SUBJECT DETAILS FOR JTKE PROGRAMMES

BETI Course Core Subjects (K)

SEMESTER 1

BETR 1304
DIGITAL ELECTRONICS & SYSTEMS /
ELEKTRONIK & SISTEM DIGITAL

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Describe the common forms of number representation in digital electronics circuits and differentiate between digital and analog representations.
2. Implement simple logic operations using combinational logic circuits.
3. Identify, formulate, and solve the logical operation of simple arithmetic and other MSI (Medium Scale Integrated Circuit).
4. Apply the concepts of synchronous state machines using flip flop.
5. Design and analyze sequential systems in terms of state machines

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

REFERENCES

1. 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.

BETR 1313
COMPUTER AIDED DESIGN /
REKABENTUK TERBANTU KOMPUTER

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Distinguish different engineering drawing format and types.
2. Produce geometric, orthographic, isometric, section cut and detail drawing by using CAD.
3. Create in terms of 2D and basic 3D solid modeling using standard CAD software command tool.
4. Recommend an accurate engineering drawing based on given problem.

SYNOPSIS
The course concentrates on Computer Aided Drafting (CAD) software. CAD software is being used to produce engineering drawing. The students will be exposed to CAD interface, editing commands, coordinate system, template preparation and layer in order to produce various types of engineering drawing. 3D drawing will also be covered.

REFERENCES

1. Mohd Ramzan Zainal, Badri Abd Ghani dan Yahya Samian, 2000, Lukisan Kejuruteraan Asas, UTM, Skudai.
2. Mark Dix, Paul Riley, 2004, Discovering AutoCAD, Prentice Hall, New York.
3. Mohd Rizal Alkahari, 2009, Modul Lukisan Berbantu Komputer, Penerbit Universiti Teknikal Malaysia Melaka, Melaka.
4. David A. Madsen and David P. Madsen, 5th Edition, 2012, Engineering Drawing and Design, Cencage Learning.
5. David C.Planchard, CSWP, 2014. Engineering Design with Solidworks 2015, SDC Publications.

BETI 1303
ELECTRIC CIRCUIT FUNDAMENTAL /
PENGENALAN LITAR ELEKTRIK

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Understand the fundamental Ohm's Law and Kircchoff's Laws.
2. Analyze DC and AC (Steady state) circuits using Mesh and Nodal analysis.
3. Analyze DC and AC (Steady state) circuits using Superposition, Thevenin, Norton and Maximum Power Transfer Theorems.
4. Simulate the operation of electric circuit using computer simulation software.
5. Assemble electrical components correctly and measure electrical quantities for DC circuits.

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

REFERENCES
1. 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.

BETR 1323
MEASUREMENT / PENGUKURAN

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Define various measurement and instrument applications and standards.
2. Use the dc/ac meter to measure current, voltage, resistance, inductance and capacitance.
3. Use the oscilloscope to display and calculate the waveforms of electrical signals.
4. Evaluate several functions of sensors/transducers for instrumentation applications.
5. Practice the knowledge profesionally and ethically

SYNOPSIS
This subject discusses about measurement standard and calibration, unit and dimension, measurement and error, use voltmeter and ammeter using PMMC, AC voltmeter design, analog and digital meters, measurement using oscilloscope, measurement using DC or AC bridges, sensors and transducers, signal and data acquisition.

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.

SEMESTER 2

BETI 1311
ELECTRICAL WORKSHOP I / BENGKEL ELEKTRIK I

LEARNING OUTCOMES

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

1. Familarise with basic electrical components and testing equipments
2. Explain basic concept of electrical wiring, contactor, relay and timer control.
3. Read and construct circuit from a given domestic wiring and relay control schematic drawing.
4. Present the project results technically in written form or verbally.
5. Abide with the electrical regulation and safety in performing task

SYNOPSIS

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

REFERENCES

1. Akta Bekalan Elektrik 1990 (Akta 447) & Peraturan-Peraturan Elektrik 1994 (Pindaan 2015), 2015.
2. Malaysian Standard International Electrotechnical Commission (MS IEC) 60364, 2015.
3. Caddick, John, Electrical Safety Handbook, McGraw Hill, 2012.
4. Brian Scaddan, 17th Edition Wiring Regulations, Newnes, 2011.

