CURRICULUM STRUCTURE
**ELECTRICAL ENGINEERING TECHNOLOGY**

**PROGRAMME OUTCOMES (PO)**

<table>
<thead>
<tr>
<th>PO</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO1</td>
<td>Ability to apply knowledge of mathematics, science, engineering fundamentals and engineering specialisation principles to defined and applied engineering procedures, processes, systems or methodologies in the field of electrical engineering technology.</td>
</tr>
<tr>
<td>PO2</td>
<td>Ability to solve broadly-defined engineering problems systematically to reach substantiated conclusions, using tools and techniques appropriate to electrical engineering technology.</td>
</tr>
<tr>
<td>PO3</td>
<td>Ability to design solutions for broadly-defined engineering technology problems, and to design systems, components or processes to meet specified needs with appropriate consideration for public health and safety, as well as cultural, societal, environmental and sustainability concerns.</td>
</tr>
<tr>
<td>PO4</td>
<td>Ability to plan and conduct experimental investigations of broadly-defined problems, using data from relevant sources.</td>
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<td>Ability to select and apply appropriate techniques, resources and modern engineering tools, with an understanding of their limitations.</td>
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<td>Ability to function effectively as individuals, and as members or leaders in diverse technical teams.</td>
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<td>PO12</td>
<td>Ability to recognise the need for professional development and to engage in independent and lifelong learning.</td>
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</table>
# Bachelor of Electrical Engineering Technology with Honours (BETY)

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<tr>
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<th>CATEGORY</th>
<th>CREDIT</th>
<th>PRE-REQUISITE</th>
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</thead>
</table>
| BETU 1013 | Matematik Teknikal  
*Technical Mathematics* | P        | 3      |               |
| BETE 1013 | Fizik Teknikal  
*Technical Physics* | P        | 3      |               |
| BETY 1303 | Pengukuran dan Sistem Instrumentasi  
*Measurement and Instrumentation System* | K        | 3      |               |
| BETR 1313 | Rekabentuk Terbantu Komputer  
*Computer Aided Design* | K        | 3      |               |
| **BETI 1303** | Pengenalan Litar Elektrik 
*Electrical Circuit Fundamental* | K        | 3      |               |
| BLHW 1702 | Tamadun Islam dan Tamadun Asia  
*Islamic and Asian Civilizations* | W        | 2      |               |
| BKKX XXX1 | Kokurikulum I  
*Cocurriculum I* | W        | 1      |               |
| **TOTAL CREDITS THIS SEMESTER** |                               |          | 18     |               |

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<tr>
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</table>
| BETU 1023 | Kalkulus untuk Teknologi  
*Calculus For Technology* | P        | 3      |               |
| BLHW 1722 | Falsafah Sains dan Teknologi  
*Philosophy of Science and Technology* | P        | 2      |               |
| BETY 1313 | Bengkel Electronik  
*Electronics Workshop* | K        | 3      |               |
| BETI 1323 | Elektrik & Kemagnetan  
*Electrics & Magnetism* | K        | 3      |               |
| BETY 1323 | Elektronik & Sistem Digital  
*Digital Electronics & System* | K        | 3      |               |
| **BETI 1333** | Litar Elektrik Lanjutan 
*Advanced Electrical Circuit* | K        | 3      | BETI 1303     |
| BKKX XXX1 | Kokurikulum II  
*Cocurriculum II* | W        | 1      |               |
<p>| <strong>TOTAL CREDITS THIS SEMESTER</strong> |                               |          | 18     |               |</p>
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<tr>
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<td>Kalkulus Lanjutan untuk Teknologi Advanced Calculus for Technology</td>
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<tr>
<td>BETY 2333</td>
<td>Pemasangan Elektrik I Electrical Installation I</td>
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<td>Peranti Elektronik Electronic Devices</td>
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<td>BETY 2353</td>
<td>Teknologi Elektrik Electrical Technology</td>
<td>K</td>
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<tr>
<td>BETR 1343</td>
<td>Pengaturcaraan Komputer Computer Programming</td>
<td>K</td>
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<tr>
<td>BETY 2361</td>
<td>Kerjaya Teknologi Kejuruteraan Elektrik Electrical Engineering Technology Career</td>
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<tr>
<td>BLHL 1XX2</td>
<td>Bahasa Ketiga Third Language</td>
<td>W</td>
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**TOTAL CREDITS THIS SEMESTER** 18

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<td>Kaedah Statistik Statistical Methods</td>
<td>P</td>
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<td>BETR 2374</td>
<td>Sistem Terbenam Embedded System</td>
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<tr>
<td>BETY 2373</td>
<td>Pemasangan Elektrik II Electrical Installation II</td>
<td>K</td>
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<td>BETR 2383</td>
<td>Pengenalan Sistem Kawalan Control System Fundamental</td>
<td>K</td>
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<td>BETR 2353</td>
<td>Elektronik Analog Analog Electronics</td>
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<td>BLHW 2403</td>
<td>Bahasa Inggeris Teknikal Technical English</td>
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<th>CREDIT</th>
<th>PRE-REQUISITE</th>
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</table>
| BETI 2383 | Teknologi Sistem Kuasa  
*Power System Technology* | K        | 3      |               |
| BETU 3803 | Rekabentuk Projek Berintegrasi  
*Integrated Design Project* | K        | 3      |               |
| BETI 2373 | Mesin Elektrik  
*Electrical Machines* | K        | 3      |               |
| BETY 3383 | Peranti Elektronik Kuasa  
*Power Electronics Devices* | K        | 3      |               |
| *BETY 3xx3 | Elektif I  
*Elective I* | E        | 3      |               |
| *BETY 3xx3 | Elektif II  
*Elective II* | E        | 3      |               |
| BLHW 2712 | Hubungan Etnik  
*Ethnic Relations* | W        | 2      |               |
| **BETU 3764 | Projek Sarjana Muda I  
*Bachelor Degree Project I* | K        | 4      |               |
| BETY 4393 | Sistem Elektronik Kuasa  
*Power Electronics Systems* | K        | 3      |               |
| BETY 3404 | Automasi Industri  
*Industrial Automation* | K        | 4      |               |
| *BETY 3xx3 | Elektif III  
*Elective III* | E        | 3      |               |
| BLHC 4032 | Pemikiran Kritis dan Kreatif  
*Critical and Creative Thinking* | W        | 2      |               |
| BLHW 3403 | Bahasa Inggeris untuk Komunikasi Profesional  
*English for Professional Communication* | W        | 3      |               |

**TOTAL CREDITS THIS SEMESTER**  
20

**SEMESTER 6**

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<th>PRE-REQUISITE</th>
</tr>
</thead>
</table>
| **BETU 3764** | Projek Sarjana Muda I  
*Bachelor Degree Project I* | K        | 4      |               |
| BETY 4393 | Sistem Elektronik Kuasa  
*Power Electronics Systems* | K        | 3      |               |
| BETY 3404 | Automasi Industri  
*Industrial Automation* | K        | 4      |               |
| *BETY 3xx3 | Elektif III  
*Elective III* | E        | 3      |               |
| BLHC 4032 | Pemikiran Kritis dan Kreatif  
*Critical and Creative Thinking* | W        | 2      |               |
| BLHW 3403 | Bahasa Inggeris untuk Komunikasi Profesional  
*English for Professional Communication* | W        | 3      |               |

**TOTAL CREDITS THIS SEMESTER**  
19
<table>
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<tr>
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<td>**BETU 4774</td>
<td>Projek Sarjana Muda II</td>
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<td></td>
<td>BETY 4413</td>
<td>Kecekapan Tenaga</td>
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<td></td>
<td>BETI 3403</td>
<td>Reka Bentuk Sistem Pengagihan Kuasa</td>
<td>K</td>
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<td></td>
<td>BETU 4053</td>
<td>Etika Kejuruteraan &amp; KKPP</td>
<td>P</td>
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<td>*BETY 4xx3</td>
<td>Elektif IV</td>
<td>E</td>
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<td>BTMW 4012</td>
<td>Keusahawanan Teknologi</td>
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**TOTAL CREDITS THIS SEMESTER**  
18

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<th>SEMESTER 8</th>
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<tr>
<td>BETU 4786</td>
<td>Latihan Industri</td>
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<tr>
<td>BETU 4796</td>
<td>Laporan Latihan Industri</td>
<td>K</td>
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**TOTAL CREDITS THIS SEMESTER**  
12

**TOTAL CREDITS**  
142

** Pre-requisite subject

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

<table>
<thead>
<tr>
<th>AREA</th>
<th>CODE</th>
<th>SUBJECT NAME</th>
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<tbody>
<tr>
<td>RENEWABLE ENERGY</td>
<td>BETY 3803</td>
<td>Sistem Tenaga diperbaharui Renewable Energy System</td>
</tr>
<tr>
<td>ELECTRICAL TRANSPORTATION</td>
<td>BETY 3813</td>
<td>Pengenalan kepada Sistem Pengangkutan Elektrik Introduction To Electrical Transportation System</td>
</tr>
</tbody>
</table>
For Elective II, students may choose subject from the list below:

<table>
<thead>
<tr>
<th>AREA</th>
<th>CODE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>RENEWABLE ENERGY</td>
<td>BETY 3823</td>
<td>Teknologi Penyimpanan Tenaga</td>
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<tr>
<td></td>
<td></td>
<td>Energy Storage Technology</td>
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<tr>
<td>ELECTRICAL TRANSPORTATION</td>
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</table>

For Elective III, students may choose any ONE (1) subject from the list below:

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<th>SUBJECT NAME</th>
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<tbody>
<tr>
<td>RENEWABLE ENERGY</td>
<td>BETY 3833</td>
<td>Polisi Tenaga</td>
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<td>Energy Policy</td>
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<td>BETY 3843</td>
<td>Rekabentuk Sistem PV</td>
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<td>PV System Design</td>
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<tr>
<td>ELECTRICAL TRANSPORTATION</td>
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<td></td>
<td>BETY 3853</td>
<td>Aplikasi Elektronik Kuasa</td>
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<td>Power Electronics Application</td>
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<td>BETY 3863</td>
<td>Pemacu Motor dan Sistem Tarikan</td>
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<tr>
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<td>Motor Drive and Traction System</td>
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For Elective IV, students may choose any ONE (1) subjects from the list below:

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<tbody>
<tr>
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<td>BETY 4873</td>
<td>Trend Teknologi dalam Industri</td>
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<td>Technology Trend in Industry</td>
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<td>BETI 4843</td>
<td>Keserasian Elektromagnetik Sistem Kuasa</td>
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<td>Power Systems Electromagnetic Compatibility</td>
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<td>BETY 4893</td>
<td>Trend Teknologi dalam Industri</td>
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<td>Technology Trend in Industry</td>
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<td>Modern Drive System</td>
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<td>BETY 4913</td>
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<td>Hybrid Electric Vehicle</td>
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<td>PO2</td>
<td>Ability to solve broadly-defined engineering problems systematically to reach substantiated conclusions, using tools and techniques appropriate to computer/industrial electronics/telecommunication engineering technology.</td>
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<td>Ethnic Relations</td>
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**Bachelor of Electronic Engineering Technology with Honours (BETZ)**

**SEMESTER 1**

- **BETU 1013** Matematik Teknikal (Technical Mathematics) - 3 credits
- **BETE 1013** Fizik Teknikal (Technical Physics) - 3 credits
- **BLHW 1722** Falsafah Sains dan Teknologi (Philosophy of Science and Technology) - 2 credits
- **BETI 1303** Pengenalan Litar Elektrik (Electric Circuit Fundamental) - 3 credits
- **BTE 1303** Bengkel Kejuruteraan I (Engineering Workshop I) - 3 credits
- **BETC 1313** Asas Pengaturcaraan (Programming Fundamental) - 3 credits

**TOTAL CREDITS THIS SEMESTER** 17

**SEMESTER 2**

- **BETU 1023** Kalkulus Untuk Teknologi (Calculus For Technology) - 3 credits
- **BETZ 1203** Analisis Litar AC (AC Circuit Analysis) - 3 credits
- **BTE 1313** Bengkel Kejuruteraan II (Engineering Workshop II) - 3 credits
- **BTE 2343** Lukisan Kejuruteraan (Engineering Drawing) - 3 credits
- **BETE 1323** Pengenalal Elektronik (Electronic Fundamentals) - 3 credits
- **BKKX XXX1** Kokurikulum I (Cocurriculum I) - 1 credit
- **BLHW 2712** Hubungan Etnik (Ethnic Relations) - 2 credits

**TOTAL CREDITS THIS SEMESTER** 18
<table>
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<th>CODE</th>
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**TOTAL CREDITS THIS SEMESTER** 18

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**TOTAL CREDITS THIS SEMESTER** 18
### Academic Handbook Session 2017/2018

#### FACULTY OF ENGINEERING TECHNOLOGY (FTK)

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<th>SEMESTER 7</th>
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<td>Pemikiran Kritis dan Kreatif Critical and Creative Thinking</td>
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**TOTAL CREDITS THIS SEMESTER** 19

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<td>Laporan Latihan Industri Industrial Training Report</td>
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**TOTAL CREDITS THIS SEMESTER** 12

**TOTAL CREDITS** 142

**Pre-requisite subject**

*For Elective I, students may choose any ONE (1) subjects from the list below:

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<td>BETT 3413</td>
<td>Teknik FR &amp; Gelombang Mikro RF Technique &amp; Microwave</td>
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<td>3</td>
<td>BETZ 4803</td>
<td>Anatomi &amp; Fisiologi Anatomy &amp; Physiology</td>
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<td>BETZ 4813</td>
<td>Pengimejan Perubatan dan Pemprosesan Imej Medical Imaging and Image Processing</td>
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<td>5</td>
<td>BETZ 4923</td>
<td>Fabrikasi Mikroelektronik Microelectronic Fabrication</td>
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<td>6</td>
<td>BETZ 4903</td>
<td>Proses Semikonduktor Semiconductor Process</td>
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* For Elective II & III, students may choose any TWO (2) subjects from the list below:

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| 1   | BETT 4813 | Komunikasi Mudah Alih  
* Mobile Communication |
| 2   | BETT 4833 | Kejuruteraan Antena  
* Antenna Engineering |
| 3   | BETZ 4823 | Peranti Perubatan dan Instrumentasi Perubatan  
* Medical Devices and Instrumentation |
| 4   | BETZ 4853 | Etika, Akta, Piawai & Keselamatan Bioperubatan  
* Biomedical Ethics Acts, Standards & Safety |
| 5   | BETZ 4873 | Rekabentuk VLSI  
* VLSI Design |
| 6   | BETZ 4883 | Rekabentuk IC Digital  
* Digital IC Design |

* For Elective IV, students may choose any ONE (1) subjects from the list below:

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| 1   | BETT 4803 | Komunikasi Satelit  
* Satellite Communication |
| 2   | BETZ 4863 | Sistem Navigasi Radio  
* Radio Navigation System |
| 3   | BETZ 4843 | Penyelenggaran Kejuruteraan Bioperubatan  
* Biomedical Engineering Maintenance |
| 4   | BETZ 4833 | Biomekanik  
* Biomechanics |
| 5   | BETZ 4913 | Seni Bina VLSI  
* VLSI Architecture |
| 6   | BETZ 4893 | Pengujian IC Digital  
* Digital IC Testing |
SUMMARY OF SUBJECTS
University Compulsory Subjects (W)

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

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply skills in relevant fields.
2. Demonstrate teamwork abilities in related subjects

SYNOPSIS
1. Cultural
2. Entrepreneurship
   Video, Film and Photography, Publishing & Journalism, Computer and Technopreneurship.
3. Society
   Fiqh Muamalat, Fiqh Amali, Tahsin Al-Quran & Yaasin and Peer Program.
4. Recreation
   Go-Kart, Adventure and Cycling.
5. Sports
   Swimming, Volley Ball, Golf, Kayaking, Takraw, Aerobic, Badminton, Football and Net ball.
6. Martial Arts
   Silat Gayong, Karate-Do and Taekwando.

BLHL 1XX2
THIRD LANGUAGE / BAHASA KETIGA

Bahasa Arab Tahap 1
Bahasa Arab Tahap 2
Bahasa Mandarin Tahap 1
Bahasa Mandarin Tahap 2
Bahasa Jepun Tahap 1
Bahasa Jepun Tahap 2
Bahasa Jerman Tahap 1
Bahasa Jerman Tahap 2
Bahasa Perancis Tahap 1
Bahasa Perancis Tahap 2
BLHW 2403
TECHNICAL ENGLISH / BAHASA INGGERIS TEKNIKAL

LEARNING OUTCOMES
At the end of the course, students should be able to:
1. Distinguish the use of tenses, run-ons, fragments, modifiers and parallelism
2. Produce a proposal and project report
3. 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 / BAHASA INGGERIS UNTUK KOMUNIKASI PROFESIONAL

LEARNING OUTCOMES
At the end of the course, students should be able to:
1. Demonstrate job-seeking skills
2. Produce a recommendation report based on a given scenario
3. Demonstrate communication skills

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
BLHW 1702
ISLAMIC & ASIAN CIVILIZATIONS / TAMADUN ISLAM DAN TAMADUN ASIA

LEARNING OUTCOMES
At the end of this course, students should be able to:
1. Discuss the role of civilizational value in the formation of community value systems.
2. Connecting elements of civilization with current community issues.

SYNOPSIS
This course provides knowledge on various civilizations. It introduces Islamic civilization as the basis for the Malay and Malaysian civilization. Additionally, issues related to the Chinese and Indian civilizations together with current and future issues of various world civilizations are also discussed.

REFERENCES

BLHW 2712
ETHNIC RELATIONS / HUBUNGAN ETNIK

LEARNING OUTCOMES
At the end of this course, students should be able to:
1. Evaluate the importance of national identity and volunteerism towards creating responsible citizens.
2. Generate social relationships and interactions between ethnics.

SYNOPSIS
This course focuses on the basic concepts of culture and ethnic relations in Malaysia. It exposes students to ethnic relations in the development of the Malaysian society. Besides, this course aims to give an understanding of the global challenges facing ethnic and cultural relations at the Malaysian level.

REFERENCES
BTMW 4012
TECHNOLOGY ENTREPRENEURSHIP / KEUSAHAWANAN TEKNOLOGI

LEARNING OUTCOMES
Upon completion of the subject, students should be able to:
1. Recognize the importance of entrepreneurship, the role of entrepreneurship in today's society, and the technical knowledge of the entrepreneurial process. (C1)
2. Explain the basic concepts of interdisciplinary competences in management, and create technology-based businesses. (C2)
3. Present a business plan project and develop an entrepreneurial profile. (C3, CS, ES)

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

REFERENCES

BLHC 4032
CRITICAL AND CREATIVE THINKING / PEMIKIRAN KRITIS DAN KREATIF

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

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

REFERENCES
BETU 1013
TECHNICAL MATHEMATICS / MATEMATIK TEKNIKAL

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Explain the concepts of matrices, trigonometry, complex number and three dimensional vector operations.
2. Use appropriate methods to solve matrices, trigonometry, complex numbers and three-dimensional vector operations.
3. Solve application problems using appropriate techniques.

