played by members of mechatronics product development teams. Process design which includes concept selection, component selection, compatibility, interfacing, Human Machine Interface, ergonomic, aesthetic and safety in designing a typical mechatronics product. Design approaches in team work toward integration of elements in mechatronics systems such as sensor, dedicated or embedded controller, drive and actuation control system, mechanism and structure to design a complete mechatronics product.

**References**
3. Dobrivoje Popovic, Mechatronics in Engineering Design And Product Development, Mareel Dekker,1999

**BEKM 4783**
**MACHINE VISION**

**Learning Outcomes**
Upon completion of this subject, students should be able to:
1. Describe the application areas, restrictions, and structure of machine vision systems
2. Operate on digital images: capture them and extract basic visual information from images
3. Analyze and apply the basics of machine learning and approaches to decision making using a computer.
4. Use of image processing and image understanding tools

**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 introduction 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 understanding 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**
BEKM 4823
DATA COMMUNICATIONS & COMPUTER NETWORKING

Learning Outcomes
Upon completion of this subject, student should be able to:
1. Explain and describe the concept of computer system network, communication model, network models, network components, network topology, network technology and applications.
2. Explain, describe and apply the coding schemes, transmission modes, transmission methods, communication modes, error detection methods, flow control, and error control in a network.
3. Explain and describe the OSI model, IEEE 802.x model, transmission media, network services, repeater, bridges, router and gateways.
4. Explain, describe and apply the network operation and technology of LAN, wireless LAN, WAN and routing.
5. Design, install, configure and troubleshoot a wired and wireless network.

Synopsis

References
BEKU SUBJECTS

BEKU 1121
BASIC ELECTRICAL & ELECTRONICS LABORATORY

Synopsis
This laboratory includes experiments/practical application for subjects of Electrical Circuit, Electronics Devices, Digital Electronics & System and Instrumentation & Measurement.

References
4. Subject file BEKP 2323
5. Subject file BEKU 2333
6. Subject file BEKU 1243

BEKU 1123
ELECTRICAL CIRCUIT I

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Grasp the fundamental electric laws and demonstrate it by being able to calculate, as well as measure voltage, current and power associated to any element or branch in an electric circuit.
2. Apply circuit analytical methods and theorems to analyze dc circuits and in ac circuits using phasors.
3. Assemble electrical components correctly including troubleshooting for defective parts and faulty connections.
4. Simulate the operation of electric circuit using simulation software.

Synopsis
This subject introduces the students to Ohm’s Law, Kirchhoff’s Laws and use them to calculate current, voltage and power in any element or in any branch. Following this the students will learn the analytical methods namely mesh and nodal analysis. The use of theorems like Thevenin, Norton, Superposition, Reciprocity 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

BEKU 1221
ANALOGUE & DIGITAL ELECTRONICS LABORATORY

Synopsis
The laboratory experiment consists of practical and simulation activities which is conducted to enhance student skills and theoretical knowledge in digital electronics system and analogue electronics topics. The experiments include small signal amplifier, power amplifier, oscillator, basic gates, combinational logic circuit, binary adder, and flip-flop.

References
3. Subject file BEKU 1243
4. Subject file BEKE 1243

BEKU 1243
DIGITAL ELECTRONICS & SYSTEMS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Describe the common forms of number representation in digital electronics circuits and differentiate between digital and analogue representations.
2. Implement simple logic operations using combinational logic circuits.
3. Identify, formulate, and solve the logical operation of simple arithmetic and other MSI (Medium Scale Integrated Circuit).
4. Apply the concepts of synchronous state machines using flip flop.
5. Define memory terminology and memory decoding process.
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 shif-register, synchronous and asynchronous sequential circuit. Initial knowledge on memory terminology will be also discussed at the end of the course content.

References
1. Thomas L. Floyd, Digital Fundamentals, Prentice Hall, 10th Ed.

BEKU 1231
ELECTRICAL & ELECTRONICS LABORATORY

Synopsis
This laboratory includes experiments/practical application for subjects of Electrical Circuit, Electronics Devices, Digital Electronics & System and Instrumentation & Measurement.