BETI 1323
ELECTRIC & MAGNETISM / ELEKTRIK & KEMAGNETAN

LEARNING OUTCOMES

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

1. Explain the basic concept and the engineering applications of electromagnetic theory
2. Explain the concepts of electrostatics, magneto-statics and plane-wave propagation.
3. Identify the characteristics of Maxwell Equation.
4. Solve simple electromagnetic engineering problem.

SYNOPSIS

This course will discuss mainly about the theory and analysis of some basic electromagnetic waves and fields. It deals with topics regarding vector calculus including transformation of coordinate systems. It is then followed by electrostatics and magnetostatics characteristics such as their static equations, field, potential and boundary conditions. After that, it is continued with Maxwell's equations and wave propagation; Faraday's law, uniform plane waves, and skin depth. Finally, the course will be ended with some transmission line topics: Matching, transient, and Smith chart.

REFERENCES

1. Ulaby, F., Electromagnetics for Engineers, Pearson Education, 2005
2. Hayt, W. and Buck, J., Engineering Electromagnetics, 6th Edition, McGraw Hill International Edition, 2001.
3. Sadiku, M.N.O., Elements of Electromagnetics, 3rd Edition, Oxford University Press, 2001.
4. Raju, G.S.N., Electromagnetic Field Theory and Transmission Lines, 1st Edition, Pearson Education, 2006.
5. Paul, C, Whites, K, and Nasar, S., Introduction to Electromagnetic Fields, 3rd Edition, McGraw Hill,1998.

BETR 1334
ELECTRONIC DEVICES / PERANTI ELEKTRONIK

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Explain the concept of semiconductor devices such as Diode, BJT, JFET MOSFET and Op Amp.
2. Analyze and demonstrate the operation of Diode, BJT, JFET, MOSFET and Op Amp.
3. Simulate the operation of semiconductor devices using simulation software.
4. Demonstrate practical competence on semiconductor devices application circuits.

SYNOPSIS
Semiconductor devices and pn junction like conductive characteristics, semiconductor carrier, p type, n type and pn junction biasing. Semiconductor diode characteristics, pn junction, Schottky diode, Photodiode, operation of bipolar junction transistor (BJT); common base, common collector and common emitter configurations. Transistor JFET and MOSFET characteristics and biasing. Operational amplifier; comparator, inverting, no inverting, summing, differential and integral. Simulation modeling of the diode, BJT, JFET using PSPICE.

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.

BETI 1333
ADVANCED ELECTRICAL CIRCUIT /
LITAR ELEKTRIK LANJUTAN

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Describe first order for RL and RC circuits transient analysis.
2. Describe second order for RLC circuits transient analysis.
3. Convert time domain into s-domain using Laplace transforms method and analyze its frequency response.
4. Conduct experiments on frequency response of R,L and C circuits and the characteristics of RLC filters.
5. Determine the parameters of two-port network connected in series, parallel or cascade.

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

REFERENCES
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
ELECTRIC CIRCUIT FUNDAMENTAL / PENGENALAN LITAR ELEKTRIK

BETR 1343
COMPUTER PROGRAMMING /
PENGATURCARAAN KOMPUTER

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Describe and convert the problems into the appropriate solutions
2. Solve problems using software engineering principles
3. Produce code by applying suitable programming structures

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. Gaddis, T., (2015), Starting Out with C++:From Control Structures through Objects, 8th Edition, Global Edition, Pearson Education.
2. Daniel Liang, Y, (2014), Introduction to Programming with C++, 3RD Edition, Pearson Education.
3. Deitel, H.D., (2014), C++ How to Program,9th Edition, Pearson Education.
4. Nell, D., (2013), Programming and Problem Solving With C++: Comprehensive, 6th Edition, Jones & Bartlett Learning.
5. Gregoire, M., (2011), Professional C++, 2nd Edition, John Wiley & Son.

SEMESTER 3

BETI 2342
ELECTRICAL WORKSHOP II / BENGKEL ELEKTRIK II

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Familarise with electrical components and testing equipments
2. Explain basic concept of electrical wiring and motor starter.
3. Read and construct circuit from a given industrial wiring and motor starter schematic drawing.
4. Able to carry out troubleshooting procedure
5. Present the project results technically in written form or verbally.

