CURRICULUM STRUCTURE

ELECTRICAL ENGINEERING TECHNOLOGY

PROGRAMME OUTCOMES (PO)

PO1	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.
PO2	Ability to solve broadly-defined engineering problems systematically to reach substantiated conclusions, using tools and techniques appropriate to electrical engineering technology.
PO3	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.
PO4	Ability to plan and conduct experimental investigations of broadly-defined problems, using data from relevant sources.
PO5	Ability to select and apply appropriate techniques, resources and modern engineering tools, with an understanding of their limitations.
PO6	Ability to function effectively as individuals, and as members or leaders in diverse technical teams.
PO7	Ability to communicate effectively with the engineering community and society at large.
PO8	Ability to demonstrate an awareness of and consideration for societal, health, safety, legal and cultural issues and their consequent responsibilities.
PO9	Ability to demonstrate an understanding of professional ethics, responsibilities and norms of engineering technology practices.
PO10	Ability to demonstrate an awareness of management, business practices and entrepreneurship.
PO11	Ability to demonstrate an understanding of the impact of engineering practices, taking into account the need for sustainable development.
PO12	Ability to recognise the need for professional development and to engage in independent and lifelong learning.

Bachelor of Electrical Engineering Technology with Honours (BETY)

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 1	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**	
SEMESTER 2	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	
TOTAL CREDITS THIS SEMESTER				**18**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 3	BETU 2033	Kalkulus Lanjutan untuk Teknologi *Advanced Calculus for Technology*	P	3	
	BETY 2333	Pemasangan Elektrik I *Electrical Installation I*	K	3	
	BETY 2343	Peranti Elektronik *Electronic Devices*	K	3	
	BETY 2353	Teknologi Elektrik *Electrical Technology*	K	3	
	BETR 1343	Pengaturcaraan Komputer *Computer Programming*	K	3	
	BETY 2361	Kerjaya Teknologi Kejuruteraan Elektrik *Electrical Engineering Technology Career*	K	1	
	BLHL 1XX2	Bahasa Ketiga *Third Language*	W	2	
TOTAL CREDITS THIS SEMESTER				**18**	
SEMESTER 4	BETU 2043	Kaedah Statistik *Statistical Methods*	P	3	
	BETR 2374	Sistem Terbenam *Embedded System*	K	4	
	BETY 2373	Pemasangan Elektrik II *Electrical Installation II*	K	3	
	BETR 2383	Pengenalan Sistem Kawalan *Control System Fundamental*	K	3	
	BETR 2353	Elektronik Analog *Analog Electronics*	K	3	
	BLHW 2403	Bahasa Inggeris Teknikal *Technical English*	W	3	
TOTAL CREDITS THIS SEMESTER				**19**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 5	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	
TOTAL CREDITS THIS SEMESTER				**20**	
SEMESTER 6	**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**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISIT
SEMESTER 7	**BETU 4774	Projek Sarjana Muda II *Bachelor Degree Project II*	K	4	BETU 3764
	BETY 4413	Kecekapan Tenaga *Energy Efficiency*	K	3	
	BETI 3403	Reka Bentuk Sistem Pengagihan Kuasa *Power Distribution System Design*	K	3	
	BETU 4053	Etika Kejuruteraan & KKPP *Engineering Ethics & OSHE*	P	3	
	*BETY 4xx3	Elektif IV *Elective IV*	E	3	
	BTMW 4012	Keusahawanan Teknologi *Technology Enterpreneurship*	W	2	
TOTAL CREDITS THIS SEMESTER				**18**	
SEMESTER 8	BETU 4786	Latihan Industri *Industrial Training*	K	6	
	BETU 4796	Laporan Latihan Industri *Industrial Training Report*	K	6	
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:

AREA	CODE	SUBJECT NAME
RENEWABLE ENERGY	BETY 3803	Sistem Tenaga diperbaharui *Renewable Energy System*
ELECTRICAL TRANSPORTATION	BETY 3813	Pengenalan kepada Sistem Pengangkutan Elektrik *Introduction To Electrical Transportation System*

* For Elective II, students may choose subject from the list below:

AREA	CODE	SUBJECT NAME
RENEWABLE ENERGY	BETY 3823	Teknologi Penyimpanan Tenaga *Energy Storage Technology*
ELECTRICAL TRANSPORTATION		

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

AREA	CODE	SUBJECT NAME
RENEWABLE ENERGY	BETY 3833	Polisi Tenaga *Energy Policy*
	BETY 3843	Rekabentuk Sistem PV *PV System Design*
ELECTRICAL TRANSPORTATION	BETY 3853	Aplikasi Elektronik Kuasa *Power Electronics Application*
	BETY 3863	Pemacu Motor dan Sistem Tarikan *Motor Drive and Traction System*

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

AREA	CODE	SUBJECT NAME
RENEWABLE ENERGY	BETY 4873	Trend Teknologi dalam Industri *Technology Trend in Industry*
	BETI 4843	Keserasian Elektromagnetik Sistem Kuasa *Power Systems Electromagnetic Compatibility*
ELECTRICAL TRANSPORTATION	BETY 4893	Trend Teknologi dalam Industri *Technology Trend in Industry*
	BETY 4903	Sistem Pemacu Moden *Modern Drive System*
	BETY 4913	Kenderaan Elektrik Hibrid *Hybrid Electric Vehicle*

ELECTRONICS & COMPUTER ENGINEERING TECHNOLOGY

PROGRAMME OUTCOMES (PO)

PO1	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 computer/industrial electronics/telecommunication engineering technology.
PO2	Ability to solve broadly-defined engineering problems systematically to reach substantiated conclusions, using tools and techniques appropriate to computer/industrial electronics/telecommunication engineering technology.
PO3	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.
PO4	Ability to plan and conduct experimental investigations of broadly-defined problems, using data from relevant sources.
PO5	Ability to select and apply appropriate techniques, resources and modern engineering tools, with an understanding of their limitations.
PO6	Ability to function effectively as individuals, and as members or leaders in diverse technical teams.
PO7	Ability to communicate effectively with the engineering community and society at large.
PO8	Ability to demonstrate an awareness of and consideration for societal, health, safety, legal and cultural issues and their consequent responsibilities.
PO9	Ability to demonstrate an understanding of professional ethics, responsibilities and norms of engineering technology practices.
PO10	Ability to demonstrate an awareness of management, business practices and entrepreneurship.
PO11	Ability to demonstrate an understanding of the impact of engineering practices, taking into account the need for sustainable development.
PO12	Ability to recognise the need for professional development and to engage in independent and lifelong learning.

Bachelor of Electronic Engineering Technology with Honours (BETZ)

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 1	BETU 1013	Matematik Teknikal *Technical Mathematics*	P	3	
	BETE 1013	Fizik Teknikal *Technical Physics*	P	3	
	BLHW 1722	Falsafah Sains dan Teknologi *Philosophy of Science and Technology*	P	2	
	BETI 1303	Pengenalan Litar Elektrik *Electric Circuit Fundamental*	K	3	
	BETE 1303	Bengkel Kejuruteraan I *Engineering Workshop I*	K	3	
	BETC 1313	Asas Pengaturcaraan *Programming Fundamental*	K	3	
TOTAL CREDITS THIS SEMESTER				**17**	
SEMESTER 2	BETU 1023	Kalkulus Untuk Teknologi *Calculus For Technology*	P	3	
	BETZ 1203	Analisis Litar AC *AC Circuit Analysis*	K	3	
	BETE 1313	Bengkel Kejuruteraan II *Engineering Workshop II*	K	3	
	BETE 2343	Lukisan Kejuruteraan *Engineering Drawing*	K	3	
	**BETE 1323	Pengenalan Elektronik *Electronic Fundamentals*	K	3	
	BKKX XXX1	Kokurikulum I *Cocurriculum I*	W	1	
	BLHW 2712	Hubungan Etnik *Ethnic Relations*	W	2	
TOTAL CREDITS THIS SEMESTER				**18**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 3	BETU 2033	Kalkulus Lanjutan Untuk Teknologi *Advanced Calculus For Technology*	P	3	
	BETE 2333	Peranti Elektronik Analog *Analogue Electronic Devices*	K	3	BETE 1323
	BETC 2404	Elektronik Digital *Digital Electronic*	K	4	
	**BETT 2423	Isyarat & Sistem *Signal & Systems*	K	3	
	BETZ 1213	Instrumentasi & Pengukuran *Instrumentation & Measurement*	K	3	
	BLHW 2403	Bahasa Inggeris Teknikal *Technical English*	W	3	
	BKKX XXX1	Kokurikulum II *Cocurriculum II*	W	1	
TOTAL CREDITS THIS SEMESTER				**20**	
SEMESTER 4	BETU 2043	Kaedah Statistik *Statistical Methods*	P	3	
	BETT 2333	Prinsip Komunikasi *Communication Principle*	K	3	
	BETE 2354	Sistem Elektronik *Electronic Systems*	K	4	
	BETE 2364	Prinsip Kawalan *Control Principles*	K	4	
	BETZ 2404	Teknologi Mikropengawal *Microcontroller Technology*	K	4	
	BLHW 1702	Tamadun Islam dan Tamadun Asia *Islamic and Asian Civilizations*	W	2	
TOTAL CREDITS THIS SEMESTER				**20**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 5	BETT 3383	Elektromagnetik *Electromagnetic*	K	3	
	BETU 3803	Projek Rekabentuk Intergrasi *Integrated Design Project*	K	3	
	BETC 2383	Sistem & Rangkaian Komputer *Computer Network & System*	K	3	
	BETT 3373	Pemprosesan Isyarat Digital *Digital Signal Processing*	K	3	BETT 2423
	BLHW 3403	Bahasa Inggeris untuk Komunikasi Profesional *English for Professional Communication*	W	3	
	*BETX XXXX	Elektif I *Elective I*	E	3	
TOTAL CREDITS THIS SEMESTER				**18**	
SEMESTER 6	BETE 3404	Perolehan Data & Penderia *Data Acquisition & Sensors*	K	4	
	**BETU 3764	Projek Sarjana Muda I *Bachelor Degree Project I*	K	4	
	BTMW 4012	Keusahawanan Teknologi *Technology Entrepreneurship*	W	2	
	BLHL 1XX2	Bahasa Ketiga *Third Language*	W	2	
	*BETX XXXX	Elektif II *Elective II*	E	3	
	*BETX XXXX	Elektif III *Elective III*	E	3	
TOTAL CREDITS THIS SEMESTER				**18**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 7	BETU 4053	Etika Kejuruteraan & KKPP *Engineering Ethics & OSHE*	P	3	
	BETE 3424	Aplikasi Sistem Terbenam *Embedded Systems Application*	K	4	
	BETE 4443	Pengurusan Kualiti *Quality Management*	K	3	
	BETU 4774	Projek Sarjana Muda II *Bachelor Degree Project II*	K	4	BETU 3764
	*BETX XXXX	Elektif IV *Elective IV*	E	3	
	BLHC 4032	Pemikiran Kritis dan Kreatif *Critical and Creative Thinking*	W	2	
TOTAL CREDITS THIS SEMESTER				**19**	
SEMESTER 8	BETU 4786	Latihan Industri *Industrial Training*	K	6	
	BETU 4796	Laporan Latihan Industri *Industrial Training Report*	K	6	
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:

NO.	CODE	SUBJECT
1	BETT 3353	Sistem Telekomunikasi *Telecommunication System*
2	BETT 3413	Teknik FR & Gelombang Mikro *RF Technique & Microwave*
3	BETZ 4803	Anatomi & Fisiologi *Anatomy & Physiology*
4	BETZ 4813	Pengimejan Perubatan dan Pemprosesan Imej *Medical Imaging and Image Processing*
5	BETZ 4923	Fabrikasi Mikroelektronik *Microelectronic Fabrication*
6	BETZ 4903	Proses Semikonduktor *Semiconductor Process*

* For Elective II & III, students may choose any TWO (2) subjects from the list below:

NO.	CODE	SUBJECT
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:

NO.	CODE	SUBJECT
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**
   Choir, Gamelan, Cak Lempung, Nasyid, Seni Khat, Seni Lakon, Art, English Elocution, Bahasa Melayu Elocution, and Kompang.
2. **Entrepreneurship**
   Video, Film and Photography, Publishing & Journalism, Computer and Technopreneurship.
3. **Society**
   Fiqh Muamalat, Fiqh Amali, Tahsin Al-Quran & Yaasin and Peer Program.
4. **Recreation**
   Go-Kart, Adventure and Cycling.
5. **Sports**
   Swimming, Volley Ball, Golf, Kayaking, Takraw, Aerobic, Badminton, Football and Net ball.
6. **Martial Arts**
   Silat Gayong, Karate-Do and Taekwando.

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
1. Indra Devi, S. & Zanariah Jano. (2008). Technical report writing. Kuala Lumpur: Pearson Prentice Hall.
2. Anderson, P.V. (2007). Technical communication: A reader-centred approach (6th ed.). California: Wadsworth Publishing.
3. Finkelstein, L. J. (2007). Pocket book of technical writing for engineers and scientists (3rd ed.) New York: McGraw Hill.
4. Hart, H. (2008). Introduction to engineering communication (2nd ed.). London: Prentice Hall.
5. Krishnan, L.A., Jong. R., Kathpalia, S.S. & Tan, M.K. (2006). Engineering your report: From start to finish (2nd ed.). Singapore: Prentice Hall.
6. Sharimllah Devi, R., Indra Devi, S. & Nurlisa Loke Abdullah. (2011). Grammar for technical writing. Selangor:Pearson Hall

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
1. Azar, B. S. & Hagen, S. A. (2006). Basic English grammar. New York: Pearson Education.
2. Casher, C. C. & Weldon, J. (2010). Presentation excellence: 25 tricks, tips and techniques for professional speakers and trainers. USA: CLB Publishing House.
3. Chin, F. C. J., Soo, K. S. E. & R. Manjuladevi. (2010). English for professional communication: Science and engineering. Singapore: Cenggage Learning Asia Pte Ltd.
4. Khoo, M. S. L, Razilah Abdul Rahim & E. Rajendraan (2006). Communication at the work place. Melaka: Jabatan Bahasa dan Komunikasi, UTeM.

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
1. Osman Bakar. (2009). Modul Pengajian Tamadun Islam & Tamadun Asia. Kuala Lumpur: Penerbit Universiti Malaya.
2. Sazelin Arif, Ahmad Ridzwan Mohd Noor, Mahadi Abu Hassan, Nooraini Sulaiman & Ali Hafizar Mohammad Rawi. (2007). Tamadun Islam dan Tamadun Asia. Kuala Lumpur: Mc Graw-Hill (Malaysia) Sdn. Bhd.
3. Hashim Musa. (2005). Pemerkasaan Tamadun Melayu Malaysia Menghadapi Globalisasi Barat. Kuala Lumpur: Penerbit Universiti Malaya. (TITAS)

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
1. Shamsul Amri Baharuddin. (2007). Modul Hubungan Etnik. UPENA, KPTM.
2. Abdul Aziz Bari. (2008). Perlembagaan Malaysia. Shah Alam: Arah Publication Sdn. Bhd.
3. Mohd Taib Hj Dora. (2005). Liberalisasi Komuniti. Melaka: Penerbit Universiti Teknikal Malaysia Melaka.

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

1. Barringer, B.R, and Ireland, R.D. (2012). Entrepreneurship 4th Edition. Pearson.
2. Scarborough, N.M. (2011). Essentials of Entrepreneurship and Small Business Management 6th.Edition. Pearson.
3. UiTM Entrepreneurship Study Group. Revised Edition (2010). Fundamentals of Entrepreneurship. Pearson.

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

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

Programme Core Subjects (P)

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

1. Bittinger, M. L. (2013). Algebra and Trigonometry: graphs and models (5th ed.). Pearson Addison.
2. Larson, R. (2012). Algebra and Trigonometry (9th ed.). Brooks Cole.
3. Williams, G. (2011). Linear algebra with applications (7th ed.). Jones and Bartlett.
4. Swokowski, E. W. & Cole, J. A. (2012). Algebra and trigonometry with analytic geometry (13th ed.). Thomson Brooks/Cole.
5. Roger, B. & Kuttler, K. (2014). Linear Algebra with applications. World Scientific Publications.

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

1. James, S. (2016). *Calculus* (8th ed.). Cengage Learning.
2. Abd Wahid Md Raji, et al. (2009). *Calculus for science and engineering*. Batu Pahat: UTHM.
3. Anton, H., Bivens, I., Davis, S., & Polaski, T. (2009). *Calculus: multivaria*ble (9th ed.). Addison-Wesley.
4. Briggs, W., Cochran, L., & Gillett, B. (2011). *Calculus: early transcendentals*. Pearson Education.
5. Goldstein, L. J., et al. (2010). *Calculus and its applications* (12th ed.). Pearson Education.
6. Stewart, J. (2008). *Calculus: early transcendentals* (6th ed.). Brooks/Cole.

BETU 2033
ADVANCED CALCULUS FOR TECHNOLOGY / KALKULUS LANJUTAN UNTUK TEKNOLOGI

LEARNING OUTCOMES

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

1. Apply the basic knowledge of vector functions and multivariable functions to solve the related problems.
2. Use appropriate methods to find the solutions of the differential equations.
3. Solve application problems using appropriate techniques.

SYNOPSIS

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

REFERENCES

1. James, S. (2016). *Calculus* (8th ed.). Cengage Learning.
2. Anton, H., Bivens, I., & Davis, S. (2013). *Calculus: Early transcendentals* (10th ed.). John Wiley & Sons.
3. Nagle, K. R., Saff, E. B. & Snider, A. D. (2012). *Fundamentals of differential equations* (8th ed.). Pearson.
4. Stewart, J. (2012). *Multivariable calculus* (7th ed.). Brooks/Cole.
5. Brannan, J. R. & Boyce, W. E. (2011). *Differential equations with boundary value problems: modern methods and applications* (2nd ed.). International Student Version. Wiley.