References
4. Subject file BEKP 2323
5. Subject file BEKU 2333
6. Subject file BEKU 1243

BEKU 2321
ELECTRICAL TECHNOLOGY LABORATORY

Synopsis
Students will conduct the experiment to support the theory such as to observe the capacitor charge and discharge process, build and analyze the second order circuit using PSPICE. Proof the resonant circuit, filter circuit and two ports network. 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.

References

BEKU 2333
ELECTRICAL CIRCUIT II

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Describe first order for RL and RC circuits transient analysis.
2. Describe second order for RLC circuits transient analysis.
3. Convert time domain into s-domain using Laplace transforms method and analyze its frequency response.
5. Determine the parameters of two-port network connected in series, parallel or cascade.

Synopsis
This 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
BEKU 2422
ENGINEERING REPORT

Synopsis
This subject is intended to enhance various basic electrical industrial skills that mostly required by many sectors related to electrical fields. It will focus on the development of technical and soft-skills and covering modules such as basic electrical wiring, motor starter and relay control, basic pneumatic, electronic circuit design works, programmable logic controller and application of engineering software such as AutoCAD and PSpice.

Assessment is focused on the aspect of knowledge, skills and attitude of the students in the form of rubric.

References
1. Akta Keselamatan dan Kesihatan Pekerjaan 1994
3. IEEE Wiring Regulation, 18th Edition
4. Akta Bekalan Elektrik (447 pindaan 2001)
5. Abdul Samad, Amalan Pemasangan Elektrik, DBP
6. Acceptability of Electronic Assemblies (Revision C, 2000)

BEKU 2432
ENGINEERING PRACTICE II

Synopsis
This subject is aimed to expose students to the most of vital component related to electrical works such as instrumentation, metering, electrical motor winding process, testing and measurement, electrical energy management, building maintenance services as well as safety, health and environment at the workplace.

Subject implementation including short courses to be conducted by the industry, case studies, project in a small size, demonstration and technical report

References
1. Akta Keselamatan dan Kesihatan Pekerjaan 1994
3. IEEE Wiring Regulation, 18th Edition
4. Akta Bekalan Elektrik (447 pindaan 2001)
5. Abdul Samad, Amalan Pemasangan Elektrik, DBP
6. Acceptability of Electronic Assemblies (Revision C, 2000)

BEKU 2431
ELECTRICAL ENGINEERING LABORATORY I

Synopsis
This subject will cover on the theories about power electronic, electric machine, control system, instrumentation system and microprocessor. Among the experiments that will be conducted are electric converter, machine electric characteristics, testing of AC/DC circuit, performance test of open loop/closed loop, microprocessor applications as well as simulation software in particular topics.
References

BEKU 3696
INDUSTRIAL TRAINING

Learning Outcomes
Upon completion of this subject, the students should be able to:
1. Adapt with the real working environment, in terms of operational, development and management system.
2. Apply knowledge learned in the university.
3. Write a report on daily activities in the log book systematically in the related field.
4. Embrace and practice professional ethics.
5. Improve their soft skills and creativity.
6. Recognize potential engineering problems to be solved in the final year project.
7. Present reports orally and written on the working experiences.

Synopsis
For Industrial training, students will gain experience in the organization/industry for a required certain number of weeks. During the designated period, they will apply knowledge learned in the university and increased the related skills required in their future profession.

References
1. Garis Panduan Latihan Industri, Pusat Universiti Industri.

BEKU 4792
FINAL YEAR PROJECT I

Learning Outcomes
Upon completion of this subject, student should be able to:
1. Identify and describe the problem and scope of project clearly.
2. Select, plan and execute a proper methodology in problem solving.
3. Work independently and ethically.
4. Present the preliminary results in written and in oral format effectively.