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

REFERENCES

BETU 1023
CALCULUS FOR TECHNOLOGY / KALKULUS UNTUK TEKNOLOGI

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Use appropriate methods to find the limits and continuity of a function.
2. Use appropriate methods to differentiate and integrate various functions.
3. Solve application problems using appropriate techniques.

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

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

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

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

1. Recognize the fundamental principles of Professional Ethics and various behaviour or conducts that need to be observed and controlled by a professional technologists.

2. Identify moral problems that related to engineering ethics and to solve the problem using various appropriate methods.

3. Explain the concepts in context of engineering ethics and to relate it with the actual phenomena.

4. Define the responsibilities of engineering technologists in the scope of their function in any organization either as an employee or as an employer and have a feeling of being a responsible and public safety and environmental conscious technologist.

5. Define the Occupational Health concept, understand the critical occupational safety health hazard that the workers exposed themselves in the factory working environment, how to prevent or at least minimize these hazards.

SYNOPSIS
This subject will discuss the concept and cases of engineering ethics; Introduction to professional ethics, engineering ethics as preventive ethics, framing the ethical problems, methods for moral problem solving, creative middle ways, organizing principles, utilitarian concept, minimalist views, respect for persons, reversibility, universal ability, responsible engineering technologists, reasonable care, good works, honesty, integrity, reliability, conflict of interest, engineering technologist as employees, engineering technologist as employers, engineers and environment, international engineering professionalism. At the end of the course, the student will be taught on the OSHA, critical safety and health hazards, first aids procedures and practice, its organization and how the OSHA manage to monitor the safety and the health effectively, case study on the occupational safety and health.

REFERENCES
LEARNING OUTCOMES
At the end of this course, students should be able to:
1. Describe the concept and philosophical issues in science and technology.
2. Reporting issues and challenges related to science and technology philosophy.

SYNOPSIS
This course discusses the concept of knowledge, philosophy of science and technology according to the perspectives of Muslim and Western scholars. The concept and achievements of Islamic civilization are also discussed because science and technology is a phenomenon which develops in line with the development of society and its environment.

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

SYNOPSIS
This course will discuss about Mechanics: Physical Quantities and Measurements, Kinematics of Linear Motion, Force, Momentum and Impulse, Work, Energy and Power, Static, Circular Motion, Properties of Matter: Static, Dynamics, Circular Motion, Simple Harmonic, Moment of Inertia, Density and Specific Gravity, Hydrostatics, Elasticity, Friction, Viscosity, Osmosis, Diffusion, Acceleration and Newton’s Second Law of Motion, Motion with a Changing Velocity and Ohm’s Law. Thermodynamics, Wave, Light & Sound. All topics covered are basic knowledge essential for engineering programs.

REFERENCES

LEARNING OUTCOMES
At the end of this course, students should be able to:
1. Describe the elements of design for Dematerialization, Detoxification, Revalorization and Renewal.
2. Design various product types with minimum environmental effects.
3. Analyze the environmental effects of products throughout their lifecycle.

SYNOPSIS
Sustainable design or green product design is to incorporate product design to eliminate negative environmental impacts completely through skillful, sensitive design. Manifestations of sustainable design require no non-renewable resources, impact the environment minimally, and relate people with the natural environment.

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

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

REFERENCES

BETY Course Core Subjects (K)

BETR 1313
COMPUTER AIDED DESIGN / REKABENTUK TERBANTU KOMPUTER

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Use a standard Computer Aided Design software command tools for basic two-dimensional drafting and produce geometric, orthographic, isometric, section cut and detail drawing.
2. Construct detailed two-dimensional engineering drawings and basic three-dimensional solid modelling models using standard Computer Aided Design software.
3. Demonstrate an accurate engineering drawing based on given problem.

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

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

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

REFERENCES

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply the knowledge, basic features and configuration of combinational logic and sequential logic circuit.
2. Construct digital system experiments and assignment.
3. Explain effectively either individually or in group for any assignment and experiment.

SYNOPSIS
This subject discusses about number systems & codes, Boolean algebra, logic families and the characteristic of logic gates, combinational logic, analysis and design. MSI combinational logic circuit, flip-flops, counter and shift-register, synchronous and asynchronous sequential circuits, analysis and design of adder, decoder, encoder, multiplexer, demultiplexer, counter and register. Simulations of digital logic systems are also included.

REFERENCES
LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Explain the concept and application of Electrical Field, Coulombs Law, Lenz Law and Faradays Law in electrical charge phenomena.
2. Demonstrate electrical concepts, basic magnetic quantities and phenomena to simple devices (DC motor and transformer) in electrical engineering technology.
3. Present written and oral communications to document work and experiment results.

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

REFERENCES

PRE-REQUISITE
BETI 1303
ELECTRICAL CIRCUIT FUNDAMENTAL / PENGENALAN LITAR ELEKTRIK

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Analyze first order and second order electrical circuit in transient and frequency response.
2. Conduct experiment on frequency response and electrical circuit measurement.
3. Present written and oral communications to document work and experiment results.

SYNOPSIS
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
BETY 1313
ELECTRONICS WORKSHOP/ BENGKEL ELEKTRONIK

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply the knowledge of basic electronic components, circuit simulation, PCB fabrication, soldering, troubleshooting and test verification of an electronic circuitry design.
2. Measure an electrical parameter in troubleshooting and test verification using appropriate tools and equipment.
3. Explain effectively the knowledge about the Health and Safety Regulation.

SYNOPSIS
This subject aims to enable the student to acquire competency in the safe use of electronics laboratory test equipment and to acquire competency in construction and testing electronic assemblies. The practical element of the electronic production is considered to be of great importance. Student gains valuable experience in physical component identification and the use of supplier catalogues in the component identification and ordering procedure. The skills of PCB fabrication, circuit design and simulation, circuit assembly and soldering, debugging and troubleshooting are developed in this subject.

REFERENCES
3. Occupational safety and health (classification, labelling and safety datasheet of hazardous chemicals) regulations 2013, Department of Occupational safety and health Malaysia
4. Laboratory Safety Guidance, Occupational Safety and Health Administration U.S. Department of Labor, 2011

SEMESTER 3
BETR 1343
COMPUTER PROGRAMMING / PENGATURCARAAN KOMPUTER

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Produce computer programming code based on principles, structures and techniques in C++.
2. Construct programming language code by applying suitable C++ programming techniques to solve a given problem.
3. Work in group effectively while performing group assignment.

SYNOPSIS
Throughout the course, students will be introduced with basic principles of computers and software development methodology. The course also consists of basic programming principles such as syntax semantic, compiling, and linking. Programming techniques using C++ such as data type and operator, selection, repetition, function, array, file, and pointer are learnt towards the end of this course.

REFERENCES
BETY 2343  
ELECTRONIC DEVICES / PERANTI ELEKTRONIK

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply knowledge of semiconductor devices in electronic circuit.
3. Explain effectively either individually or in group for any assignment and experiment

SYNOPSIS
This subject introduces students to semiconductor devices. There are four semiconductor devices involve which are diode, bipolar junction transistor (BJT), field effect transistor (FET) and operational amplifier. Students will learn the types of these four devices, structure characteristic, configuration and application. In term of circuit analysis, student will learn how to calculate current and voltage in a circuit contain these semiconductor devices and draw output voltage waveform for diode application circuit. This subject will be supported by laboratory works and assignment to impart the students some basic practical skills.

REFERENCES

BETY 2333  
ELECTRICAL INSTALLATION I / PEMASANGAN ELEKTRIK I

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Design single phase electrical installation based on domestic application.
2. Perform single phase electrical installation based on domestic application.
3. Conform to single phase electrical installation based on existing acts, regulations and standards.

SYNOPSIS
This course outlines the principles, design and application of single phase electrical installation system. The course covers various matters of single phase electrical installation system such as electrical requirements by i.e Public Works Department, consultants and electrical utility companies. This would also involve relevant acts, regulations, standards and safety to be complied with the existing legal requirement by the Energy Commission of Malaysia and electrical utility companies. Students will carry out their learning activities on single phase electrical installation involving planning (sizing of circuit breakers and cables), application designing (electrical drawing, single line diagram, commissioning (cable installation) and troubleshooting.

REFERENCES
1. Ir Md Nazri, Aminuddin Aman, Md hairul Nizam, Engineering Practice: Wiring System & Motor Starter.
3. Mohd Nazi, Teknologi Pemasangan Elektrik, DBP.
LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Identify the requirement of electrical engineering technology practices in terms of engineering ethics, economy, finance and law and route to professional engineering technologist.
2. Apply the main features of groups and team that affect teamwork or team effectiveness in relation to electrical engineering technology field.
3. Explain the professional experiences gain through industrial talk and industrial visit.

SYNOPSIS
In this subject, students will be equipped with general introduction to the field of electrical engineering technology. The students will be exposed to attributes of an electrical technologist. They will also be exposed with engineering seminars by the industrialists and/or by professional member of engineering bodies and also several sessions of industrial visits. The context of the subject will be related to exposure of electrical engineering technology practices in terms of engineering ethics, economy, finance and law. They also look into general contemporary issues and career path related to engineering technologists.

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Analyze single-phase, three-phase and magnetic circuit for alternating current (AC).
2. Conduct experiment on single-phase and three-phase system for alternating current (AC).
3. Participate effectively to fulfill experimentation task with peers.