BETU 2043
STATISTICAL METHODS / KAEDAH STATISTIK

LEARNING OUTCOMES

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

1. Apply the knowledge of probability and statistics to solve the related problems.
2. Solve problems in statistical inferences related to hypothesis testing, regression and ANOVA.
3. Solve real application problems using appropriate statistical software.

SYNOPSIS

This course covers the concept of probability and statistics and their real application problems. Probability topics include all the basic concepts of probability including events and probability, mutually exclusive events, independent events, multiplication rule, addition rule, conditional probability, discrete and continuous random variables. The inferential statistics covers topics like sampling, hypothesis testing, correlation, simple linear regression, chi-square independent test and ANOVA. Students will be exposed to a statistical software package.

REFERENCES

1. Montgomery, D. C. & Runger, G. C. (2011). *Applied statistics and probability for engineers* (5th ed.). John Wiley & Sons.
2. Navidi, W. (2011). *Statistics for engineers and scientists* (3rd ed.). McGraw-Hill.
3. Vining, G. G. & Kowalski, S. (2011). *Statistical methods for engineers* (3rd ed.). Brooks/Cole Cengage Learning.
4. Weiss, N.A. (2008). Introductory Statistics. (8th ed.). PearsonsVining, G. G. & Kowalski, S. (2011). Statistical methods for engineers (3rd ed.). Brooks/Cole Cengage Learning.

BETU 4053
ENGINEERING ETHICS & OSHE /
ETIKA KEJURUTERAAN & KKPP

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

1. Harris, C. E., Michael S. Pritchard, and Michael J. Rabins. Engineering Ethics: Concepts and Cases. Belmont, CA: Wadsworth, 2009. Print.
2. Fleddermann, C. B. (2014). Engineering Ethics (4th ed.). Pearson.
3. Martin, M. K. & Schinzinger, R. (2010). Engineering Ethics (2nd ed.). McGraw-Hill.
4. Undang-undang Malaysia. Akta 768, Akta Teknologis dan Juruteknik (2015). Occupational Safety and Health Act, 1994
5. Factories and Machinery Act, 1967.

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

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 disscussed because science and technology is a phenomenon which develops in line with the development of society and its environment.

REFERENCES

1. Radzuan Nordin, Ahmad Ridzwan Mohd Noor, Norliah Kudus, Nor Azilah Ahmad, Shahrulanuar Mohamed, Ali Hafizar Mohamad Rawi, Ismail Ibrahim & Mahadi Abu Hassan. (2008). Modul Falsafah Sains dan Teknologi. Cetakan Dalaman UTeM.
2. Yahaya Jusoh & Azhar Muhammad. (2007). Pendidikan Falsafah Sains Al-Quran. Skudai: Penerbit UTM Press.
3. Osman Bakar. (2008). Tauhid dan Sains: Perspektif Islam Tentang Agama dan Sains Edisi Kedua. Bandung: Pustaka Hidayah.

JTKE, JTKEK and JTKM Programme Core Subjects (P)

BETE 1013
TECHNICAL PHYSICS / FIZIK TEKNIKAL

LEARNING OUTCOMES

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

1. Apply the physics concept systematically in engineering.
2. Display an ability to follow lab procedure in handling physic experiment through lab session.
3. Work individually or in groups effectively to perform assignments/tasks given.

SYNOPSIS

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

REFERENCES

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

JTKP Programme Core Subjects (P)

BETD 4013
SUSTAINABLE DEVELOPMENT / PEMBANGUNAN LESTARI

LEARNING OUTCOMES

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

1. Describe the elements of design for Dematerialization, Detoxification, Revalorization and Renewal.
2. Design, various product type with minimum environmental effect.
3. Analyze the environmental effect of product throughout its lifecycle.

SYNOPSIS

Sustainable design or green product design is to incorporate product design to eliminate negative environmental impact 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

1. Frederic P Miller, Agnes F Vandome, John McBrewster, (2010) Design for Environment, VDM Publishing House Ltd.
2. Joseph Fiksel, Joseph R. Fiksel, (2009) Design for environment: a guide to sustainable product development. McGraw Hill
3. Fabio Giudice, Guido La Rosa, Antonino Risitano, (2006) Product design for the environment: a life cycle approach, Taylor and Francis.

SUBJECT DETAILS FOR JTKE PROGRAMMES

BETY Course Core Subjects (K)

SEMESTER 1

BETY1303
MEASUREMENT & INSTRUMENTATION SYSTEM /
PENGUKURAN & SISTEM INSTRUMENTASI

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

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

REFERENCES
1. Alan S. Moris and Reza Langari, Measurement and Instrumentation: Theory and Application, Academic Press, 2011.
2. HS Kalsi, Electronic Instrumentation, McGraw Hill, 2011.
3. Uday A. Bakshi and Ajay V. Bakshi, Electrical & Electronic Measurement, Technical Publication, 2012.
4. Uday A. Bakshi and Ajay V. Bakshi, Electrical Measurements and Instrumentation, Technical Publication, 2014.
5. Muhammad Sharil Yahya et. Al, Asas dan Konsep Pengukuran, Penerbit UTeM, 2012.
6. Muhammad Sharil Yahya et. Al, Pengukuran & Instrumentasi, Penerbit UTeM, 2013.

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
1. David Planchard Marie Planchard, (2012), engineering Design with Solidworks 2012, SDC.
2. Bertoline, G.R., & Wiebe, E.N., et. (2011), Fundamental of Graphics Communication, 6th Edition McGraw Hill.
3. Dassault System, (2014), Introducing Solidworks Manual 2014.

BETI 1303
ELECTRICAL CIRCUIT FUNDAMENTAL /
PENGENALAN LITAR ELEKTRIK

LEARNING OUTCOMES

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

1. Apply analytical method and theorem to DC and AC (steady state) circuits in electrical circuit.
2. Conduct experiment on DC and AC (steady state) circuit based on electrical circuit theorem.
3. Participate effectively for any assignment and experiment.

SYNOPSIS

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

REFERENCES

1. Thomas L. Floyd, Principles of Electric Circuits, 9th Ed., Pearson, 2010.
2. Charles Alexander and Matthew Sadiku, Fundamentals of Electric Circuits, 5th Ed., McGraw Hill, 2013.
3. Allan H. Robbins and Wilhelm C Miller, Circuit Analysis Theory and Practice, 5th Ed., Delmar and Cengage Learning, 2012.
4. James W. Nilsson and Susan Riedel, Electric Circuits, 10th Ed., Prentice Hall, 2014.

SEMESTER 2

BETY 1323
DIGITAL ELECTRONICS & SYSTEM /
ELEKTRONIK & SISTEM DIGITAL

LEARNING OUTCOMES

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

1. Apply the knowledge, basic features and configuration of combinational logic and sequential logic circuit.
2. Construct digital system experiments and assignment.
3. Explain effectively either individually or in group for any assignment and experiment.

SYNOPSIS

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

REFERENCES

1. Aminurrashid Noordin et. al (2014), Digital Electronics & Systems, Penerbit UTeM.
2. Thomas Floyd, Digital Fundamentals, Global Edition, 11th Edition, Jan 2015, Pearson New International Edition.
3. Ronald Tocci, Neal Widmer, Greg Moss, Digital Systems Principles and Applications, 11th Edition, Jul 2013, Pearson New International Edition.
4. Thomas Floyd, Digital Electronics A Systems Approach, CourseSmart eTextBook, Oct 2012, Pearson New International Edition.

BETI 1323
ELECTRICS & MAGNETISM /
ELEKTRIK & KEMAGNETAN

LEARNING OUTCOMES

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

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

SYNOPSIS

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

REFERENCES

1. John W. Jewett, Jr. Raymond A. Serway, (2014), Physics for Scientists and Engineers, 9th Edition, BROOKS/COLE CENGAGE Learning.
2. Matthew N. O. Sadiku (2015) Principles of Electromagnetics, 6th Edition, Oxford University Press.
3. Ulaby, F. (2012) Electromagnetics for Engineers, Pearson Education, 6th Edition.
4. Hayt, W. and Buck, J., (2011) Engineering Electromagnetics, 8th Edition, McGraw Hill International Edition.
5. Raju, G.S.N. (2006) Electromagnetic Field Theory and Transmission Lines, 1st Edition, Pearson Education.

BETI 1333
ADVANCED ELECTRICAL CIRCUIT /
LITAR ELEKTRIK LANJUTAN

LEARNING OUTCOMES

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

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

SYNOPSIS

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

1. Charles, K.A & Sadiku, N.O (2013). Fundamental of Electric Circuit (5th ed.). McGraw-Hill.
2. Nilsson, J. W. & Riedel, S. (2015). Electric Circuit (10th ed.). Prentice Hall.
3. Glisson, T. H. (2011). Introduction to Circuit Analysis and Design. Springer.
4. Hayt, W. H.(2012). Engineering Circuit Analysis (8th ed.). McGraw-Hill.
5. O'Maley, J. (2011). Basic Electric Circuit. McGraw-Hill.