Synopsis
This subject is the first part of the Final Year Project. In this subject, students are expected to propose a project under a supervision of a lecturer. Students need to carry out the project, present the proposed project and submit a progress report at the end of semester

References
1. Guidelines of the Implementation of FYP.
3. Any related materials based on student’s project

BEKU 4883
ENGINEERING ETHICS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Discuss critically the moral and ethical theories leading to engineering ethics.
2. Familiarize themselves with codes of ethics and inter-relate them through examples of case studies.
3. Develop strong commitment of professional and ethical responsibilities.
4. Inculcate special regards for health, safety and the environment.
5. Manage and resolve ethical problems in client/engineer/society relationship in carrying out duty as a professional engineer.
6. Review case studies and analyze the situations that have occurred.

Synopsis
Introduction to scope and goal of engineering ethics. Moral thinking and ethical theory. The laws and ethical theory in engineering practice. The responsibility of providing service,

References

BEKU 4894
FINAL YEAR PROJECT II

Learning Outcomes
Upon completion of this subject, student should be able to:
1. Collect and present data into meaningful information using relevant tools
2. Demonstrate appropriate skills required to solve the problem adequately
3. Plan and execute project implementation systematically
4. Work independently and ethically
5. Present the results in written and in oral format effectively
6. Identify basic entrepreneurship skills in project management

Synopsis
This subject is continuation from Final Year Project 1. Student should complete the project to obtain outcome either in hardware, software or studies. Student needs to present the project outcomes, and write a final report in thesis format. Student will be assessed based on performance, projects’ quality, presentation and project report.

References
1. Guidelines of the Implementation of FYP.
3. Any related materials based on student’s project.
SERVICE SUBJECTS (FTMK)

BITG 1113
COMPUTER PROGRAMMING

Learning Outcomes
In the end of the course, student will be able to:
1. Explain terminology of computer hardware and software
2. Identify the language elements used in C++
3. Build an algorithm to solve programming problems.
4. Design and implement simple programming using programming structure such as conditions, loops and function.
5. Create programs by using suitable techniques.
6. Using computer system to edit, arrange and execute programs.

Synopsis

References

SERVICE SUBJECTS
(FPTT, PBPI & CO-CURRICULUM UNIT)

BLHW 1013
FOUNDATION ENGLISH

Learning Outcomes
In the end of the course, student will be able to:
1. Infer information from various oral texts of different complexity levels.
2. Respond to stimuli and justify reasons individually and in group discussions on a wide range of contemporary issues.
3. Apply information in cloze texts based on passages from various sources.
4. Produce an extended writing and a report based from non-linear sources.

Synopsis
This course is designed to help students improve their proficiency in English language and to communicate effectively in both spoken and written forms. It is tailored to the four components, namely Listening, Speaking, Reading and Writing of the Malaysian University English Test (MUET). Grammar component is taught in an integrated approach to build confidence among the learners to become efficient speakers of English in their tertiary education and workplace environment. The Cooperative Learning approach is incorporated in this course.

Pre-requisite
Students with MUET Band 1 and Band 2 only.

References:
BLHW 2403
TECHNICAL ENGLISH

Learning Outcomes
In the end of the course, student will be able to:
1. Distinguish the use of tenses, run-ons, fragments, modifiers and parallelism.
2. Summarise and paraphrase main ideas.
3. Write a proposal as well as progress and project reports in a group.
4. Organise and present project report in groups.

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

References

BLHW 3403
ENGLISH FOR PROFESSIONAL COMMUNICATION

Learning Outcomes
In the end of the course, student will be able to:
1. Select and apply the appropriate tenses, parallelism, direct and indirect speech, transitional markers and misplaced modifiers.
2. differentiate between facts and opinions, and use vocabulary relevant to its context.
3. respond to interviews and participate in meetings.
4. Demonstrate communication and oral presentation skills.
5. Produce resumes application letter and recommendation report.

Synopsis
This course is designed to develop oral communication, as well as enhance students' level of English literacy which will be beneficial to their professional careers. It also aims to equip students with the communication skills necessary for the workplace. It complements the skills taught in BLHW 3403. Grammar will be taught implicitly in the course content. Students will acquire effective presentation skills as well as gain experience in mock interviews prior to seeking employment. The Student-Centred Learning approach is employed in teaching and learning process.