SYNOPSIS
This subject is required students to carry out practical works in Electrical Workshop in order to gain learning experience in three phase wiring system and construct motor starter circuit. Students will experience in wiring and constructing circuit layout drawing, industrial wiring, motor starter and troubleshooting. Students are also emphasized on the safety and regulatory requirements. Assessment will be conducted on student ability in the functionality, wiring, testing, safety awareness, discipline while carry out the practical tasks.

REFERENCES
1. Akta Bekalan Elektrik 1990 (Akta 447) & Peraturan-Peraturan Elektrik 1994 (Pindaan 2015), 2015.
2. Malaysian Standard International Electrotechnical Commission (MS IEC) 60364, 2015.
3. Caddick, John, Electrical Safety Handbook, McGraw Hill, 2012.
4. Brian Scaddan, 17th Edition Wiring Regulations, Newnes, 2011.

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

BETI 2353
STATIC & THERMODYNAMIC /
STATIK & TERMODINAMIK

LEARNING OUTCOMES

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

1. State the basic concept of force and material mechanics.
2. Analyze the force on a mechanical system.
3. Understand and elaborate the forces on a mechanical system.
4. Define basic terms of thermodynamics and identify systems, properties and processes.
5. Use of property tables and draw property diagrams of pure substances to define the state of the system.
6. Define the ideal gas and use the related equations.
7. Apply the concept of First Law of Thermodynamics in Closed Systems and Control Volumes.
8. Analyze the concept of Second Law of Thermodynamics to determine the performance of heat engines, refrigerators and heat pumps.

SYNOPSIS

STATICS

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

THERMODYNAMICS

This course covers the basic concepts and definitions of engineering thermodynamics, energy, work and heat, properties of pure substances (relationships of P-v, T-v, P-T and T-s diagrams), First Law of Thermodynamics, Second Law of thermodynamics and Entropy.

REFERENCES

1. Hibbeler R. C., 2004, Statics and Mechanics of Materials, SI Edition, Prentice Hall, New York.
2. Riley W. F, Sturges L. D. Morris, D. H., 2002, Statics and Mechanics of Materials: An Integrated Approach, 2nd Edition, John Wiley & Sons, New York.
3. Hibbeler, R. C., 2004, Engineering Mechanics- Statics, 3rd SI Edition, Prentice Hall, New York
4. Cengel, Y. A. and Boles, M. A..2007. Thermodynamics: An Engineering Approach, 6th ed, McGraw Hill.Singapore.
5. S.C.Gupta,2008. Thermodynamics, 1st ed, Pearson Education(Singapore) Pte. Ltd
6. Sonntag, R.E., Borgnakke. C, Van .W and Gordon J., 2008. Fundamentals of Thermodynamics, 7th ed, John Wiley & Sons, Inc.New York.
7. Wark Jr., K. and Richards, D. E. 1999. Thermodynamics, 6th Edition, McGraw Hill.
8. Joel, R., 1996, Basic Engineering Thermodynamics, 5th ed, Prentice Hall. New York.

BETI 2364
ELECTRICAL TECHNOLOGY / TEKNOLOGI ELEKTRIK

LEARNING OUTCOMES

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

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

SYNOPSIS

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

REFERENCES

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.

BETR 2353
ANALOG ELECTRONICS / ELEKTRONIK ANALOG

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Explain the concept of BJT amplifier, active filter, voltage regulator, oscillator and power amplifier.
2. Analyze the operation and characteristics of BJT amplifier, active filter, power amplifier and power supply.
3. Aimulate the operation of BJT amplifier, active filter and oscillator using simulation software.
4. Conduct experiments and analyze data of BJT amplifier and oscillator.

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

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

SEMESTER 4

BETI 2373
ELECTRICAL MACHINES / MESIN ELEKTRIK

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Understand basic type of electrical machines, physical construction and equivalent electrical circuit diagrams.
2. Identify the difference of physical construction and working principles between dc machines and ac machines; and synchronous machines and asynchronous machines.
3. Run some specific test for electrical and mechanical parameters determination.
4. Investigate the performance of electric machines.