PRE-REQUISITE

BETI 1303
ELECTRICAL CIRCUIT FUNDAMENTAL / PENGENALAN LITAR ELEKTRIK

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

1. Thomas L. Floyd, Electronic Devices, Pearson Education, Limited, 5 Jan 2017
2. Hughes, John M., Practical Electronics: Components and Techniques, O'Reilly Media, 2015
3. Occupational safety and health (classification, labelling and safety datasheet of hazardous chemicals) regulations 2013, Department of Occupational safety and health Malaysia
4. Laboratory Safety Guidance, Occupational Safety and Health Administration U.S. Department of Labor, 2011
5. R. S. Khandpur, Printed Circuit Boards: Design, Fabrication, Assembly and Testing, Tata McGraw-Hill Education, 2005
6. Howard Manko, Solders and Soldering, Fourth Edition, McGraw Hill Professional, Mar 2001
7. Rudolf Strauss, Dr.Ing., FIM, SMT Soldering Handbook, second edition, Newnes, 1998

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

1. Abdul Kadir, (2016), C++ Programming A Practical Hands-on for Self Learning, 1st Edition, Penerbit Universiti, Universiti Teknikal Malaysia Melaka.
2. Gaddis, T., (2015), Starting Out with C++: From Control Structures through Objects, 8th Edition, Global Edition, Pearson Education.
3. Daniel Liang, Y, (2014), Introduction to Programming with C++, 3rd Edition, Pearson Education.
4. Deitel, H.D., (2014), C++ How to Program, 9th Edition, Pearson Education.
5. Nell, D., (2013), Programming and Problem Solving with C++: Comprehensive, 6th Edition, Jones & Bartlett Learning.

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.
2. Perform the experiment of semiconductor devices using simulation software and electronic components in electronic circuit.
3. Explain effectively either individually or in group for any assignment and experiment

SYNOPSIS

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

REFERENCES

1. Thomas L. Floyd, Electronic Devices, 9th, Pearson, 2012.
2. Robert L. Bolysted, Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, Pearson, 2013.
3. S. Salivahanan, N. Suresh Kumar, Electronic devices and circuits, 3rd Edition, McGraw-Hill, 2012.
4. Atul P. Godse, Uday A. Bakshi, Electronic devices & circuits, Technical Publication Pune, 2011.

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.
2. Md Nasir, Panduan Pendawaian Elektrik, IBSbuku, 2006.
3. Mohd Nazi, Teknologi Pemasangan Elektrik, DBP.
4. Akta Bekalan Elektrik (447 pindaan 2001).
5. Brian Saddan, IEE wiring regulations 3rd edition, Inspection, Testing and Certification, Newnes, 2001.

BETY 2361
ELECTRICAL ENGINEERING TECHNOLOGY CAREER / KERJAYA TEKNOLOGI KEJURUTERAAN ELEKTRIK

LEARNING OUTCOMES

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

1. Identify the requirement of electrical engineering technology practices in terms of engineering ethics, economy, finance and law and route to professional engineering technologist.
2. Apply the main features of groups and team that affect teamwork or team effectiveness in relation to electrical engineering technology field.
3. Explain the professional experiences gain through industrial talk and industrial visit.

SYNOPSIS

In this subject, students will be equipped with 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.

BETY 2353
ELECTRICAL TECHNOLOGY / TEKNOLOGI ELEKTRIK

LEARNING OUTCOMES

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

1. Analyze single-phase, three-phase and magnetic circuit for alternating current (AC).
2. Conduct experiment on single-phase and three-phase system for alternating current (AC).
3. Participate effectively to fulfil experimentation task with peers.

SYNOPSIS

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

REFERENCES

1. Hughes, Electrical & Electronics Technology, 11th ed., Prentice Hall, Feb 2012.
2. Bird, J.O., Electrical Circuit Theory and Technology, 5th ed., Routledge, Nov 2013.
3. Bird, J.O., *Electrical Principles and Technology for Engineering,* Elsevier, 2013.
4. Aminurrashid Noordin et. al*, Principles of Electric & Electronics (Part 1),* Penerbit UteM, 2013.
5. Asri Din et, al*, Principles of Electric & Electronics (Part 2),* Penerbit UteM, 2013.

SEMESTER 4

BETR 2353
ANALOG ELECTRONICS / ELEKTRONIK ANALOG

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Analyze the operation of analog electronic circuit based on the component characteristics
2. Conduct experiment on analog electrical circuit by using measurement equipment and simulation software
3. Explain effectively in group for assignment

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

REFERENCES
1. Modul Analog Electronics, UTeM
2. Bolysted, R., Nashelsky, L., Electronic Devices and Circuit Theory, 11th Edition, Prentice Hall, 2012.
3. Floyd, T., Electronic Devices,9th, Edition Prentice Hall, 2012.
4. L.K. Maheswari, M.M.S. Anand, Analog Electronics, Eastern economy ed. , 2012
5. Atul P. Godse, Uday A. Bakshi, Electronic circuits, 2009.

BETR 2374
EMBEDDED SYSTEM / SISTEM TERBENAM

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Analyze the operation of a microcontroller's architecture, peripherals subsystem.
2. Construct hardware and software of microcontroller based system to solve related problem.
3. Demonstrate business practice and entrepreneurship in microcontroller project development

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

REFERENCES
1. Peatman, J.B., Design with PIC microcontrollers, 8th ed., Prentice Hall, 1998.
2. http://www.mikroe.com/eng/chapters/view/1/introduction-world-of-microcontrollers/ (online PIC book)
3. Milan Verle., PIC Microcontroller, Mikroelektronika
4. Milan Verle., PIC Microcontroller – Programming in C, Mikroelektronika
5. Iovine, J., PIC Microcontroller Project Book, McGraw-Hill, USA 2000.

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.
3. Report the analysis of transient and steady state performance for first and second order control systems.

SYNOPSIS

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

REFERENCES

1. Norman S. Nise, Control Systems Engineering, 6th Edition, John Wiley & Sons Inc., 2011.
2. Katsuhiko Ogata, Modern Control Engineering, 5th Edition, Pearson, 2010.
3. Richard C. Dort, Robert H. Bishop, Modern Control Systems, 12th Edition, Pearson, 2011.
4. Syed Najib Syed Salim, Maslan Zainon, Control Systems Engineering, 2nd Edition, Penerbit UTeM, 2016.
5. Gopal, M, Control Systems: Principles and Design, 4th Edition, Mc Graw Hill, 2012.
6. Khalil Azha Mohd Annuar et. Al., Introduction to Control System, Penerbit UTeM, 2015

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.
2. Md Nasir, Panduan Pendawaian Elektrik, IBSbuku, 2006.
3. Mohd Nazi, Teknologi Pemasangan Elektrik, DBP.
4. Akta Bekalan Elektrik (447 pindaan 2001).
5. Brian Saddan, IEE wiring regulations 3rd edition, Inspection, Testing and Certification, Newnes, 2001.

SEMESTER 5

BETI 2383
POWER SYSTEM TECHNOLOGY /
TEKNOLOGI SISTEM KUASA

LEARNING OUTCOMES

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

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

SYNOPSIS

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

REFERENCES

1. Glover & Sarma, Power System Analysis and Design, 5th Edition, Thomson Learning, 2012.
2. Hadi Saadat, Power System Analysis, 3rd Edition, McGraw Hill, 2010.
3. Arthur R. Bergen, Power System Analysis, 2nd Edition, Prentice Hall, 2000.
4. Grainger and Stevenson Jr., Power System Analysis, McGraw Hill, 1994.
5. Willian D. Stevenson Jr., Elements of Power System Analysis, 4th Edition, McGraw Hill, 1998.

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

1. Electric machinery fundamentals, Stephen J. Chapman, 5th ed., New York, NY: McGraw-Hill, 2012.
2. Electric machines, Mulukutla S. Sarma, Mukesh K. Pathak.,Singapore: Cengage Learning, 2010.
3. Fitzgerald & Kingsley's electric machinery, Stephen D. Umans., 7th ed.,New York, NY: McGraw-Hill Companies, 2014.
4. Electric machines, D.P. Kothari, I.J. Nagrath.,4th ed.., New Delhi: Tata McGraw-Hill, 2010 (Rep. 2011).
5. Linear electric machines, drives, and maglevs handbook, Ion Boldea, Boca Raton, FL: CRC Press/Taylor & Francis, 2013.

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

1. Ned Mohan, Power electronics: a first course, John Wiley & Sons, 2012.
2. Daniel W. Hart, Power Electronics, McGraw-Hill, 2011.
3. Ioinovici, Adrian, Power electronics and energy conversion systems, John Wiley & Sons, 2013.
4. Fang Lin Luo, Hong Ye. Power electronics: advanced conversion technologies – Circuits, Devices, and Applications, Taylor & Francis, 2010.
5. D S. Sivanagaraju, M. Balasubba Reddy, A. Mallikarjuna Prasad, Power electronics, PHI Learning, 2012

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.
2. Dieter, G.E. & Schmidt, L.C.(2013). Engineering Design, 5th Edition, McGraw Hill.
3. Theodore R. Bosela Ph.D. PE, 2003, Electrical Systems Design 1st Edition.
4. Ulrich, K.T. & Eppinger, S.D.(2008). Product Design and Development, 4th Edition, McGraw Hill.
5. Keith H. Sueker, Power Electronics Design: A Practitioner's Guide, 2005.
6. Mahesh Patil, Pankaj Rodey, Control Systems for Power Electronics: A Practical Guide. Springer, 2015.
7. Ziyad Salameh, Renewable Energy System Design, 2014 Elsevier Inc.
8. Michael F. Ashby., 2010, *Materials Selection in Mechanical Design, Fourth Edition 4th Edition,* Butterworth-Heinemann; 4 edition (October 5, 2010).
9. Malaysian standard guidelines. (Can be access via UTeM's library, guideline: http://bit.ly/2bCWuvi).