References

- BKKX XXXX
  CO-CURRICULUM I & II
- BLHW 1722
  SCIENCE & TECHNOLOGY PHILOSOPHY
  OR
- BLHW 1732
  SOCIO ECONOMIC DEVELOPMENT OF MALAYSIA
- BLHL 1XX2
  THIRD LANGUAGE
- BLHC 3012
  TECHNOCRACY COMMUNICATION SKILLS
Material Mechanics
Introduction to types of structures, types of supports, the concept of stress, strain, shear force, bending moment, bending beam theory, torque theory, shear flow, combination of load and beam deflection.

References

BMCG 1253
DYNAMIC & MECHANISM

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. State the concept and principles of basic kinematics and particle’s kinetics and rigid body, movement transmission system, balancing system and gyroscope movement.
2. Conduct and analyze experiments related to dynamics and mechanisms.
3. Understand the introduction and basic principles of dynamics and mechanisms.

Synopsis
Introduction and basic principles of dynamics, particle’s kinematics and rigid body, moment of inertia, transmission system based on friction (conveyor, brake and grip), dynamic system’s balance (rotating body and reciprocal movement body), simple harmonic movements and vibration (one degree freedom vibration, free vibration, free damped vibration and forced damped vibration), speed control (cycle and centrifugal).

References
BMCG 2343
INTRODUCTION TO MECHANICAL ENGINEERING

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Analyze the mechanical properties of materials
2. Describe the basic concepts of dynamics and thermodynamics
3. Conduct and demonstrate the basic practical works of mechanical system
4. Define basic terms of thermodynamics and identify systems, properties and processes.
5. Use property tables and draw property diagrams of pure substances to define the state of the system.
6. Apply the concept of First Law of Thermodynamics in Closed Systems and Control Volumes.
7. Analyze the concept of Second Law of Thermodynamics to determine the performance of heat engine, refrigerators and heat pumps.
8. Describe different modes of heat transfer: conduction, convection and radiation, and calculate the thermal conductivity, heat transfer coefficients, heat transfer through plates, cylinders and spheres.

Synopsis

References

BMCG 2372
FLUID MECHANICS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Define and explain the terms of fluid and its usage.
2. Explain the concept, laws and equations related to fluid mechanics and verify the concept.
3. Conduct experiments which are related to fluid mechanics.

Synopsis
Basic introduction to the characteristics, physical and concept of fluid pressure; Methods of solution to the hydrostatic pressure and its application in pressure measurement; Analyse static force and its relation to floating, sinking and analysis on floating force; Introduction to analysis of dynamic flow with technique in solving flow problems; Solution on Bernoulli theorem in flow, flow rate, mass/volume loss in piping network; Analyse dimension and its equations.

References

BMCG 3512
ENGINEERING GRAPHICS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Learn engineering drawing techniques and drawing skills using the AUTOCAD software.
2. State about basic CAD, orthographic, isometric, machine theory and detailed drawing.
3. Draw geometric drawings and engineering drawings using mechanical drawing instruments and AUTOCAD software.

Synopsis
Basic CAD, geometric drawing, orthographic, isometric, machine theory, detailed drawing, orthographic, machine drawing and detailed drawing will be completed using a computer through manipulation, solid modelling method in CAD (2D and 3D).

References

BMCG 3522
ENGINEERING MATERIALS

Learning Outcomes
Upon completion of this subject, the student should be able to:
1. Understand and state the terms used in material engineering and its importance.
2. Explain the theory and practical for material characteristics, material selection, material strength analysis and manufacturing design.
3. Conduct hardness study, impact test, compression test, Poisson’s ratio and bending stress

Synopsis
Introduce students to the science and engineering of materials, material structure classification, material characteristics, material physical characteristics, types of metal alloy, use, process and analysis of material's strength.

References

BMCG 3643
PNEUMATIC & HYDRAULIC SYSTEMS

Learning Outcome
1. Describe fundamental principles that govern the behavior of fluid power systems.
2. Explain the common hydraulic and pneumatic components, their use, symbols and their applications in industry.
3. Analyze mathematical models of hydraulic and pneumatic circuits in order to study performance of the system.
4. Design the hydraulic and pneumatic circuit manually or using related computer software.
5. Construct the hydraulic and pneumatic circuit and their electrical circuit.