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

REFERENCES
1. Stephen J. Chapman, Electric Machinery Fundamentals, 5th ed., McGraw-Hill, 2011.
2. Austin Hughes, Electric Motors and Drives: Fundamentals, Types and Applications, Newnes, 2013.
3. Fitzgerald, Kingsley, Umans, Electric Machinery, 7th ed., McGraw-Hill, 2013.
4. Theodore Wildi, Electric Machines, Drives & Power System, 6th ed., Prentice Hall, 2013.

BETI 2383
POWER SYSTEM TECHNOLOGY /
TEKNOLOGI SISTEM KUASA

LEARNING OUTCOMES

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

1. Formulate the mathematical models of basic power system components.
2. Analyze the power system performance using the power system model and per-unit quantities.
3. Explain the basic concept of electrical power protection.
4. Demonstrate practical competence on power system equipments such as generator, transformer and transmission line.

SYNOPSIS

This subject gives the overall components of power system to the students without going into detail. The power system components will be modelled for the analysis purposes. The topics include per-unit quantities, transmission line, transformer, synchronous generator, power flows, symmetrical components, power protection and power system stability.

REFERENCES

1. JD Glover, MS Sarma, TJ Overbye, Power System Analysis & Design, 5th (SI) Edition, Thomson, 2012.
2. Hadi Saadat, Power System Analysis, 3rd Edition, Mc Graw Hill, 2011.
3. S. Ramar, S. Kuruseelan, Power System Analysis, PHI Learning, Pvt. Ltd., 2013.
4. Glover, Sarma, Power System Analysis and Design, 3rd ed., Thomson Learning, 2002.

BETR 3423
INSTRUMENTATION SYSTEM /
SISTEM INSTRUMENTASI

LEARNING OUTCOMES

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

1. Explain the principles and elements of instrument and data acquisition system
2. Apply the right sensors/transducers for instrument and data acquisition system
3. Design signal conditioning circuit for instrument and data acquisition system
4. Evaluate the A/D and D/A techniques, interfaces standards and types of data presentation
5. Exhibit communication and critical thinking skills on specialized, reliability and economics topics in instrumentation

SYNOPSIS

This subject emphasize on instrumentation elements for complete instrumentation system and data acquisition system such as sensors & transducers, signal conditioning & processing, A/D and D/A conversion, interfacing standards and data presentation. This subject also touches on some specialized instrumentation, reliability & economics in instrumentation and also introduces instrumentation for industrial and process control application.

REFERENCES

1. Roman Malaric, Instrumentation and Measurement in Electrical Engineering, 1st Ed., Brown Walker Press, 2011.
2. Clarence W. de Silva, Sensors and Actuators: Engineering System Instrumentation, 2nd Ed., CRC Press, 2015.
3. Alan S Morris, Measurement and Instrumentation: Theory and Application, 1st Ed., Butterworth-Heinemann, 2011.
4. John G. Webster Ramon Pallas-Areny Sensors and Signal Conditioning-International Edition, 2nd Ed., Wiley India Pvt Ltd, 2012
5. H S Kalsi, Electronic Instrumentation, 3ed Ed., Mc Graw Hill, 2010.

SEMESTER 5

BETI 3393
ADVANCED POWER SYSTEM /
SISTEM KUASA LANJUTAN

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Illustrate bus admittance and impedance matrices to be applied in power system analysis
2. Explain and analyze load flow, power control, fault studies and transient stability
3. Analyze load flow, power control, fault studies and transient stability using simulation software.

SYNOPSIS
This course deals with node equations of power system networks, development of bus admittance and bus impedance matrixes, utilization of bus admittance and bus impedance matrixes in power system analysis, i.e. symmetrical fault analysis, asymmetrical fault analysis, load flow study and transient stability analysis.