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

1. Leon Freris & David Infield, Renewable Energy in Power System, Wiley 2008
2. Godfrey Boyle, renewable Energy: Power for Sustainable Future, Oxford 2014
3. D.P Kothari, KC Singal, Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, Prentice Hall of India, 2008

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

1. James Larminie and John Lowry, “Electrical Vehicle” John Wiley & Sons, 2012.
2. Mark Warner, “The Electric Vehicle Conversion handbook” –HP Books, 2011.
3. Iqbal Husain, “Electric & Hybrid Vehicles-Design Fundamentals”, Second edition, CRC press
4. D. A. J. Rand, R. Woods R. M. Dell, “Batteries for Electric Vehicles”, New York, John Wiley and Sons.

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

1. Bruno Scrosati, Jurgen Garche and Werner Tilmetz, “Advances in Battery Technologies for Electric Vehicles” Elsevier Ltd., 2015.
2. Gianfranco Pistoia,”Electric and Hybrid Vehicles”, Elsevier, 2010.
3. H.A.Kiehne, “Battery Technology Handbook”, 2nd Ed., CRC Press, 2003.

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 effetively

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

REFERENCES
1. *Manual Projek Sarjana Muda (PSM),* Fakulti Teknologi Kejuruteraan, Universiti Teknikal Malaysia Melaka.

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
1. Haitham Abu-Rub, Atif Iqbal, Jaroslaw Guzinski, High Performance Control of AC Drives with Matlab / Simulink Models, John Wileys & Sons Ltd., 2012.
2. Ned Mohan, Tore M. Undeland, William P. Robbins, Power Electronics-Converters, Applications and Design, 3rd Edition, John Wiley and Sons, 1995.
3. Ioinovici, Adrian, Power electronics and energy conversion systems, John Wiley & Sons, 2013.
4. Fang Lin Luo, Hong Ye. Power electronics: advanced conversion technologies – Circuits, Devices, and Applications, Taylor & Francis, 2010.
5. D S. Sivanagaraju, M. Balasubba Reddy, A. Mallikarjuna Prasad, Power electronics, PHI Learning, 2012.

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

1. Perez, Adrover E. (2012), Introduction to PLCs: A Beginner's Guide to Programmable Logic Controllers, CRC Press.
2. Macaulay, Tyson (2012), Cybersecurity for Industrial Control Systems: SCADA, DCS, PLC, HMI, and SIS, CRC Press.
3. Frank, Lamb (2013), Industrial Automation, McGraw-Hill.
4. Doug, Arent (2013), Automation Systems of the 21st Century: New Technologies, Applications and Impacts on the Environment & Industrial Processes, Nova Science.

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

1. Hamilton, Michael S., Energy Policy Analysis, A Conceptual Framework, M.E. Sharpe, Inc. 2013.
2. Gilbert M. Masters, Renewable and Efficient Electric Power Systems, Wiley, 2005
3. Pratt, Joseph A. Exxon: Transforming Energy 1973-2005, 2013.

BETY 3843
REKABENTUK SISTEM PV / PV SYSTEM DESIGN

LEARNING OUTCOMES

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

1. Perform the design and sizing of PV system that includes inverter, solar cable and protection components.
2. Integrate the design of the PV system's Balance of System (BOS) that includes inverter, solar cable and protection components.
3. Explain the impact of PV system towards sustainable development.

SYNOPSIS

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

REFERENCES

1. SEDA Malaysia, "Grid-Connected Photovoltaic Systems Design Course", 2015
2. SEDA Malaysia, "Procedure for the Testing and Commissioning of Grid-Connected Photovoltaic Systems in Malaysia, 2015
3. Global Sustainable Energy Solutions, "Grid-Connected PV Systems Design and Installation", 2012.

BETY 3853
APLIKASI ELEKTRONIK KUASA /
POWER ELECTRONICS APPLICATION

LEARNING OUTCOMES

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

1. Apply the application of power electronics in renewable energy, industrial appliances, consumer goods, transportation and power system.
2. Execute the function and interaction between components and sub-system used in power electronic applications with their limitation.
3. Complete the assignment and experiment on basic power electronics application.

SYNOPSIS

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

REFERENCES

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

BETY 3863
PEMACU MOTOR DAN SISTEM TARIKAN /
MOTOR DRIVE AND TRACTION SYSTEM

LEARNING OUTCOMES

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

1. Evaluate power electronics converters and control strategies for DC and AC motor drive system.
2. Conduct the investigation on the performance of DC and AC motor drives in various operating condition.
3. Demonstrate application of DC and AC drives in modern electrified traction system.

SYNOPSIS

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

REFERENCES

1. I. Boldea, Syed A. Nasar and S.A. Nasar, Electric drives, CRC/Taylor & Francis, 2nd edition, 2006.
2. Mukhtar Ahmad, High Performance AC Drives: Modelling Analysis and Control, Spronger, 2010.
3. Andre Veltman, Duco W. J. Pulle, R. W. A. A. De Doncker, Fundamentals of electrical drives, Springer, 2007.
4. J. Pachl, Railway Operation and Control. VTD Rail Publishing, Mountlake Terrace
5. (USA) 2004.
6. Bonnett, Clifford F. Practical railway engineering, London: Imperial College Press, 2005.
7. O.S. Lock, Railway Signalling, 3rd Edition, A & C Black, 1993

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

1. *Manual Projek Sarjana Muda (PSM),* Fakulti Teknologi Kejuruteraan, Universiti Teknikal Malaysia Melaka.

PRE-REQUISITE

BETU 3764
BACHELOR DEGREE PROJECT I / PROJECT SARJANA MUDA I

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

1. Hadi Saadat, Power System Analysis, 2nd Ed., Mc Graw Hill, 2004.
2. Wildi,T., Electrical Machines, Drives and Power Systems, 5th Ed., Prentice Hall, 2002.
3. Marizan Sulaiman, Ekonomi dan Pengurusan Sistem Kuasa, Utusan Publications & Distributors.

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 exposed to the use of standard design procedures and type of testing and troubleshooting required for low voltage system.

REFERENCES

1. Akta Bekalan Elektrik 1990 (Akta 447) & Peraturan-Peraturan Elektrik 1994 (Pindaan 2015), 2015.
2. Malaysian Standard International Electrotechnical Commission (MS IEC) 60364, 2015.
3. Boca Raton, The Electric Power Engineering Handbook, 3rd Ed., CRC Press, 2012.
4. H.L Wilis, R.R. Schrieber, Aging Power Delivery Infrastructures, 2nd Ed., CRC Press, 2013.
5. U.A Bakshi, M.V Bakshi, Transmission & Distribution, 2nd Ed., India Technical Pub., 2012.

BETY 4873
TREND TEKNOLOGI DALAM INDUSTRI/ TECHNOLOGY TREND 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

1. Introduction to Electromagnetic Compatibility (EMC), Clayton R. Paul, 2nd edition, Wiley, 2006.
2. Electric machinery fundamentals, Stephen J. Chapman, 5th ed., New York, NY: McGraw-Hill, 2012.
3. Electric machines, Mulukutla S. Sarma, Mukesh K. Pathak., Singapore: Cengage Learning, 2010.
4. Fitzgerald & Kingsley's electric machinery, Stephen D. Umans., 7th ed., New York, NY: McGraw-Hill Companies, 2014.
5. Electric machines, D.P. Kothari, I.J. Nagrath.,4th ed.., New Delhi: Tata McGraw-Hill, 2010 (Rep. 2011).
6. Linear electric machines, drives, and maglevs handbook, Ion Boldea, Boca Raton, FL: CRC Press/Taylor & Francis, 2013.

BETY 4903
SISTEM PEMACU MODEN / MODERN DRIVE SYSTEM

LEARNING OUTCOMES

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

1. Apply the principle of vector-controlled and DTC-controlled drive systems in AC machine.
2. Construct the experiment of three phase AC drive system.
3. Demonstrate practical competence on modern AC drive systems.

SYNOPSIS

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

REFERENCES

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

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

1. I. Boldea, Syed A. Nasar and S.A. Nasar, Electric drives, CRC/Taylor & Francis, 2nd edition, 2006.
2. Mukhtar Ahmad, High Performance AC Drives: Modelling Analysis and Control, Spronger, 2010.
3. Andre Veltman, Duco W. J. Pulle, R. W. A. A. De Doncker, Fundamentals of electrical drives, Springer, 2007.
4. J. Pachl, Railway Operation and Control. VTD Rail Publishing, Mountlake Terrace
5. (USA) 2004.
6. Bonnett, Clifford F. Practical railway engineering, London: Imperial College Press, 2005.
7. O.S. Lock, Railway Signalling, 3rd Edition, A & C Black, 1993

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.