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

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

1. Analyze the operation of analog electronic circuit based on the component characteristics
2. Conduct experiment on analog electrical circuit by using measurement equipment and simulation software
3. Explain effectively in group for assignment

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

REFERENCES
1. Modul Analog Electronics, UTeM

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

1. Analyze the operation of a microcontroller’s architecture, peripherals subsystem.
2. Construct hardware and software of microcontroller based system to solve related problem.
3. Demonstrate business practice and entrepreneurship in microcontroller project development

SYNOPSIS
This course exposes students to the basic concept of microcontroller and microprocessor. It starts with understanding microcontrollers architecture, compiler, programming language and software. All the interrupt available including timers and counters are explained in details. Then, it continues with the analog digital converter and PWM signal. Students are exposed to the integration of DC motor, servo motor, stepper motor and to the application of programming including the input and output such as switches and ‘Light Emitting Diodes’, multiple sensors, serial and i2c devices. Students will apply microcontroller to simple mechatronic system.

REFERENCES
3. Milan Verle, PIC Microcontroller, Mikroelektronika
BETR 2383
CONTROL SYSTEM FUNDAMENTAL / PENGENALAN SISTEM KAWALAN

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply appropriate techniques in describing the characteristics of control systems in time domain.
2. Construct experiments to distinguish system performances of open loop and closed loop systems.

SYNOPSIS
This subject will discuss about the concepts in control system; open and closed loop system; transfer function; block diagram reduction and signal flow graphs; modeling for electrical system, mechanical system and electromechanical system; transient and steady-state performance for first and second order systems; Routh Hurwitz criteria for stability; steady-state error analysis; speed and position control system analysis using ScicosLab.

REFERENCES

BETY 2373
ELECTRICAL INSTALLATION II / PEMASANGAN ELEKTRIK II

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Design three phase electrical installation and motor starter circuit based on industrial application.
2. Perform three phase electrical installation and motor starter circuit based on industrial application.
3. Conform to three phase electrical installation and motor starter circuit based on existing acts, regulations and standards.

SYNOPSIS
This course outlines the principles, design and application of three phase electrical installation system and electrical motor control. The course covers various matters of three phase electrical installation system such electrical requirements by i.e Public Works Department, consultants and electrical utility companies. This would also involve relevant acts, regulations, standards and safety to be complied with the existing legal requirement by the Energy Commission of Malaysia and electrical utility companies. Students will carry out their learning activities on three phase electrical installation and motor control involving planning (sizing of circuit breakers and cables), application designing (electrical drawing, single line diagram, main circuit and control circuit), commissioning (cable installation) and troubleshooting.

REFERENCES
1. Ir Md Nazri, Aminuddin Aman, Md hairul Nizam, Engineering Practice: Wiring System & Motor Starter.
3. Mohd Nazi, Teknologi Pemasangan Elektrik, DBP.
LEARNING OUTCOMES

Upon completing this subject, the student should be able to:
1. Calculate the power system parameters using power system model, per unit (P.U) quantities and protection system requirements.
2. Conduct experiments on power system components using hardware or simulation software.
3. Present written and oral communications to document work and experiment results.

SYNOPSIS

This subject gives the overall information on components of power system to the students. The power system components will be modelled for analysis purposes. The topics covered are including per-unit quantities, transmission lines, transformer, synchronous generator, power flows, symmetrical components, power protection and power system stability.

REFERENCES


BETI 2373
ELECTRICAL MACHINES / MESIN ELEKTRIK

LEARNING OUTCOMES

Upon completion of this subject, student should be able to:
1. Analyze the differences of physical and electrical construction and working principles of DC and AC electrical machines.
2. Perform experiments to determine electrical and mechanical parameters and the performance of DC and AC electrical machines.
3. Conform to the safety and legal requirements for DC and AC electrical machines operation.

SYNOPSIS

This course deals with knowledge and practical related experience on electrical machines. Students will have the opportunity to experience and be assessed on laboratory activities involving determination of electrical and mechanical parameters and also the performance of DC and AC electrical machines covering both types; generators and motors. Students will also be emphasized on the safety and regulatory requirements on electrical machines. On top of that, students will also experience and be assessed on the ability to setup specific laboratory connection which will lead towards a complete electrical machine training system to be used for laboratory activities.

REFERENCES

BETY 3383
POWER ELECTRONICS DEVICES /
PERANTI ELEKTRONIK KUASA

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Analyze the characteristics power electronic devices and performance of uncontrolled rectifier, DC-DC converter and single-phase inverter.
2. Design an uncontrolled rectifier, DC-DC converter and single-phase inverter for various engineering application.
3. Report the analysis on basic power electronics circuitry.

SYNOPSIS
This course covers the basic principles of power electronics devices such as MOSFET, IGBT and thyristor, and its application in uncontrolled rectifier circuit, DC to DC converter and single-phase inverter. It covers aspects such as switching methods, analysis on switching losses, heat dissipation, snubbers and harmonic effects. Students are also introduced to the design aspect of various converter and inverter through computer simulation (PSIM, MATLAB or Pspice) as well as lab practical.

REFERENCES

BETU 3803
INTEGRATED DESIGN PROJECT /
REKABENTUK PROJEK BERINTEGRASI

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Design solution by synthesizing electrical engineering technology knowledge that will solve broadly defined engineering technology problem in accordance with relevant standards.
2. Utilize modern engineering technology and IT tools in facilitating solutions to broadly defined engineering technology problem with an understanding of the limitations.
3. Evaluate the impact of the design product, component or processes in term of safety, environmental and sustainability factors.
4. Demonstrate effectively teamwork skill in completing the IDP.
5. Apply project management and financial knowledge effectively in completing the IDP.

SYNOPSIS
Integrated Design Project is a course where students have to design an engineering technology project to solve broadly defined problem. Broadly defined problem is engineering problems which cannot be pursued without a coherent and detailed knowledge of defined aspects of a professional discipline with a strong emphasis on the application of developed technology. The design project activities include project management, project planning, project feasibility study, design selection, design costing and sizing, analysis and evaluation. The course focuses on the implementation and integration of product/conceptual design development to produce a comprehensive final technical report, including engineering proposals and drawings, specifications and bills of quantities, cost estimates of development projects given to students, working in groups. Apart from basic engineering design, students are also required to integrate their knowledge of other engineering disciplines such as (but not limited to) structural analysis and design, including material selections, project scheduling techniques and sustainable development considerations into their overall project work. At the end of this course, the students will be able to comprehend the needs and requirements for product design procedures and are able to appreciate the importance of integration and synthesis of various disciplines of electrical engineering knowledge.
REFERENCES
1. International Engineering Alliance, Graduates attributes and professional competencies, version 3, June 2013.

BETY 3803
SISTEM TENAGA DIPERBAHARUI / RENEWABLE ENERGY SYSTEM

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Classify general principles and technology of Renewable Energy Systems for electrical power generation
2. Perform experiments of Renewable Energy Systems for system performance
3. Explain effectively as an individual and group members for conducted assignment and experiment

SYNOPSIS
This subject is an introductory course for renewable energy system. The material encountered in the subject includes: introduction of energy usage, conventional energy sources, renewable energy sources (e.g PV, Wind, Biomass), basic energy storage, renewable energy case study, and engineering recommendations and generator protection requirements.

REFERENCES
BETY 3813
PENGENALAN KEPADA SISTEM PENGANGKUTAN ELEKTRIK/ INTRODUCTION TO ELECTRIC TRANSPORTATION SYSTEM

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Analyze the principle operation of various types of road, railway and elevation electric transportation systems.
2. Construct lab experiment load estimation and energy requirement of electrical transportation.
3. Demonstrate practical competence on basic electric vehicle system.

SYNOPSIS
This subject will discuss on principle operation of various types of electric transportation systems, covering on the aspects of overall system architecture, energy sources, power conversion as well as the control system. The energy sources aspect introduces student to various types of energy sources mainly the battery with their characteristics and performances. Then the power electronics interfacing for power conversion is discussed covering the AC/DC, DC/DC and DC/AC conversion modules. The control techniques used such as the speed control, acceleration characteristics etc with application on electric cars/train in general will also be covered. Practical lab sessions will expose student on the development and performance improvement of low power electric vehicle.

REFERENCES

BETY 3823
TEKNOLOGI PENYIMPANAN TENAGA / ENERGY STORAGE TECHNOLOGY

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Discuss operation principle of various kinds of energy storage applied in electric vehicle system and renewable energy application.
2. Analyse various battery management system used in electrical transportation and renewable energy application.
3. Demonstrate understanding on energy storage design and performance characteristic evaluation.

SYNOPSIS
The course covers on the introduction of various kinds of energy storage devices used for the electric vehicle system and renewable energy application. Students learn on battery construction, cell characteristics, electric data, energy density, capacity retention and the cycle life. Focus is given on the battery management system where students analyze the performance of the energy storage devices applied in any particular application. The course work examines the developments and design process of energy storage and evaluate its performance.

REFERENCES
SEMESTER 6

BETU 3764
BACHELOR DEGREE PROJECT I / PROJEK SARJANA MUDA I

LEARNING OUTCOMES
At the end of the subject, students should be able to:
1. Explain the problem, objectives and scope of project associated to the industrial or community needs.
2. Use related previous work and its relevant theory
3. Choose a proper methodology
4. Present the preliminary findings in the oral and written forms effectively

SYNOPSIS
The student needs to plan and implement the project individually that related to the respective engineering technology field. The student should implement a project, do the analysis and apply the theory to solve the problems related to topic. At the end, the student should write a problem based learning report that covers problem statement, literature review, methodology to overcome the problem. The student needs to achieve the objective of the project and presented it in the report.

REFERENCES

BETY 4393
POWER ELECTRONICS SYSTEMS / SISTEM ELEKTRONIK KUASA

LEARNING OUTCOMES
Upon completing this subject, the students should be able to:
1. Analyze the principle operation, characteristics and performance parameters of three phase inverter and multilevel inverter.
2. Construct a design process appropriate switching technique to improve converters performances using simulation / IT tools.
3. Complete the assignment and experiment in group effectively for the given works related to basic power electronics systems

SYNOPSIS
This subject will cover the principle operation of single-phase and three-phase controlled rectifier, three phase inverter and multilevel inverter. It also includes the design and analysis of various switching/modulation techniques and performance analysis of the converter circuits. The design and performance improvement of converters with selection of appropriate switching techniques will be verified via simulation tools (e.g. Pspice and MATLAB).