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.

References
BMCG 3653
THERMODYNAMICS & HEAT TRANSFER

Learning Outcomes
After completion of the course, the students should be able to:
1. Define basic terms of thermodynamics and identify systems, properties and processes.
2. Use property tables and draw property diagrams of pure substances to define the state of the system.
3. Apply the concept of First Law of Thermodynamics in Closed Systems and Control Volumes.
5. Describe different modes of heat transfer: conduction, convection and radiation, and calculate the thermal conductivity, heat transfer coefficients, heat transfer through plates, cylinders and spheres.
6. Apply the concept of heat transfer for cooling of electronics and hydraulic systems.

Synopsis

Reference

SERVICE SUBJECTS (FKM)
BMCG 1123
MATERIAL MECHANICS & STATICS

Learning Outcomes
Upon completion of this subject, the student should be able to:
4. State the basic concept of force and material mechanics.
5. Analyze the force on a mechanical system.
6. Understand and elaborate the forces on a mechanical system.

Synopsis
Statics
Introduction and basic concepts, unit system, scalar and vector, forces system, force cohesion and coupling/moment, particle in balance, free body diagram, rigid body balance, distributed forces, center of gravity and centroid, truss system analysis, simple frame and friction.

Material Mechanics
Introduction to types of structures, types of supports, the concept of stress, strain, shear force, bending moment, bending beam theory, torque theory, shear flow, combination of load and beam deflection.

References

BMCG 1253
DYNAMIC & MECHANISM

Learning Outcomes
Upon completion of this subject, the student should be able to:
4. State the concept and principles of basic kinematics and particle's kinetics and rigid body, movement transmission system, balancing system and gyroscope movement.
5. Conduct and analyze experiments related to dynamics and mechanisms.
6. Understand the introduction and basic principles of dynamics and mechanisms.
Synopsis
Introduction and basic principles of dynamics, particles’s kinematics and rigid body, moment of inertia, transmission system based on friction (conveyor, brake and grip), dynamic system’s balance (rotating body and reciprocal movement body), simple harmonic movements and vibration (one degree freedom vibration, free vibration, free damped vibration and forced damped vibration), speed control (cycle and centrifugal).

References

BMCG 2343
INTRODUCTION TO MECHANICAL ENGINEERING

Learning Outcomes
Upon completion of this subject, the student should be able to:
9. Analyze the mechanical properties of materials
10. Describe the basic concepts of dynamics and thermodynamics
11. Conduct and demonstrate the basic practical works of mechanical system
12. Define basic terms of thermodynamics and identify systems, properties and processes.
13. Use property tables and draw property diagrams of pure substances to define the state of the system.
15. Analyze the concept of Second Law of Thermodynamics to determine the performance of heat engine, refrigerators and heat pumps.
16. Describe different modes of heat transfer: conduction, convection and radiation, and calculate the thermal conductivity, heat transfer coefficients, heat transfer through plates, cylinders and spheres.

Synopsis

References

BMCG 2372
FLUID MECHANICS

Learning Outcomes
Upon completion of this subject, the student should be able to:
4. Define and explain the terms of fluid and its usage.
5. Explain the concept, laws and equations related to fluid mechanics and verify the concept.
6. Conduct experiments which are related to fluid mechanics.

Synopsis
Basic introduction to the characteristics, physical and concept of fluid pressure; Methods of solution to the hydrostatic pressure and its application in pressure measurement; Analyse static force and its relation to floating, sinking and analysis on floating force; Introduction to analysis of dynamic flow with technique in solving flow
problems; Solution on Bernoulli theorem in flow, flow rate, mass/volume loss in piping network; Analyse dimension and its equations.

References

BMCG 3512
ENGINEERING GRAPHICS

Learning Outcomes
Upon completion of this subject, the student should be able to:
4. Learn engineering drawing techniques and drawing skills using the AUTOCAD software.
5. State about basic CAD, orthographic, isometric, machine theory and detailed drawing.
6. Draw geometric drawings and engineering drawings using mechanical drawing instruments and AUTOCAD software.