SUBJECT DETAILS FOR JTKEK PROGRAMMES

BETZ Course Core Subjects (K)

SEMESTER 1

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
Introduction to Industrial Safety and Health + Lab Safety, Equipment- theory, industrial practices, testing and circuit diagnostic & Report writing, Component – introduction, theory, assembly and soldering, Simulation tools - MULTISIM – introduction and application, Problem Based Learning (PBL).

REFERENCES
1. Environmental, Engineering: Environmental Health and Safety for Municiple Infrastructure, 6thEdition, Nelson L. Nemerow, Franklin J. Agardy, Joseph A. Salvato, 2009, WILEY
2. Circuit Systems with MATLAB and PSpice, Won Y. Yang, Seung C. Lee, 2012, Hongrung Science
3. Managing, Controlling and Improving Quality, 1st Edition, Douglas C. Montgomery, Cheryl L. Jennings, Michele E. Pfund, 2010, WILEY
4. Clyde Coombs, Happy Holden; Printed Circuits Handbook, 7th 2016, McGraw-Hill Education
5. Engineering Design: A Project Based Introduction, 3rd Edition, 2009, WILEY

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
1. Thomas L. Floyd, Principles of Electric Circuits, 9th Ed., Pearson, 2010.
2. Charles Alexander and Matthew Sadiku, Fundamentals of Electric Circuits, 5th Ed., McGraw Hill, 2013.
3. Allan H. Robbins and Wilhelm C Miller, Circuit Analysis Theory and Practice, 5th Ed., Delmar and Cengage Learning, 2012.
4. James W. Nilsson and Susan Riedel, Electric Circuits, 10th Ed., Prentice Hall, 2014.

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

1. Michael A. Vine, C Programming 2nd Edition for The Absolute Beginner, Thomson Course Technology, USA, 2008.
2. Jeri R. Hanley, Elliot B. Koffman, Problem Solving and Program Design in C, 7th Edition, Pearson Education Inc, 2013.
3. Paul Deitel, Harvey Deitel, C How To Program 6th Edition, Pearson Education Inc, 2010.

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:
Bohr Atomic Model: valency, period table of elements, trivalent, tetravalent and pentavalent elements, movement electrons in solid: conductor, insulator and semiconductor, bands theory: energy band, conduction band and forbidden band. Doping, p and n materials, pn junction. Silicon Semiconductor Diodes: characteristics and measurement of forward & reverse biased, composite characteristics and load line analysis, clipping and simple rectifier (half & full) circuits, Zener diodes characteristics, and simple shunt regulators. Bipolar Junction Transistor: construction and operation of BJT, BJT characteristics and measurement technique, limits of operation, βdc and αdc, DC biasing – DC Load Lines. Amplification of signal. Transistor as a switch. Field Effect Transistor: construction and operation of FET, FET characteristics & diagram, Shockley's equation, DC biasing – DC Load Lines-Graphical and mathematical approach.

REFERENCES

1. Boylestad R., Nashelsky L., *"Electronic Devices and circuit Theory",* Ninth Edition, Prentice Hall Inc., 2006.
2. Floyd, "Electronic Devices", Sixth Edition, Prentice Hall, 2002.
3. R P Punagin, "Basic Electronics", Mc-Graw Hill, 2000

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

1. Mohd Ramzan Zainal, Badri Abd Ghani dan Yahya Samian, Lukisan Kejuruteraan Asas, UTM Skudai, 2000.
2. Yarwood, An Introduction To AutoCAD 2002, Prentice Hall, London, 2002.
3. F. E. Giesecke, Technical Drawing, 11th Ed., Prentice Hall, New York, 1999.
4. Jensen, D. H. Jay, Engineering Drawing And Design, 5th Ed., Glencoe and McGraw Hill, New York, 1996.

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
2. Handbook of International Electrical Safety Practices, Peri, 2010, Wiley
3. Audel House Wiring, All New 8th Edition, Paul Rosenberg, 2004 Wiley
4. EMC and the Printed Circuit Board: Design, Theory and Layout Made Simple. 2005 Mark.I, Montrose, Wiley
5. Industrial Bioseparations: Principles and Practice, 2008. Daniel Forciniti, Wiley

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

1. Charles, K.A & Sadiku, N.O. Fundamental of Electric Circuit (6th ed.). 2016. McGraw-Hill.
2. Nilsson, J. W. & Riedel, S. Electric Circuit (10th ed.). 2015. Prentice Hall.
3. Hughes, Electrical & Electronics Technology, 11th ed. 2012. Prentice Hall, Feb 2012
4. McPherson G., An Introduction to Electrical Machine & Transformers. 1990. Wiley, 2nd Edition

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

1. Boylestad R., Nashelsky L., *"Electronic Devices and circuit Theory",* Ninth Edition, Prentice Hall Inc., 2006.
2. S.H. Ruslan et.al. "ElektronikII*"* Penerbitan UTM 1998.
3. Floyd, *"Electronic Devices"*, Sixth Edition, Prentice Hall, 2002.
4. Theodore F. Bogart Jr., Jeffrey S. Beasley and Guillermore Rico, *"Electronic Devices and Circuits",* Sixth Edition, Pearson Education, 2004.

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

The course will cover various topics such as Introduction to Signals and Systems: Fundamental Concept, Transformations of Signals, Signal Characteristics, Common Signals, Systems and Its Properties, Convolution for LTI Systems, Properties of Convolution, Properties of LTI Systems; Fourier Series And Discrete Time Fourier Series: Introduction of Fourier Series and Its Coefficients, Frequency Spectra, Fourier Series Properties; Fourier Transform And Discrete Time Fourier Transform: Definition, Properties of Fourier Transform, Application of Fourier Transform, Energy and Power Density Spectra; Laplace Transform: Definition, Properties of Laplace Transform, Response of LTI Systems: Initial Condition, Transfer Functions, Convolution, Transforms with Complex and Repeated Poles. Sampling Theory and aliasing.

REFERENCES

1. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, Signals and Systems, 2nd Ed. 2015
2. Kumar, A. Anand, Signals and systems, 2nd Edition, New Delhi: PHI Learning, 2012.
3. Roberts, Michael J, Signals and systems : Analysis using transform methods and MATLAB, 2nd Edition, New York, NY: McGraw-Hill, 2012
4. Palamides, Alex, Signals and systems laboratory with MATLAB, Boca Raton, Fla.: CRC Press, 2011.
5. Floyd, Thomas L, Electric circuits fundamentals, 8th Edition, Upper Saddle River, NJ: Prentice Hall, 2010.

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

1. Thomas L. Floyd, Digital Fundamentals, 11th Edition, Prentice Hall, 2015
2. Ronald J.Tocci, Neal S.Widmer, Gregory L.Moss, Digital Systems: Principles and Applications, 12th Edition, Pearson Prentice Hall, 2016.
3. William Klietz, Digital Electronic: A Practical Approach, 8th Edition, Prentice Hall, 2007.
4. Marcovitz A. B., Introduction to Logic Design, 3rd Edition, McGraw Hill, 2005.

BETZ 1213
INSTRUMENTATION & MEASUREMENT /
INSTRUMENTASI & PENGUKURAN

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 accelerator 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
3. S Wolf, Richard F.M Smith, Reference Manual for Electronic Instrumentation Laboratories 2nd Ed., Prentice-Hall, 2004
4. Calibration Book, Vaisala Oyj, Vaisala 2006

SEMESTER 4

BETT 2333
COMMUNICATION PRINCIPLE / PRINSIP KOMUNIKASI

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.
3. Report effectively an assignment in a group.

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

1. Wayne Tomasi, Electronics Communications Systems Fundamentals Through Advanced, Prentice Hall, 5th Edition, 2008.
2. John G. Proakis, Fundamentals of Communication Systems Engineering, Prentice Hall, 2013.
3. Frenzel, Communication Electronics/; Principles and Applications, McGraw Hill, Third Edition, 2000.

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 adjusment 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

1. Nise, S Norman, Control Systems Engineering, 3th Edition, John Wiley & Sons Inc., United State of America, 2008.
2. Bishop, Dorf, Modern Control Systems, 10th Edition, Prentice Hall, 2008.
3. Smarajit Ghosh, "Control System: Theory and Applications", Pearson India, 2005.

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

1. Boylestad R., Nashelsky L., "Electronic Devices and circuit Theory", Eleventh Edition, Prentice Hall Inc., 2014.
2. Floyd, "Electronic Devices", Ninth Edition, Prentice Hall, 2014.
3. Stanley, W.D., "Op-Amps. and Integrated Linear Circuit", Prentice Hall, 2002

BETZ 2404
MICROCONTROLLER TECHNOLOGY /
TEKNOLOGI MIKROPENGAWAL

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

1. Microcontrollers: Architecture, Programming, Interfacing and System Design, Rajkamal, 2nd Ed Pearson (2012)
2. PIC Microcontroller and Embedded System, Using Assembly and C for PIC18. Muhammad Ali Mazidi et. al. Prentice Hall (2010)
3. Pic microcontroller programming. Mohanamba G. CreateSpace Independent Publishing (2015).