REFERENCES
BETY 3404
INDUSTRIAL AUTOMATION / AUTOMASI INDUSTRI

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply knowledge to solve basic industrial automation system problems using a PLC system.
2. Demonstrate PLC system and accessories experiments.
3. Communicate effectively for any assignments and experiments.

SYNOPSIS
This subject will expose students with knowledge and skills of PLC including its definition, main and hard components, PLC programming languages, interfacing PLC with console and computers, data communication, integrates PLC to hardware components and to design a simple automation system.

REFERENCES

BETY 3833
POLISI TENAGA / ENERGY POLICY

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Evaluate the success criteria and success of RE and sustainable energy development authority.
2. Analyze the Feed in Tariff (FiT) in Malaysia.
3. Develop the monitoring and reporting plan for the energy policy and energy education.
4. Explain the objectives and strategies of national renewable energy policies, act and action plan.

SYNOPSIS
The course reviews the objectives and strategies of renewable energy policies world-wide. It will examine policy drivers, including environmental impact, community service obligations and industry development, as well as policy instruments and how they are applied, including taxation, legislation, tariffs, targets and incentives. The policies and strategies will be illustrated with international case studies of renewable energy programs.

REFERENCES
LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Perform the design and sizing of PV system that includes inverter, solar cable and protection components.
2. Integrate the design of the PV system’s Balance of System (BOS) that includes inverter, solar cable and protection components.
3. Explain the impact of PV system towards sustainable development.

SYNOPSIS
This subject introduces students on basic solar engineering and the design and operation principles of solar cells. The students will also learn the design and sizing of PV systems components that include inverter, solar cable and protection devices. System design will focus on grid-connected application, but the design principles of stand-alone PV system will be discussed. Finally, student will evaluate solar PV system’s performance using key performance indicator. The course will utilize actual system data available.

REFERENCES

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply the application of power electronics in renewable energy, industrial appliances, consumer goods, transportation and power system.
2. Execute the function and interaction between components and sub-system used in power electronic applications with their limitation.
3. Complete the assignment and experiment on basic power electronics application.

SYNOPSIS
This course covers on various power electronics application such as variable speed drive, renewable energy generation and high voltage direct current (HVDC) system. Students are exposed on the integration and interaction of sub-systems within a larger and complex system. Various case studies are also introduced through lectures and lab demonstration.

REFERENCES
LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Evaluate power electronics converters and control strategies for DC and AC motor drive system.
2. Conduct the investigation on the performance of DC and AC motor drives in various operating condition.
3. Demonstrate application of DC and AC drives in modern electrified traction system.

SYNOPSIS
This course aims to provide an overview of variable speed drive system employing power electronic control of DC and AC motor. The topics cover the DC motor drive system from a variable DC chopper supply and a fully controlled bridge supply. The AC induction motor, and its operation from a variable frequency variable voltage inverter are also investigated. The students are also exposed on the application of these drives mechanism in the electrified traction systems.

REFERENCES
**BETY 4413**  
**ENERGY EFFICIENCY / KECEKAPAN TENAGA**

**LEARNING OUTCOMES**  
Upon completion of this subject, student should be able to:  
1. Analyze the properties of electrical power management for improving energy efficiency in electrical system  
2. Demonstrate the functionality of important electrical parameters for controlling electrical energy efficiency through experiments in laboratory  
3. Create awareness among colleagues regarding the importance of energy sustainability

**SYNOPSIS**  
This course is an introductory course to electrical energy efficiency technologies, application and standard (eg: ISO, IEC and CEN). This subject provides students a comprehensive introduction to: standardization terminologies; ampacity calculation of the cables or lines for the solution of heat transfer, cable sizing and thermal consideration; power transformers losses, efficiency and load factor, cooling system, regulations, life cycle costing and design material; building automation control and management systems such as temperature control, lighting, drives and motors, technical alarm management, remote control, KNX / SCADA systems and Building Energy Performance; power quality phenomena and indicators in RMS voltage level, voltage fluctuations, voltage and current unbalance, and voltage and current distortion; tariff structure and cost rate charged to residential, commercial and industry.

**REFERENCES**  

**BETI 3403**  
**POWER DISTRIBUTION SYSTEM DESIGN / REKA BENTUK SISTEM PENGAGIHAN KUASA**

**LEARNING OUTCOMES**  
Upon completing this subject, the student should be able to  
1. Design low voltage distribution system based on problem statement or case study given  
2. Perform testing on protection and metering equipment based on low voltage distribution design drawing.  
3. Conform to the safety and legal requirements for designing and testing of low voltage distribution system.

**SYNOPSIS**  
This course outlines the principles and design of electrical distribution system. There are various issues of distribution system that is covered; including regulations and standards related to electrical installation. Characteristic and specification for circuit breakers, cable size selection, and method of earthing and earthing arrangement are described in detail. Students will also be exposed to the use of standard design procedures and type of testing and troubleshooting required for low voltage system.

**REFERENCES**  
BETY 4873
TREND TEKNOLOGI DALAM INDUSTRI/ TECHNOLOGY TRENDS IN INDUSTRY

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Assess the current renewable energy and electric transportation technologies and applications.
2. Demonstrate renewable energy and electric transportation system applications commonly used in industries.
3. Function effectively as a team in laboratory works/project/case studies in renewable energy and electric transportation industrial application.

SYNOPSIS
This course provides students an exposure to current trend and development in technologies related to renewable energy and electric transportation in the industries. It may cover topics on the usage of high end equipment, technology development, technology application as well as services and maintenance. Lectures on various topics will be conducted by experienced lecturers in the respected fields and experts from the industry. For the course implementation, each topic will be covered for 3 to 5 weeks, with course works in parallel.

REFERENCES
References are based on the Selected Topics.

BETI 4843
KESERASIAN ELEKTROMAGNETIK SISTEM KUASA/ POWER SYSTEMS ELECTROMAGNETIC COMPATIBILITY

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Analyse the technical requirements of testing, shielding, grounding and bonding of EMC for power systems operation
2. Perform experiments to determine suitable types of EMC mitigation approach for a different power systems scenario.
3. Conform to the safety and legal requirements for EMC for power systems operation.

SYNOPSIS
The general aim of this course is to enable students to identify and examine the main concepts related to the function and design of EMC mitigation for power transmission, distribution and (to a lesser extent) generation systems. Upon completion of the course, students should be able to understand the reasons why power systems EMC are required, the basic philosophies of EMC phenomena, shielding, grounding and bonding, the components involved and how typical EMC mitigation are designed and configured.

REFERENCES
BETY 4903
SISTEM PEMACU MODERN / MODERN DRIVE SYSTEM

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply the principle of vector-controlled and DTC-controlled drive systems in AC machine.
2. Construct the experiment of three phase AC drive system.
3. Demonstrate practical competence on modern AC drive systems.

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

REFERENCES

BETY 4913
KENDERAAN ELEKTRIK HIBRID/ HYBRID ELECTRIC VEHICLE

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Accessing the various architectures and working principle of hybrid electric vehicles in term of energy storage and conversion, transmission, and control subsystems.
2. Assemble various component of hybrid electrical vehicle energy management through simulation [PO5, P5].
3. Function effectively as a team in analyzing hybrid electric vehicle performances.

SYNOPSIS
Introduction to architectures and technologies associated with hybrid electric vehicles including their components and working principle. Specific topics include electric and hybrid electric drive trains, energy storage (batteries/ultracapacitors, fuel cells), electromechanical energy conversion (induction and permanent magnet motors and generators), power electronics, vehicle-level modeling and control, and optimization.

REFERENCES
4. J. Pachl, Railway Operation and Control. VTD Rail Publishing, Mountlake Terrace
5. (USA) 2004.
LEARNING OUTCOME
At the end of the subject, students should be able to:
1. Show technical competencies and skills gained throughout their internship.
2. Prepare a report on the industrial field daily activities in the log book systematically.
3. Communicate effectively with staff, colleagues and other personnel.
4. Practice professional ethics in accordance with industry rules and regulations.

SYNOPSIS
All students are required to undergo industrial training as part of their curriculum to complete four (4) years course for the Bachelor of Engineering Technology. The duration of training is 24 weeks and it will be taken place at the end of the course (semester 8). The students are expected to gain knowledge and enhance their technical skills within industrial environment relevant to their field of study.

REFERENCES
UTeM Guideline Handbook for Industrial Training.

PRE-REQUISITE
Student required to pass Industrial Training BETU 4786 in order to pass Industrial training report.

REFERENCES
UTeM Guideline Handbook for Industrial Training.
BETZ Course Core Subjects (K)

**BETE 1303**
ENGINEERING WORKSHOP I /
BENGKEL KEJURUTERAAN I

**LEARNING OUTCOMES**
Upon completion of this subject, students should be able to:
1. Explain industrial OSHA and industrial practices in the lab activity.
2. Diagnose an electronic circuit using electronic testing equipment.
3. To build the electronic circuit according to IPC standard and project using the appropriate simulation tools.

**SYNOPSIS**

**REFERENCES**

**BETI 1303**
ELECTRIC CIRCUIT FUNDAMENTAL /
PENGENALAN LITAR ELEKTRIK

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

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

**REFERENCES**
BETC 1313
PROGRAMMING FUNDAMENTAL /
ASAS PENGATURCARAAN

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Explain the fundamental of programming principles and algorithms of C programming language.
2. Apply C Programming Language to solve given problems.
3. Manipulate C programming structure using programming fundamentals and principles.