Synopsis
Basic CAD, geometric drawing, orthographic, isometric, machine theory, detailed drawing, orthographic, machine drawing and detailed drawing will be completed using a computer through manipulation, solid modelling method in CAD (2D and 3D).

References

BMCG 3522
ENGINEERING MATERIALS

Learning Outcomes
Upon completion of this subject, the student should be able to:
4. Understand and state the terms used in material engineering and its importance.
5. Explain the theory and practical for material characteristics, material selection, material strength analysis and manufacturing design.
6. Conduct hardness study, impact test, compression test, Poisson's ratio and bending stress.

Synopsis
Introduce students to the science and engineering of materials, material structure classification, material characteristics, material physical characteristics, types of metal alloy, use, process and analysis of material's strength.

References

BMCG 3643
PNEUMATIC & HYDRAULIC SYSTEMS

Learning Outcome
6. Describe fundamental principles that govern the behavior of fluid power systems.
7. Explain the common hydraulic and pneumatic components, their use, symbols and their applications in industry.
8. Analyze mathematical models of hydraulic and pneumatic circuits in order to study performance of the system.
9. Design the hydraulic and pneumatic circuit manually or using related computer software.
10. Construct the hydraulic and pneumatic circuit and their electrical circuit.

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.

References

BMCG 3653
THERMODYNAMICS & HEAT TRANSFER

Learning Outcomes
After completion of the course, the students should be able to:
7. Define basic terms of thermodynamics and identify systems, properties and processes.
8. Use property tables and draw property diagrams of pure substances to define the state of the system.
10. Analyze the concept of Second Law of Thermodynamics to determine the performance of heat engine, refrigerators and heat pumps.
11. Describe different modes of heat transfer: conduction, convection and radiation, and calculate the thermal conductivity, heat transfer coefficients, heat transfer through plates, cylinders and spheres.
12. Apply the concept of heat transfer for cooling of electronics and hydraulic systems.

Synopsis

Reference
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**FACILITIES & INFRASTRUCTURE**

**FKE’S BUILDING MAP**

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**BLOCK A**

- Ground Floor: Lecturers’ rooms, Lecture Room 2
- 1st Floor: Ladies prayer room, Lecturer rooms, Seminar room
- 2nd & 3rd Floor: Lecturer rooms

**BLOCK B**

- Ground Floor: Lecturers’ rooms, Lecture Room 1
- 1st Floor: Lecturers’ rooms, Discussion Room 1 & 2
- 2nd Floor: Lecturers’ rooms, Discussion room 4 & 5
- 3rd Floor: Lecturers’ rooms

**BLOCK C**

- Ground Floor: Faculty lobby, Lecturers’ rooms
- 1st Floor: Faculty administration office, Dean, Deputy Dean/Head of Department
- 2nd Floor: FKE meeting room, ISO files room, waiting room.
- 3rd Floor: Lecturers’ rooms.

**BLOCK D**

- Ground Floor: Power electronic and drive lab.
- 1st Floor: Robotic and industry automation research lab, Mechatronic and CIA lab.
- 2nd Floor: Electrical Technology lab 1, Post graduate room 1

**BLOCK E**

- Ground Floor: Power systems Labs 1 & 2, Pneumatic and hydraulic Lab, Power electronic lab, Lecture Rooms 3 & 8, Students prayer room (male)
- 1st Floor: Power electronic and drive lab research room, Post graduate room 2, Final year project room, Lecture Rooms 4,9 & 10, Students prayer room (female), CIA simulation lab, Energy Efficiency lab.
- 2nd Floor: Power electronic applications lab, Power electronic simulation lab, Lecture rooms 5 ,10 & 12 Mechatronic system lab, Control system lab.
- 3rd Floor: Energy and power system lab, Lecture Rooms 6 ,13 & 14, Briefing room 7 , PLC & Process control lab, Robotic and automation lab.