SEMESTER 5

BETT 3383
ELECTROMAGNETIC / ELEKTROMAGNETIK

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

1. M.N.O. Sadiku, Elements of Electromagnetics, 6th. Edition, Oxford University Press, 2014.
2. U. S. Inan, A. Inan and R. Said, Engineering Electromagnetics and Waves, 2nd Ed, Pearson 2015
3. S. M. Wentworth, Fundamentals of Electromagnetics with Engineering Applications, Wiley, 2006

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.
3. Report effectively an assignment in a group.

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
1. Sanjit K.Mitra, Digital Signal Processing: A Computer Based Approach, 4th Ed.Mc Graw Hill,2010.
2. Oppenheim, Schafer, Discrete-time Signal Processing, Prentice-Hall, 2010.
3. Proakis, Manolikas, Digital Signal Processing: Principles, Algorithms, and Applications, 4th Edition, Pearson, 2013.

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
1. Faurozan, B, Data Communication & Networking, 5th Ed. McGraw Hill, 2014.
2. Vilas S. Bagad, Iresh A. Dhotre, Data Communication and Networking, 2nd Ed. India: Technical Pub., 2013. Chris Sanders, Practical Packet Analysis, 3rd Ed. Willian Pollock. 2017.
3. Douglas Comer, Computer networks and Internets, 6thEd. Prentice Hall 2014.

BETU 3803
INTEGRATED DESIGN PROJECT /
PROJEK REKABENTUK INTEGRASI

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.
2. Richard G. Budynas and J. Keith Nisbett, Shigley's Mechanical Engineering Design (McGraw-Hill Series in Mechanical Engineering) 10th Edition, January 27, 2014
3. Peter R. N. Childs, 2013, Mechanical Design Engineering Handbook Butterworth-Heinemann; 1 edition (November 18, 2013).
4. Michael F. Ashby., 2010, Materials Selection in Mechanical Design, Fourth Edition 4th Edition, Butterworth-Heinemann; 4 edition (October 5, 2010).

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
1. Annabel Z. Dodd, "The Essential Guide to Telecommunications." 5th Ed. Prentice Hall, 2012.
2. Afif Osseiran, Jose F. Monserrat, Patrick Marsch, Mischa Dohler, 5G Mobile and Wireless Communications Technology, Cambridge University Press, 2016.
3. Cory Beard and William Stallings, Wireless Communication Networks and System, Pearson, 2015
4. Bassem R. Mahafza, Radar System Analysis and Design Using MATLAB, 3rd Ed. CRC Press, 2013.
5. L. J. Ippolito Jr. Satellite Communications Systems Engineering: Atmospheric Effects, Satellite Link Design and System Performance, Wiley. 2017.
6. Bran Edgeworth, Aaron Foss, Ramiro Garza Rios, IP Routing on Cisco IOS, IOS XE, and IOS XR: An Essential Guide to Understanding and Implementing IP Routing Protocols (Networking Technology), Cisco Press, 2014.

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
1. Frank Gustrau, RF and Microwave Engineering: Fundamentals of Wireless Communications, Wiley. 2012
2. Pierre Jarry and Jacques N. Beneat, Microwave Amplifier and Active Circuit Design Using the Real Frequency Technique, Wiley-IEEE, 2016
3. Roger, C. Palmer, An Introduction to RF Circuit Design for Communication System, Copyright, 2016
4. Ahmad Shahid Khan, Microwave Engineering: Concepts and Fundamentals, CRC Press, 2014

BETZ 4803
ANATOMY AND PHYSIOLOGY /
ANATOMI AND FISIOLOGI

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

1. F. Martini, M. Timmons, and R. Tallitsch, Human Anatomy. 2012.
2. E. N. Marieb and K. Hoehn, Human Anatomy & Physiology, 10th ed. Pearson, 2015.
3. C. L. Stanfield, Principles of Human Physiology, 6th ed. Pearson Education, 2016.
4. D. U. Silverthorn, Human Physiology : An Integrated Approach, 7th ed. Pearson Education, 2016.
5. E. N. Marieb and L. A. Smith, Human Anatomy and Physiolog Laboratory, 11th ed. Pearson, 2015

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

1. S. R. Sternberg, “Biomedical Image Processing,” Computer (Long. Beach. Calif)., vol. 16, no. 1, pp. 22–34, 1983.
2. W. Birkfellner, “Applied Medical Image Processing: A Basic Course,” 2nd ed. CRC Press, 2014.
3. K. Najarian and R. Splinter, Biomedical Signal and Image Processing, 2nd ed. CRC Press, 2012.
4. M. Analoui, J. D. Bronzino, and D. R. Peterson, Medical Imaging : Principles and Practices. CRC Press, 2013.
5. M. Sonka and J. M. Fitzpatrick, Eds., Handbook of Medical Imaging, Volume. Medical Image Processing and Analysis. SPIE Publications, 2009.
6. M. D. Abràmoff, P. J. Magalhães, and S. J. Ram, “Image processing with ImageJ,” Biophotonics International, vol. 11, no. 7. pp. 36–41, 2004.

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

1. Donald A. Neaman, Semiconductor Physics and Devices : Basic Principles, 4th Ed., McGraw-Hill, 2011
2. Umesh Mishra and Jasprit Singh, Semiconductor Device Physics and Design, Springer, 2014
3. Josef Lutz, Heinrich Schlangenotto, Uwe Scheuermann and Rik De Doncker, Semiconductor Power Devices:Physics, Characteristics, Reliability, Springer, 2011

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 tought to give understanding on the important materials and component for high quality product.

REFERENCES

1. Hwaiyu Geng, CMfgE, P.E. (Palo Alto, California), "Semiconductor Manufacturing Handbook, Second Edition", McGraw-Hill Education; 2 edition (October 6, 2017)
2. ICON Group International, "The 2018-2023 World Outlook for Semiconductor and Related Device Manufacturing", ICON Group International, Inc. (February 7, 2017)
3. Hong Xiao, "3D IC Devices, Technologies, and Manufacturing (SPIE Press Monographs)", SPIE-The,International Society for Optical Engineering (April 30, 2016)
4. Peter Van Zant, "Microchip Fabrication: A Practical Guide to Semiconductor Processing, Sixth Edition 6th Edition", McGraw-Hill Education; 6 edition (January 7, 2014).

SEMESTER 6

BETE 3404
DATA ACQUISITION & SENSORS /
PEROLEHAN DATA & PENDERIA

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

1. Hee C. Lim Sensors interfacing with LabVIEW, CreateSpace Independent Publishing Platform, 2016
2. Maurizio D. P. Emilio, Data acquisition systems : From Fundamentals to Applied Design, Springer 2013.
3. Jacob Fraden, Handbook of Modern Sensors, Physics, Designs, and Applications, Springer.2015
4. Nikolai V. Kirianaki and Sergey Y. Yurish, Data Acquisition for Smart Sensors, Wiley, 2002

BETU 3764
BACHELOR DEGREE PROJECT I /
PROJEK SARJANA MUDA 1

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 effetively.

SYNOPSIS

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

REFERENCES

1. *Manual Projek Sarjana Muda (PSM),* Fakulti Teknologi Kejuruteraan, Universiti Teknikal Malaysia Melaka.

BETT 4833
ANTENNA ENGINEERING / KEJURUTERAAN ANTENA

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

1. C.A. Balanis:"Antenna Theory, Analysis & Design", 4th Ed. John Wiley 2016
2. Boris Levin, "Antenna Engineering : Theory and Problems" CRC Press, 2017
3. Stutzman and Thiele, Antenna Theory and Design, 3rd., John Wiley, 2012

BETT 4813
MOBILE COMMUNICATION / KOMUNIKASI MUDAH ALIH

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

1. Theodore S. Rappaport, *Wireless Communications: Principles and Practice*, 2nd Edition, Prentice Hall, 2004.
2. Wayne Tomasi, *Electronic Communications Systems*, 5th Edition, Prentice Hall, 2004.
3. W.C.Y. Lee, *Mobile Cellular Telecommunications: Analog and Digital Systems*, McGraw-Hill, 1995.
4. R. Blake, "Wireless Communication Technology", Thomson Delmar, 2003.
5. W.C.Y.Lee, "Mobile Communications Engineering: Theory and applications, Second Edition, McGraw-Hill International, 1998.
6. S. Hideichi, "Mobile Communications", Ohmsha Ltd., 2000.

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

1. L. J. Street, Introduction to Biomedical Engineering Technology, 3rd ed. CRC Press, 2017.
2. Y. K. Chan, Biomedical Device Technology, 2nd ed. Charles C Thomas Pub Ltd, 2016.
3. A.B. Ritter, V. Hazelwood, A. Valdevit and A. N. Ascione, Biomedical Engineering Principles, CRC Press, 2011.
4. S. Chatterjee and A. Miller, Biomedical Instrumentation Systems. New York: Delmar Cengage Learning, 2010.
5. WHO, Maintenance and Repair of Laboratory, Diagnostic Imaging and Hospital Equipment, World Health Organization, 1994.