SYNOPSIS
Topics covered: basic programming principles such as introduction to C programming consists of syntax, variables and basic data type, more fundamentals programming structure such as operator, rules / condition, looping, function, array and sequences. The subject is compulsory to build a basic background in programming.

REFERENCES

SEMESTER 2
BETE 1323
ELECTRONIC FUNDAMENTALS /
PENGENALAN ELEKTRONIK

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Apply the semiconductors theory in electronic applications.
2. Construct electronics circuit of diode, BJT and FET.
3. Report the findings orally or in writing by performing assignments/experiments effectively.

SYNOPSIS
This course will discuss:

REFERENCES
BETE 2343
ENGINEERING DRAWING / LUKISAN KEJURUTERAAN

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Apply mechanical engineering design drawing using Computer Aided Design (CAD).
2. Draw Geometric, orthographic, isometric, sectional, assembly, part and detailed drawings by using CAD based on the given problem.
3. Work individually or in groups effectively to perform assignments/tasks give.

SYNOPSIS
This subject will discuss on draft techniques manually and using computer software (AUTOCAD), basic hardware of draft drawing, technique and applications in producing various technical drawing, AUTOCAD software, interfacing AUTOCAD, editing command, coordinate systems, template and layers 3D modeling. It will help students to read the engineering drawing as well in the AUTOCAD drawing. This subject will introduce students to basic information, skills, and concepts related to drafting and design with the usage of AutoCAD tools and commands

REFERENCES

BETE 1313
ENGINEERING WORKSHOP II / BENGKEL KEJURUTERAAN II

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Construct an electronic circuit using appropriate software.
2. Demonstrate the electrical wiring technique by using appropriate tools.
3. Fabricate Printed Circuit Board (PCB) using appropriate software and equipment

SYNOPSIS
Simulation tools that covers the software of MATLAB, PSpice and AutoCad. Domestic Wiring – theory on domestic wiring, wiring diagram and lab practical. Printed Circuit Board (PCB) circuit design, practical design and fabrication using the design software of Proteus.

REFERENCES
1. Introduction to PSpice Using OrCAD for Circuits and Electronics 2015, by Muhammad H. Rashid
BETZ 1203
AC CIRCUIT ANALYSIS / ANALISA LITAR AC

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Apply the principles of the electrical system.
2. Conduct experiment on electrical circuit in single phase and three phase measurement.
3. Present written and oral communications to document work and experiment results.

SYNOPSIS
This subject exposes students to the application of several tools in analyzing AC electrical circuits, such as the Laplace transform and two ports network. Kirchhoff’s law magnetic hysteresis, single phase circuit, series and parallel resonance, power factor, transformer, phasor diagram, equivalent circuit voltage regulation and efficiency, open circuit and short circuit test, voltage generation and excitation method. The students are required to use the tools to analyze transient and frequency response in electrical circuit.

REFERENCES

SEMESTER 3
BETE 2333
ANALOGUE ELECTRONIC DEVICES / PERANTI ELEKTRONIK ANALOG

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Apply the fundamental of small signal amplifiers using BJT and FETs and Op-amp circuits.
2. Measure response of single stage, multistage amplifiers and basic op-amp circuit.
3. Report the findings orally or in writing by performing assignments/experiments effectively.

SYNOPSIS
This subject will discuss on BJT Transistor modeling, CE, CC and CB configuration, BJT small signal analysis, Feedback configuration, FET small-signal analysis, Frequency response, Bode plot, bandwidth, Special amplifier: cascade, cascode, Darlington, multistage, differential amplifier circuit, Operational amplifiers: inverting, non-inverting, summing and buffer.

REFERENCES

PRE-REQUISITE
BETE 1323
ELECTRONIC FUNDAMENTALS / PENGENALAN ELEKTRONIK
**BETT 2423**  
**SIGNAL & SYSTEMS / ISYARAT & SISTEM**

**LEARNING OUTCOMES**  
Upon completion of this subject, students should be able to:  
1. Explain the basic concepts and properties of signal and systems.  
2. Use appropriate analysis techniques in solving signal and system problems.  
3. Conduct experimental works to analyse the performance of signal and system applications.

**SYNOPSIS**  

**REFERENCES**  
1. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, Signals and Systems, 2nd Ed. 2015  

**BETC 2404**  
**DIGITAL ELECTRONIC / ELEKTRONIK DIGITAL**

**LEARNING OUTCOMES**  
Upon completion of this subject, students should be able to:  
1. Construct digital system using combinational and sequential logic circuits.  
2. Assemble fully-function digital logic circuits.  
3. Complete given tasks effectively as an individual or in groups.

**SYNOPSIS**  
This subject will cover the topics of transistor- transistor logic. Logic functions, logic diagrams, Karnaugh maps, Boolean algebra, DeMorgan’s Theorem. Numerical codes, arithmetic functions. Combinational circuits such as encoders, decoders, multiplexers, de-multiplexers, comparators. This subject also covers the introduction to memory, programmable logic devices and microcomputer systems. Student will learn the topics on latches and flip-flops, flip-flops operating characteristics and applications. Registers and counters, shift registers, synchronous, asynchronous and modulo counters.

**REFERENCES**  
LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Describe the principle, various terms and standards in measurement.
2. Select the appropriate technique or measurement tool to perform electrical signal measurement.
3. Report the findings orally or in writing by performing assignments/experiments effectively.

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

REFERENCES
1. HS Kalsi, Electronic Instrumentation, 3rd Ed., Tata McGraw Hill, 2010
2. Robert B. Northrop, "Introduction to Instrumentation and Measurements" 3rd Ed. CRC Press, 2017

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LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Apply the basic principles of analogue modulation system and noise
2. Manipulate the performance of analogue modulation techniques through experiments that commonly used in telecommunication system.

SYNOPSIS
This subject will discuss on Introduction to Telecommunication, Linear Modulation, Single Sideband (SSB) Communication Systems, Angle Modulation, Noise and Introduction to Digital Communication. The rationale of offering this subject is as the progression of communication system where students should have knowledge of communication principles and basic skills required by the industry.

REFERENCES
BETE 2364
CONTROL PRINCIPLES / PRINSIP KAWALAN

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Demonstrate performance of a design control system.
2. Display respond of gain adjustment compensator in controlling broadly define system.
3. Work individually or in groups effectively to perform assignments/tasks given.

SYNOPSIS
This subject will discuss on introduction to control system, frequency domain modelling, Laplace transform, transfer function, electric network transfer function, translational mechanical system, rotational mechanical system transfer function, time domain modelling, general state space representation, transfer function and state space conversion, time response, poles, zeros and system response, First and Second order systems, under-damped system, reduction of multiple subsystems, blocks diagrams, feedback systems, signal flow graphs, Mason’s rule, Routh- Hurwitz criterion and Gain Adjustment compensator design.

REFERENCES

BETE 2354
ELECTRONIC SYSTEMS / SISTEM ELEKTRONIK

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Analyze the characteristic and performance of the electronics devices.
2. Measure the performance of applied electronic circuits through lab sessions.
3. Report the findings orally or in writing by performing assignments/experiments.

SYNOPSIS
This subject will discuss about Electronic Devices: Application of electronic devices such as SCR, SCS, GTO, LASCR, DIAC, TRIAC, UJT and PUT. Filter: filter applications (basic filter concepts, filter response characteristics, active LP filter, active HP filter, active BP filter, active BS filter and filter response measurement). Oscillator circuits: Feedback oscillator principles, oscillators with the RC feedback circuits, LC feedback circuits, crystal oscillator, Astable and Monostable using op-amp, the 555 timer and applications. Power amplifier circuits: Class A, class B and class AB. Power supply: Power supply circuit, IC voltage regulator and application. These topics are very important to students because it gives emphasis on the design of circuits used in electronic systems.

REFERENCES
LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Demonstrate a working knowledge of microcontroller architecture and peripheral subsystem.
2. Manipulate the hardware-software functionalities and technologies to solve given task using appropriate techniques and tools.
3. Propose sustainable solutions to given problems.

SYNOPSIS
This subject will provide the students both solid theoretical and practical applications to the microcontrollers based system. Extensive practical-oriented sessions will be given using PIC microcontroller involving program development software, chip programming and debugging. Topics covered are microcomputer system & peripheral design, software and hardware integration; interrupt control system, analog interfacing, subsystems on microcontroller, applications, peripheral devices and system control design.

REFERENCES

SEMESTER 5

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Apply the knowledge of electromagnetic laws and principles.
2. Construct experimental investigation of wave electromagnetic properties.
3. Display the ability to perform the task given independently by optimizing available resources.

SYNOPSIS
This subject will discussed on Vector analysis: Vector algebra, coordinate system and transformation, vector calculus; Electrostatics: Electrostatic fields, Gauss Law, Poisson’s equation, electric fields in material space, electrostatic boundary; Magnetostatics: Magnetostatic fields, Stokes Theorem, Biot-Savart Law, Gauss Law, magnetic forces, material and devices and magnetostatic boundary; Waves: Maxwell’s equations, Faraday’s Law, time-varying electromagnetic field, induced emf, displacement current. Electromagnetic wave propagation: free space, lossy and lossless dielectric, good conductors, power and Pyonting vector, incident, reflected and refracted wave.

REFERENCES
BETT 3373
DIGITAL SIGNAL PROCESSING / PEMPROSESAN ISYARAT DIGITAL

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Apply appropriate concepts and methods in demonstrating digital signals processing and systems.
2. Organize the implementation of digital signal processing in a system.

SYNOPSIS
Topics covered: Introduction to discrete-time signals and system, properties, difference equations, infinite impulse response (IIR), finite impulse response (FIR), z-transform and its applications, analysis, design and application of digital filters and random signals.