**BLOCK F**

- Ground Floor: Power industry workshop, Engineering practices workshop, Electrical machine labs 1 & 2, High voltage lab, Generation and transmission lab, Protection system lab, Machine drive lab.
- 2nd Floor: Electrical & Electronic Labs 1 & 2, Lecture Room 15 & 16
- 3rd Floor: Microprocessor Lab, Instrumentation and DSP Lab, Sensor and Transducer Lab.
<table>
<thead>
<tr>
<th>No</th>
<th>Laboratory / Workshop</th>
<th>Room No.</th>
<th>Equipments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power system lab 1</td>
<td>E/G-2</td>
<td>TERCO Transmission System Training Set, TERCO Power Utilization System Training Set</td>
</tr>
<tr>
<td>2</td>
<td>Power system lab 2</td>
<td>E/G-7</td>
<td>TERCO Generation System Training Set</td>
</tr>
<tr>
<td>3</td>
<td>Energy Efficiency lab</td>
<td>E/1-19</td>
<td>Various tools &amp; equipment of energy efficiency studies</td>
</tr>
<tr>
<td>4</td>
<td>Protection system lab</td>
<td>F/G-27</td>
<td>LABVOLT Protection System Training Set, PC</td>
</tr>
<tr>
<td>5</td>
<td>Electrical &amp; Electronic Lab 1</td>
<td>F/2–4</td>
<td>PCs, Function Generators, Oscilloscopes, Digital Lab Trainers, Multimeters</td>
</tr>
<tr>
<td>6</td>
<td>Electrical &amp; Electronic Lab 2</td>
<td>F/2–15</td>
<td>PCs, Function Generators, Oscilloscopes, Digital Lab Trainers, Multimeters</td>
</tr>
<tr>
<td>7</td>
<td>Electrical Technology lab 1</td>
<td>D/2–11</td>
<td>LABVOLT meters, loads, tools &amp; equipments for electrical technology studies</td>
</tr>
<tr>
<td>8</td>
<td>Generation and Transmission lab</td>
<td>F/G–22</td>
<td>Vacant</td>
</tr>
<tr>
<td>9</td>
<td>High voltage lab</td>
<td>F/G-18</td>
<td>HAEBFLY high voltage engineering modular training set</td>
</tr>
<tr>
<td>10</td>
<td>Sensor and Transducer Lab.</td>
<td>E/2–16</td>
<td>PC (pesim), Transducers &amp; instrumentation training set, WOOSON sensor application training set</td>
</tr>
<tr>
<td>11</td>
<td>CIA simulation lab</td>
<td>E/1–14</td>
<td>PC c/w Matlab &amp; Multisim, Micro-Box</td>
</tr>
<tr>
<td>12</td>
<td>PLC &amp; Process control lab</td>
<td>E/3–13</td>
<td>OMRON PLC Training Set, Test Panel DOL Motor Starter, Test Panel STAR-DELTA Motor Starter and various equipments of automation</td>
</tr>
<tr>
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<td>Room No.</td>
<td>Equipments</td>
</tr>
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</tr>
<tr>
<td>13</td>
<td>Microprocessor Lab</td>
<td>F/3–8</td>
<td>PCs, Oscilloscopes, Multimeter, Mechatronics project kit, PIC Training Kit</td>
</tr>
<tr>
<td>14</td>
<td>Instrumentation and DSP Lab</td>
<td>F/3–5</td>
<td>LORENZO CBT Modul, Multimeters, function generators, digital lab trainer, analog oscilloscope, magnaprobe, Galvanometer, Decade resistor, Decade Inductor</td>
</tr>
<tr>
<td>15</td>
<td>Control System Lab</td>
<td>E/2-21</td>
<td>Modular Servo System, Mathlab software, Digital Oscilloscope.</td>
</tr>
<tr>
<td>16</td>
<td>Robotic and automation lab</td>
<td>E/ 3-18</td>
<td>Rhino robot trainer, Scara robot trainer, etc,</td>
</tr>
<tr>
<td>17</td>
<td>Pneumatic and hydraulic Lab</td>
<td>E/G-15</td>
<td>BOSCH REXROTH Pneumatic &amp; Hydraulic System Training Set</td>
</tr>
<tr>
<td>18</td>
<td>Power Electronic Lab</td>
<td>E/G–20</td>
<td>PCs, oscilloscope digital Tektronix and various equipments for power electronics studies, Power Electronics training system model labvolt</td>
</tr>
<tr>
<td>19</td>
<td>Power Electronic Simulation Lab</td>
<td>E/2–7</td>
<td>PCs &amp; LabView software</td>
</tr>
<tr>
<td>20</td>
<td>Power electronic applications lab</td>
<td>E/2–2</td>
<td>PCs, ERACS &amp; PSCAD software</td>
</tr>
<tr>
<td>21</td>
<td>Electrical machine lab 1</td>
<td>F/G–14</td>
<td>LORENZO electrical machines</td>
</tr>
<tr>
<td>22</td>
<td>Electrical machine lab 2</td>
<td>F/G-11</td>
<td>Dissectible machine</td>
</tr>
<tr>
<td>23</td>
<td>Machine drive lab</td>
<td>F/G-30</td>
<td>Terco scan drive</td>
</tr>
<tr>
<td>24</td>
<td>Power Electronic workshop</td>
<td>F/G–4</td>
<td>Wiring bays, tools and equipments for domestic &amp; motor control/starter wiring</td>
</tr>
<tr>
<td>25</td>
<td>Mechatronic and CIA workshop</td>
<td>D/1-10B</td>
<td>CIM System, AGV, CNC machine, OMRON machine vision, robot arm training set</td>
</tr>
</tbody>
</table>