REFERENCES
1. Graigner and Stevenson Jr, Power System Analysis, McGraw Hill, 1994.
2. Sama and Glover, Power System Analysis and Design, 3rd ed., Brooks/Cole, 2002.
3. Hadi Saadat, Power System Analysis, International ed., McGraw Hill, 1999.
4. Marizan Sulaiman, Analisis Sistem Kuasa, Penerbit USM, 2004

PRE-REQUISITE
BETI 2383
POWER SYSTEM TECHNOLOGY / TEKNOLOGI SISTEM KUASA

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

LEARNING OUTCOMES
Upon completing this subject, the student should be able to
1. Identify the standard and regulation related to electrical installation.
2. Differentiate the characteristic, specification of circuit breakers and power cables.
3. Determine the method of earthing system and earthing arrangement.
4. Use standard design procedures to design of low voltage system with compliance to the regulation.
5. Perform testing and troubleshooting on low voltage installation.
6. Work in team as individual or with capacity as a leader in completing task

SYNOPSIS
This subject presents the principles and design of electrical distribution system. There are various issues of distribution system that are covered; including regulations and standards related to electrical installation. Characteristics and specifications for circuit breakers, cable size selection, and method of earthing and earthing arrangement are described in detail. The students are also exposed to the use of standard design procedures and the type of testing and troubleshooting required for low voltage systems.

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.

BETR 3414
PLC & APPLICATIONS / PLC & APLIKASI

LEARNING OUTCOMES

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

1. Describe the functionality of each components of PLC
2. Write and execute a PLC programming language that used in industrial application
3. Execute a PLC connection to input and output devices
4. Integrates the PLC hardware and software
5. Design a simple and complete automation system using PLC
6. Identify, analyze and solve critically the problems

SYNOPSIS

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

REFERENCES

1. D. Petruzella, Frank Programmable Logic Controller, 3rd Ed., McGraw Hill, 2005
2. Mikell P. Groover, Automation, Production Systems & Computer-Integrated Manufacturing, 3rd Ed., 2008
3. Morris, S.B, Programmable Logic Controllers, Prentice Hall, 2000.
4. Parr, E.A, Programmable Controllers: An Engineer's Guide, 2nd Ed., Newness 1999
5. Rohner, PLC: Automation with programmable logic controllers, MacMillan Press, 1996.

BETR 2383
CONTROL SYSTEM FUNDAMENTAL /
PENGENALAN SISTEM KAWALAN

LEARNING OUTCOMES

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

1. Describe the basic features and configuration of control systems.
2. Apply the mathematical model for electrical, mechanical and electromechanical linear time invariant systems.
3. Apply appropriate techniques to perform block diagram reduction of multiple subsystems in order to oBETain its transfer function.
4. Analyze the transient and steady state performance in time domain for first and second order systems.
5. Apply the Routh Hurtwitz criterion to determine stability of a system.
6. Apply other resources and ideas to complete the task given

SYNOPSIS

This subject will discuss about the concepts in control system; open and closed loop system; transfer function; signal flow graphs; feedback control system; hydraulic and pneumatic process control systems; modeling for electrical system, mechanical system, electromechanical system, speed control system and process control system such as current, temperature and flow; using MATLAB and Simulink.

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. Gopal, M, Control Systems: Principles and Design, 4th Edition, Mc Graw Hill, 2012.
5. Khalil Azha Mohd Annuar et. Al., Introduction to Control System, Penerbit UTeM, 2015.

BETI 3413
POWER ELECTRONICS / ELEKTRONIK KUASA

LEARNING OUTCOMES
Upon completing this subject, the students should be able to:
1. Define the characteristic of thyristors, bipolar devices, MOSFETs, IGBETs and choose the appropriate devices for an application.
2. Use the basic topology of converters, inverters and power supplies for device applications in industrial practices.
3. Analyze the characteristics and performance of rectifiers, choppers and inverters using simulation software such as PESIM and PsPice.
4. Design rectifiers, choppers, switch-mode power supplies (SMPS) and inverters.
5. Demonstrate practical competence on power electronics converter.
6. Integrate power electronics drives for electrical machines.

SYNOPSIS
This course is about the basic principles of semiconductor devices, switching process and the application in rectifier circuit, one and three-phase inverter, switching losses, heat sink, the application of semiconductor devices as AC to DC, DC to AC and DC to DC converters, circuits as DC drives, AC drives, snubbers and harmonic effects, and also the introduction to computer simulation (PESIM).

REFERENCES
1. 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.