REFERENCES

PRE-REQUISITE
BETT 2423
SIGNAL & SYSTEMS / ISYARAT & SISTEM

BETC 2383
COMPUTER NETWORK & SYSTEM / SISTEM & RANGKAIAN KOMPUTER

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Explain the fundamentals of computer network technology and its components
2. Analyze the OSI and TCP/IP models, protocols, and the functions of each layer
3. Manipulate different types of network devices in developing a sustainable network design.

SYNOPSIS
Topics covered: Overview: Introduction to Computer Network and System, Networking Equipment and Data Communications, Network Architecture and Protocols, Local and Wide Area Networks, Client-Server Computing: Web technologies, Wireless, Mobile Computing and Mobile Data Access Computer Network and System is a program targeted for dynamic digital and communication careers. It is strongly emphasis on technical aspect and enables employers to meet the needs of Computer Networks and System graduates including some of the best platform for many companies specializing in computer networking and system. This unique curriculum balances theory with extensive hands-on experiments. Fundamental of IOT, Application of IOT.

REFERENCES
LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Design solution by synthesizing mechanical engineering technology knowledge that will solve broadly defined engineering technology problem in accordance with relevant standards.
2. Utilize modern engineering technology and IT tools in facilitating solutions to broadly defined engineering technology problem with an understanding of the limitations.
3. Evaluate the impact of the design product, component or processes in term of safety, environmental and sustainability factors.
4. Demonstrate effectively teamwork skill in completing the IDP.
5. Apply project management and financial knowledge effectively in completing the IDP.

SYNOPSIS
Integrated Design Project is a course where students have to design an engineering technology project to solve broadly defined problem. Broadly defined problem is engineering problems which cannot be pursued without a coherent and detailed knowledge of defined aspects of a professional discipline with a strong emphasis on the application of developed technology. The design project activities include project management, project planning, project feasibility study, design selection, design costing and sizing, analysis and evaluation. The course focuses on the implementation and integration of product/conceptual design development to produce a comprehensive final technical report, including engineering proposals and drawings, specifications and bills of quantities, cost estimates of development projects given to students, working in groups. Apart from basic engineering design, students are also required to integrate their knowledge of other engineering disciplines such as (but not limited to) structural analysis and design, including material selections, project scheduling techniques and sustainable development considerations into their overall project work. At the end of this course, the students will be able to comprehend the needs and requirements for product design procedures and are able to appreciate the importance of integration and synthesis of various disciplines of mechanical engineering knowledge.

REFERENCES
1. International Engineering Alliance, Graduates attributes and professional competencies, version 3, June 2013.
BETT 3353
TELECOMMUNICATION SYSTEM /
SISTEM TELEKOMUNIKASI

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Apply the concept of telecommunication system.
2. Manipulate the concept of telecommunication system.
3. Report effectively in given tasks and assignment by managing different information from multiple resources for commercialization.

SYNOPSIS
This subject will discuss on Radio Spectrum, Broadcasting, PSTN/ISDN, Satellite System, Radar System, Optical Communication and Wireless Communication. The rationale of offering this subject is as providing fundamental knowledge on various types of telecommunication system and as foundation for higher level subjects. IP core.

REFERENCES

BETT 3413
RF TECHNIQUE AND MICROWAVE /
TEKNIK RF & GELOMBANG MIKRO

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Evaluate transmission line circuits of RF system.
2. Construct the design of transmission line circuits for RF system.
3. Report current sustainable technologies and relate to the given assignment.

SYNOPSIS
This subject will discuss on Introduction to RF and Microwave Engineering; Transmission Lines; Microwave Network Analysis; Impedance Matching and Tuning; Power Dividers and Couplers; Microwave Filter and Microwave Amplifier.

REFERENCES
LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Perceive terminologies to describe anatomical parts and physiological of biological functions.
2. Dismantling and re-assemble parts and functions of the human body with no errors
3. Report the findings orally and in writing by performing assignments effectively

SYNOPSIS
This course has been designed to introduce the student to human anatomy and physiology. Due to the close interrelationship between structure and function in biological systems, each functional physiology topic will include a brief overview of anatomic structure. The physical and chemical laws that are the basis of the physiological processes and also applications to current biomedical research and clinically relevant situations are discussed.

REFERENCES

BETZ 4813
MEDICAL IMAGING AND IMAGE PROCESSING / PENGIMEJAN PERUBATAN DAN PEMPROSESAN IMEJ

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Perceive basic understanding of medical imaging and fundamental image processing techniques.
2. Manipulates imaging concepts and image processing techniques to acquire and process biomedical images.
3. Report the findings orally and in writing by performing assignments effectively

SYNOPSIS
The aim of the course is to show how to extract, model, and analyze information from medical data and applications to help diagnosis, treatment and monitoring of diseases through computer science. Medical image computing is a highly interdisciplinary field involving not only medicine and computer science but also mathematics, biology, statistics, probability, psychology and other fields. The course includes topics in an introduction to the physics and engineering of tomographic imaging devices, medical image analysis: image segmentation, registration, statistical modeling and applications of computational tools for medicine. It will also include selected topics relating to medical image formation. It will be application oriented.

REFERENCES
BETZ 4923
MICROELECTRONIC FABRICATION /
FABRIKASI MIKROELEKTRONIK

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Explain the fundamental physical properties of semiconductors and the operation of fundamental semiconductor devices
2. Analysis the behaviour of semiconductor devices.
3. Propose sustainable solutions to given problems.

SYNOPSIS
This course introduces the basic concepts of the operation of the semiconductor devices that comprise today’s integrated circuits. Topics to be discussed include semiconductor materials, basic device physics, p-n junctions, metal-semiconductor junctions and transistors, both bipolar and metal-oxide-semiconductor (MOS).

REFERENCES

BETZ 4903
SEMICONDUCTOR PROCESS /
PROSES SEMIKONDUKTOR

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Explain the basic semiconductor manufacturing process and its materials for front end, back end and testing process.
2. Display the understanding towards process flow, hazards, Personal Protective Equipment (PPE), attire and available technology in semiconductor process.
3. Describe semiconductor technology individually or in a group.

SYNOPSIS
Semiconductor manufacturing process towards front end and back end of lines will be taught to give understanding on the important materials and component for high quality product.

REFERENCES
LEARNING OUTCOMES
Upon completing this course, the student should be able to:
1. Classify the concept of data acquisition system and sensor.
2. Construct data monitoring system by using appropriate data acquisition tools.
3. Report the findings orally or in writing by performing assignments/experiments effectively.

SYNOPSIS
This subject will discuss on introduction on Data Acquisition and Sensor, Data Acquisition Hardware, Analog and Digital Signals, Signal Conditioning, Serial Data Communications, Distributed & Standalone Loggers/Controllers, IEEE 488 Standard, Ethernet & LAN Systems, Universal Serial Bus (USB), Specific Techniques, LabView, Interfacing Software and Hardware, controlling automation system using LabView, bluetooth technology.

This subject prepares students with knowledge and skills to use data acquisition hardware and software as well as sensors.

REFERENCES
4. Nikolai V. Kirianaki and Sergey Y. Yurish, Data Acquisition for Smart Sensors, Wiley, 2002
LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Evaluate the antenna parameters and structures.
2. Measure the performance of antenna structures and network.
3. Revise sustainable technologies and relate to the given assignment.

SYNOPSIS
This course will discuss on Introduction and Fundamentals of Antenna, Antenna Solution using Maxwell Equation, Types of Antenna, Matching and Feeding Networks, Antenna Measurement and Introduction to Radio-wave Propagation.

REFERENCES

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Evaluate the concepts, theories and strategies in solving of mobile communication system.
2. Measure the performance of radio wave propagation model.
3. Revise sustainable technologies and relate to the given assignment.

SYNOPSIS
This subject will discuss on Introduction and Basic Concept of Mobile Communication System, Radio Wave propagation in Mobile Communication Systems, High Spectrum Efficiency Modulation Systems, Zone Techniques for Configuration and Channel Assignment, Techniques to Improve Transmission Quality and Error Control Techniques. Mobile communications technology has seen a thriving development in recent years. Driven by technological advancements as well as application demands, various classes of communication networks emerged. This is why this subject should be included in the program.

REFERENCES
BETZ 4823
MEDICAL DEVICES AND INSTRUMENTATION / PERANTI PERUBATAN DAN INSTRUMENTASI PERUBATAN

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Perceive the concepts and operations of the medical instruments.
2. Dismantling and re-assembling various components of the medical devices with efficiency and no errors.
3. Report the findings orally and in writing by performing assignments effectively

SYNOPSIS
Description designs and applications of electronic medical instruments for ECG, EEG, EMG, pressure, flow, volume, bio impedance, temperature, concentration, cell count and so on. Including the introduction to clinical analysers and therapeutic device. Origins, physiology and acquisition of biological signals, the use of electrodes and sensors and the processing of analogue and digital biological signals are discussed. Topic on electrical safety of the devices and patients are also included

REFERENCES

BETZ 4853
BIOMEDICAL ETHICS, ACTS, STANDARDS & SAFETY / ETIKA, AKTA, PIAWAI & KESELAMATAN BIOPERUBATAN

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Evaluate problems and scenarios and give recommendation based of learned concepts and ideas.
2. Manipulate learned concepts to solve given ethical, regulations and safety issues.
3. Report systematic planning in solving problems orally and in writing by performing assignments effectively.

SYNOPSIS
This course exposes students to the acts, regulations and laws concerning the design, application and use of biomedical devices. It also emphasizes on the biomedical engineering ethics principles and case studies.