**Engineering Practices Workshop**

**Power electronic and drive research lab**
<table>
<thead>
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<th>Laboratory / Workshop</th>
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<th>Equipments</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>Engineering Practices Workshop</td>
<td>F/G-6</td>
<td>Hitachi bench drill, welding set, grander, break cutter, pallet jack, spanner Canady</td>
</tr>
<tr>
<td>27</td>
<td>Power electronic and drive workshop</td>
<td>D/G-11</td>
<td>Vacant</td>
</tr>
<tr>
<td>28</td>
<td>Mechatronic system lab</td>
<td>F/3-2</td>
<td>PCB machine</td>
</tr>
<tr>
<td>29</td>
<td>Robotic and industry automation research lab</td>
<td>D/1–10A</td>
<td>CIM System, AGV, CNC machine, OMRON machine vision, robot arm training set</td>
</tr>
<tr>
<td>30</td>
<td>Power electronic and drive research lab</td>
<td>E/1-3</td>
<td>Oscilloscope, dc power supply, power analyzer, ac power source, current probe, solar panel &amp; solar generator, wind turbine, load bank, spectrum analyzer, function generator, programmable ac-dc electronic load, ac-dc current measurement, high voltage differential probe</td>
</tr>
<tr>
<td>31</td>
<td>Energy and power system lab</td>
<td>E/3-2</td>
<td>Fluke Multimeter, oscilloscope, pc</td>
</tr>
<tr>
<td>32</td>
<td>Post graduate room 1</td>
<td>D/2-10</td>
<td>TV, CCTV Camera, Digital multimeter, recorder (Cynics 9), Programmable 3 phase AC power source, Research tools and accessories.</td>
</tr>
<tr>
<td>33</td>
<td>Post graduate room 2</td>
<td>E/1-4</td>
<td>DSPACE/DS1103, Digital Oscilloscope 4 channel, DC power supply. Professional Service Engineering tool kit, Digital multimeter, Research tools and accessories.</td>
</tr>
<tr>
<td>34</td>
<td>Final Year Degree &amp; Diploma Project Lab</td>
<td>E/1-5</td>
<td>Final year project collections</td>
</tr>
</tbody>
</table>
The faculty would like to extend our gratitude and appreciation to all who have contributed to the success of Academic Handbook completion:

Associate Professor Dr. Zulkifilie bin Ibrahim
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Kyairul Azmi bin Baharin
Mohamad Riduwan bin Md Nawawi
Aimie Nazmin bin Azmi
Nurul Ain binti Mohd Said
Fadilah binti Abdul Azis
Mohd Hanif bin Che Hasan
Siti Aisyah bin Mat Zain
Mohd Fauzi bin Roslan
Siti Fatimah binti Kamaruddin

And all of the parties involved.