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

1. T. L. Beauchamp and J. F. Childress, Principles of Biomedical Ethics, 7th ed. Oxford University Press, 2012.
2. R. M. Veatch, A. M. Haddad, and D. C. English, Case Studies in Biomedical Ethics : Decision-making, principles and cases, 2nd ed. Oxford University Press, 2014.
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

BETZ 4873
VLSI DESIGN / REKABENTUK VLSI

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

1. Partha P. Sahu, VLSI Design, McGraw-Hill Education, 2013
2. Yuan Taur and Tak H. Ning, Fundamentals of Modern VLSI Devices, 2nd Ed. Cambridge University Press, 2013
3. Hongjiang Song, VLSI Analog Circuits: Algorithms, Architecture, Modeling, and Circuit Implementation, 2nd, McGraw Hill Professional, 2016
4. El-Hang Lee, Louay A. Eldada, Manijeh Razeghi, Chennupati Jagadis, VLSI Micro- and Nanophotonics: Science, Technology and Applications, CRC Press 2016IEC 62353 Medical electrical equipment - Recurrent test and test after repair of medical electrical equipment

BETZ 4883
DIGITAL IC DESIGN / REKABENTUK IC DIGITAL

LEARNING OUTCOMES

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

1. Evaluate suitable digital system design to solve engineering problem.
2. Design complete digital system on FPGA by using the HDL.
3. Propose sustainable solutions to given problems.

SYNOPSIS

This course provides exposure to digital hardware IC design, which consists of the design entry, simulation and verification of the digital circuits. Students will learn how to design from simple logic gates and combinational logic to more complex circuits by using the Hardware Description Language (HDL). The transformation process from design entry to the physical design will be explained. Moreover, an introduction to the digital circuit timing analysis will also be covered towards the end of this course.Sequential logic structures: Storage mechanisms in CMOS logic, Dynamic latch circuits, Static latch and flip-flop circuits, sequential circuit design.

REFERENCES

1. Steven H. Voldman, ESD : Circuits and Devices, 2nd., Wiley, 2015
2. Charles H. Roth, Lizy Kurian John and Byeong Kil Lee, Digital Systems Using Verilog, Cengage Learning, 2016
3. Louis Scheffer, Luciano Lavagno, Igor L. Markov and Grant Martin, Electronic Design Automation for IC Implementation, Circuit Design, and Process Technology (Electronic Design Automation for Integrated Circuits Handbook), 2nd, CRC Press 2016

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

1. *Manual Projek Sarjana Muda (PSM)*, Fakulti Teknologi Kejuruteraan, Universiti Teknikal Malaysia Melaka.

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 organisatition, 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

1. S.Thomas Foster., *"Managing Quality",* Second Edition, Pearson, Prentice Hall Inc.
2. Barrie G. Dale. *"Managing Quality",* Fifth Edition
3. Stephen R. Covey's book, *The 7 Habits of Highly Effective People*

BETE 3424
EMBEDDED SYSTEMS APPLICATION /
APLIKASI SISTEM TERBENAM

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 System, 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

1. Elecia White, “Making Embedded Systems: Design Pattern for Great Software”, O”Reilly Media, 2011
2. Tim Wilmshurst, “Designing Embedded Systems with PIC Microcontrollers, Second Edition: Principles and Applications”, Newnes, 2009.
3. Dogan Ibrahim“PIC Microcontroller Projects in C”, Newnes, 2014

BETT 4803
SATELLITE COMMUNICATION / KOMUNIKASI SATELIT

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

1. Timothy Pratt, Charles Bostian, Jeremy Allnutt, “Satellite Communication”, JWiley Publications 2nd Editions, 2003.
2. Wilbur L. Pritchard, Robert A Nelson, Hendri G. Suyderhoud, “Satellite Communication Enginering”, Pearson Publications 2003.
3. M. Richharia,, Satellite Communication, BSP, 2003
4. K.n. Raja Rao, Fundamentals of Satellite Communications, PHI, 2004
5. G. Maral & M. Bousquet, Satellite Communications Systems, 4th Edition, John Wiley & Sons, 2002.
6. Dennis Roddy, Satellite Communications, 3rd Edition, McGraw Hill, 2001

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

Introduction to Terrestrial Systems: shape of the Earth, maps and coordinate systems/Datum, distances and direction on the surface of the Earth, errors calculations. Introduction to Radar: continuous scan, radar equations, types of radar dispersion characteristics. Hyperbolic Systems: OMEGA, DECCA, LORAN-C.Direction Finding: frequencies and transmitter, directivity, receiver antenna, accuracies.Aircraft Systems: VHF Omnidirectional Range (VOR), Distance Measuring Equipment (DME), Instrument Landing System (ILS), Microwave Landing System (MLS).Introduction to Satellite Systems: satellite orbits and geometry, satellite navigation principles, error calculations.TRANSIT: satellites, navigation principles, receiver, frequencies, accuracy. Coding of Satellite Signals: spread spectrum, spreading functions, correlation function, generation of the codes, receiver, spread spectrum in NAVSTAR/GPS. NAVSTAR/GPS: satellite orbits, satellites, control segment, navigation messages, receiver, differential GPS, accuracy, integration with other navigation systems. GLONASS: satellite orbits, navigation signals, codes, navigation messages, receiver, accuracy. Other Satellite Navigation Systems: TSIKADA, STARFIX, GEOSTAR/LOCSTAR, NAVSTAR, Galileo, Beidou/Compass.

REFERENCES

1. John W. Betz, Engineering Satellite-Based Navigation and Timing: Global Navigation Satellite Systems, Signals, and Receivers, Wiley, 2015
2. Mohinder S. Grewal and Angus P. Andrews, Global Navigation Satellite Systems, Inertial Navigation, and Integration, Wiley.2013
3. B. Hofmann-Wellenhof, Klaus Legat and M. Wieser, Navigation Principles of Positioning and Guidance, Springer-Verlag, 2011

BETZ 4843
BIOMEDICAL ENGINEERING MAINTENANCE / PENYELENGGARAN KEJURUTERAAN BIOPERUBATAN

LEARNING OUTCOMES

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

1. Evaluate and determine fault based learned concepts.
2. Manipulates learned concepts in solving problems of the medical devices and electronic circuits.
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 quality assurance program and building facility for 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

1. D. R. Tomal and A. S. Agajanian, Electronic Troubleshooting, 4th ed. McGraw-Hill Education, 2014.
2. R. Khandpur, Troubleshooting Electronic Equipment. McGraw-Hill Education TAB, 2006.
3. R. G. Gupta, Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting. Tata Mcgraw-Hill Publishing Company Limited, 2001.

4. R. Pain, Practical Electronic Fault Finding and Troubleshooting. Oxford: Reed Educational and Professional Publishing Ltd, 1996.
5. R. Pease, Troubleshooting Analog Circuits (EDN Series for Design Engineers). Newnes, 1991
6. G. Cameron, TRIZICS : Teach yourself TRIZ, how to invent, innovate and solve "impossible" technical problems systematically. CreateSpace Independent Publishing Platform, 2010.
7. WHO, Maintenance and Repair of Laboratory, Diagnostic Imaging and Hospital Equipment, World Health Organization, 1994.

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

1. N. Özkaya, D. Leger, D. Goldsheyder, and N. Margareta, Fundamentals of Biomechanics : Equilibirium, Motion and Deformation, 4th ed. Springer, 2017.
2. N. Margareta and V. H. Frankel, Basic Biomechanics of Musculoskeletal System, 4th ed. Lippincott Williams & Wilkins, 2012.
3. J. Hamill, K. M. Knutzen, and T. R. Derrick, Biomechanical Basis of Human Movement, 4th ed. Lippincott Williams & Wilkins, 2015.

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

1. Louis Scheffer, Luciano Lavagno, Igor L. Markov and Grant Martin, Electronic Design Automation for IC Implementation, Circuit Design, and Process Technology (Electronic Design Automation for Integrated Circuits Handbook), 2nd, CRC Press 2016
2. Hongjiang Song, VLSI Analog Circuits: Algorithms, Architecture, Modeling, and Circuit Implementation, 2nd, McGraw Hill Professional, 2016
3. Yuan Taur and Tak H. Ning, Fundamentals of Modern VLSI Devices, 2nd Ed. Cambridge University Press, 2013

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

1. Louis Scheffer, Luciano Lavagno, Igor L. Markov and Grant Martin, Electronic Design Automation for IC Implementation, Circuit Design, and Process Technology (Electronic Design Automation for Integrated Circuits Handbook), 2nd, CRC Press 2016
2. Charles H. Roth, Lizy Kurian John and Byeong Kil Lee, Digital Systems Using Verilog, Cengage Learning, 2016
3. Louis Scheffer and Luciano Lavagno, EDA for IC System Design, Verification and Testing, CRC Press, 2016

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.