REFERENCES
3. Medical Device Regulation 2012
4. Medical Act 2012 (Act 737)
5. Medical Device Authority Act 2012 (Act 738)
6. Electrical equipment in medical practice (TC62)
7. IEC 60601 - Medical Electrical Equipment
8. IEC 61010 - Safety requirements for electrical equipment for measurement, control and laboratory
9. IEC TR 61852 Medical electrical equipment - Digital imaging and communications in medicine (DICOM) - Radiotherapy objects
10. IEC 62353 Medical electrical equipment - Recurrent test and test after repair of medical electrical equipment
LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Evaluate solutions to problems in designing IC and its subcomponents by using adequate techniques.
2. Construct logic gates or subsystems circuits by using appropriate tools and techniques in VLSI.
3. Propose sustainable solutions to given problems.

SYNOPSIS
Topics covered: Electronic properties of materials: Solid-state materials, Electronics and holes, Doping, acceptors and donors, p- and n-type material, Conductivity and resistivity, Drift and diffusion currents, mobility and diffusion; Function of the basic inverter structure: Connectivity, layout, and basic functionality of a CMOS inverter. The CMOS inverter voltage transfer characteristic (VTC), Analysis of the CMOS VTC for switching threshold, VOH, VOL, VIH, VIL, and noise margins, Effect of changing the inverter configuration on the CMOS VTC, Connectivity and basic functionality of a Bipolar ECL inverter, Connectivity and basic functionality of a Bipolar TTL inverter; Combinational logic structures: Basic CMOS gate design, Layout techniques for combinational logic structures, Transistor sizing for complex CMOS logic devices, Transmission gates, Architectural building blocks (multiplexers, decoders, adders, counters, multipliers); Sequential logic structures: Storage mechanisms in CMOS logic, Dynamic latch circuits, Static latch and flip-flop circuits, Sequential circuit design.

REFERENCES
SEMESTER 7

BETU 4774
BACHELOR DEGREE PROJECT II / PROJEK SARJANA MUDA II

LEARNING OUTCOMES
After completing the course, students will be able to:
1. Execute project implementation systematically.
2. Interpret data in a meaningful form using relevant tools
3. Work independently and ethically.
4. Present the results in the oral and written forms effectively.

SYNOPSIS
This is the second part of the Bachelor Degree Project. Students are expected to continue the project done in Bachelor degree Project Part 1 till completion. At the end of the semester students are required to submit the Bachelor Degree Project report both orally and in writing for assessment.

REFERENCES

PRE-REQUISITE
BETU 3764
BACHELOR DEGREE PROJECT I / PROJECT SARJANA MUDA I

BETE 4443
QUALITY MANAGEMENT / PENGURUSAN KUALITI

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Analyze any given problem and solution based on quality theories.
2. Work individually or in groups effectively to perform assignments/tasks given.
3. Study appropriate quality tools to improve the quality of management, process and product in organisation.

SYNOPSIS
This subject will discuss on the different of quality theories for many organisation, comparisme international quality standard for customer satisfaction. The designing of strategy planning, strategy process and ethic to enhance the quality improvement for process and, product with using quality tools. Six –sigma are using for management to improve the mangement strategy planning.

REFERENCES
3. Stephen R. Covey’s book, The 7 Habits of Highly Effective People
LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Analyse suitable microcontrollers to be used in a given scenario and constraints.
2. Construct embedded systems using programmable or reconfigurable devices.
3. Report the findings orally or in writing by performing assignments/experiments.

SYNOPSIS
This subject will discuss about embedded systems, characteristics & application areas, introduction to digital hardware technologies, introduction to computer systems & architectures, introduction to assembler-level software and high level language programming for embedded systems, introduction to interfacing computer systems to external hardware, application-level embedded system design concepts in industrial electronics. These topics are very important to students because it gives emphasis on the design of circuits used in embedded systems.

REFERENCES

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Evaluate the mechanic orbit, satellite link and noise in satellite communication system.
2. Measure the performance of satellite link and satellite subsystem in telecommunication.
3. Revise sustainable technologies and relate to the given assignment.

SYNOPSIS
This subject will discuss on introduction to satellite communication - frequency allocations, applications, future trends satellite communication; Orbital mechanics and launchers- Orbital Mechanics, Look angle determination; Satellite subsystem - telemetry, tracking, command and monitoring, power systems, communication subsystems, satellite antenna; Satellite Link Design - design of downlink, uplink design, design of satellite links for specific C/N ; and Earth station technology.

REFERENCES
BETZ 4863  
RADIO NAVIGATION / SISTEM NAVIGASI RADIO

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Apply knowledge of the technical specification of various radio navigation systems.
2. Evaluate the selection of a radio navigation system for a given application
3. Report and explain clearly their given assignment

SYNOPSIS

REFERENCES

BETZ 4843  
BIOMEDICAL ENGINEERING MAINTENANCE / PENYELENGGARAAN KEJURUTERAAN BIOPERUBATAN

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Evaluate and determine fault based learned concepts.
3. Report the findings orally and in writing by performing assignments effectively

SYNOPSIS
This course is designed to focus on the ability and skills of the students in identifying and troubleshooting faults in electronic circuits and devices. It also encompasses the ability to select and use suitable equipment for troubleshooting and elementary calibration of devices.

This course will also include:
i. Project management for procurement, equipping, installing, commissioning, decommissioning, testing and handing over of biomedical equipment
ii. A maintenance strategy includes procedures for inspection, as well as preventive and corrective maintenance. Performance inspections ensure that equipment is operating correctly, safety inspections ensure the equipment is safe for both patients and operators, and preventive maintenance (PM) aims to extend the life of the equipment and reduce failure rates.
iii. Troubleshooting the electronic circuit and calibration the medical equipment
iv. Students will be taught to develop flow charts and event-tree analysis in fault finding. Students will also be exposed to the principles of innovative problem-solving techniques (TRIZ).

REFERENCES

BETZ 4833
BIOMECHANICS / BIOMEKANIK

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Perceive concepts of mechanical properties and dynamics of the human structure.
2. Assembles procedures in measuring and modelling the human mechanics.
3. Report the findings orally and in writing by performing assignments effectively.

SYNOPSIS
The course provides an overview of musculoskeletal anatomy, the mechanical properties and structural behavior of biological tissues, and biodynamics. Specific course topics will include structure and function relationships in tissues and organs; application of stress and strain analysis to biological tissues; analysis of forces in human function and movement; energy and power in human activity; introduction to modeling viscoelasticity. More specifically, it is expected that the student will: (a) acquire knowledge and experience necessary to structurally, functionally, and mechanically analyse the performer and performance of physical activities; (b) make appropriate recommendations about modifying performance; (c) demonstrate how bones, joints, and muscles serve as components of human levers, acting in accordance with the laws of mechanics; (d) demonstrate the application of knowledge of joint structure, joint stability factors and those factors influencing joint range of motion to the selection of developmental exercises for muscle strengthening, treatment and prevention of sport/athletic injuries; (e) demonstrate the basic principles of mechanics as they apply to the analysis of human movement; and (f) be able to approach training, rehabilitation, and/or coaching from an analytical point of view.

REFERENCES
BETZ 4913
VLSI ARCHITECTURE / SENI BINA VLSI

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Select the suitable hardware implementation strategy for IC architectures.
2. Construct digital systems by using adequate implementation techniques.
3. Propose sustainable solutions to given problems.

SYNOPSIS
This course will expose to VLSI architecture and hardware implementation techniques for advanced applications. It will cover techniques such as pipelining and parallel processing which are applied in various VLSI applications such as microprocessors, memory hierarchies, digital signal processing and arithmetic operations. Besides, the concept of low-power design of digital systems will also be introduced.

REFERENCES

BETZ 4893
DIGITAL IC TESTING / PENGUJIAN IC DIGITAL

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Evaluate the performance and effectiveness of the IC testing techniques.
2. Perform different techniques of IC testing effectively.
3. Propose sustainable solutions to given problems.

SYNOPSIS
This course will introduce to the testing techniques and methodology of the integrated circuit. Students will be exposed to different topics such as types of defects and faults in the wafer fabrication, faults detection using various methods, different type of tests, test pattern generation and also design for testability technique. By using the aide of the software, students will learn how to perform an IC testing by using several methods such as SCAN and BIST techniques. Towards the end of this course, the introduction to the board level testing using boundary scan technique will also be covered.

REFERENCES
SEMESTER 8

BETU 4786
INDUSTRIAL TRAINING / LATIHAN INDUSTRI

LEARNING OUTCOME
At the end of the subject, students should be able to:
1. Show technical competencies and skills gained throughout their internship.
2. Prepare a report on the industrial field daily activities in the log book systematically.
3. Communicate effectively with staff, colleagues and other personnel.
4. Practice professional ethics in accordance with industry rules and regulations.

SYNOPSIS
All students are required to undergo industrial training as part of their curriculum to complete four (4) years course for the Bachelor of Engineering Technology. The duration of training is 24 weeks and it will be taken place at the end of the course (semester 8). The students are expected to gain knowledge and enhance their technical skills within industrial environment relevant to their field of study.

REFERENCES
UTeM Guideline Handbook for Industrial Training.

BETU 4796
INDUSTRIAL TRAINING REPORT / LAPORAN LATIHAN INDUSTRI

LEARNING OUTCOME
At the end of the subject, students should be able to:
1. Produce industrial training report
2. Present report orally on working experience

SYNOPSIS
All students are required to undergo industrial training as part of their curriculum to complete four (4) years course for the Bachelor of Engineering Technology. The duration of training is 24 weeks and it will be taken place at the end of the course (semester 8). The students are expected to gain knowledge and enhance their technical skills within industrial environment relevant to their field of study.

PRE-REQUISITE
Student required to pass Industrial Training BETU 4786 in order to pass Industrial training report.

REFERENCES
UTeM Guideline Handbook for Industrial Training.