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

BETI 3423
ACTUATORS & DRIVES / PENGGERAK & PEMACU

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

SYNOPSIS
This subject will introduce to the electrical, mechanical, pneumatic and hydraulic electrical actuator & drive system. This subject wills discussion on the definition, symbols, system, circuits, operation and component of the pneumatic, hydraulic and mechanical actuator system. Another part of this subject will covers on the electrical drive for DC and AC motor. It focuses on the fundamental of the electrical drive including element, block diagram, feedback, load characteristics and motor sizing. In addition special discussion on the four quadrants operation with chopper fed dc driver for DC motor drive and three phase drive system.

REFERENCES
1. Electric Drives – an integrative approach, Ned Mohan, MNPERE, Minneapolis
2. Power Electronic Control of AC Motors – JMD Murphy & FG Turbull, Pergamon Press
3. Electric motor drives, R. Krishnan, Prentice–Hall, 2001

BETI 3433
ENERGY EFFICIENCY / KECEKAPAN TENAGA

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

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

REFERENCES
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 3443
COMMUNICATION SYSTEM / SISTEM KOMUNIKASI

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Explain the basic principles and components of telecommunication systems.
2. Apply knowledge and analyze AM, SSB, FM and digital modulation/demodulation techniques that are typically used in telecommunication systems.
3. Apply and analyze the effect of noise in telecommunication systems.
4. Desribe the various types and characteristics of transmission lines used as the transmission media.

SYNOPSIS
Topics covered are: Introduction to Telecommunications, Transmission Modes, Power Measurements, Electromagnetic Frequency Spectrum, Bandwidth and Information Capacity, Amplitude Modulation Transmission & Reception, Single-Sidebands Communications Systems, Angle Modulation Transmission & Reception, Digital communication, FM Stereo, Noise in Telecommunication Systems and Transmission Lines.

REFERENCES
1. Wayne Tomasi, Electronics Communications Systems Fundamentals Through Advanced, Prentice Hall, Fifth Edition, 2004.
2. Jeffrey S. Beasley, Modern Electronic Communication, Pearson, 9th Edition, 2008.
3. William Schweber, Electronics Communication Systems A Complete Course, Prentice Hall, Third Edition, 1999.
4. John Proakis, Essentials of Communication Systems Engineering, Prentice Hall, 2005.
5. George Kennedy, Electronics Communication Systems, McGraw Hill, 2004.
6. R.E. Ziemer, Principles of Communication, John Wiley & Sons, 2002.

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

BETI 4803
POWER SYSTEM OPERATION & AUTOMATION / OPERASI & AUTOMASI SISTEM KUASA

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Describe the power system operation criteria and standards appropriately.
2. Apply asset management strategies through Reliability Centre Maintenance (RCM) properly.
3. Explain the basic structure and component of Supervisory Control & Data Acquisition (SCADA) and Remote Terminal Unit (RTU) correctly.
4. Use the basic application of Supervisory Control & Data Acquisition (SCADA) and its component properly.
5. Explain the energy and distribution management system accurately.
6. Practice the knowledge professionally and ethically

SYNOPSIS
This subject discuss about operation criteria and standards use in power system. It also cover the load and operation management, asset management strategies, RCM in power system especially in distribution level. This subject also cover the automation in power system which is focus in basic SCADA system, RTU and it components. Describe RTU, SCADA and master station protocol and communication. Explain about Distribution Management System (DMS) and Energy Management System (EMS).

REFERENCES
1. Boca Raton, The Electric Power Engineering Handbook, 3rd Ed., CRC Press, 2012.
2. H.L Wilis, R.R. Schrieber, Aging Power Delivery Infrastructures, 2nd Ed., CRC Press, 2013.
3. U.A Bakshi, M.V Bakshi, Transmission & Distribution, 2nd Ed., India Technical Pub., 2012.
4. M. Cepin, Assessment of Power System Reliability: Methods and Applications, Springer, 2011.

BETI 4813
QUALITY IMPROVEMENT TOOLS / KAEDAH PENAMBAHBAIKAN KUALITI

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Describe the seven basic and new quality improvement tools.
2. Use the Acceptance Sampling System.
3. Construct the Control Charts for Variables and Attributes as well as others Statistical Process Control (SPC) tools.
4. Apply the tools and techniques of SPC to solve quality problems.

SYNOPSIS
This subject focuses on the tools of quality. It begins with a brief discussion of Ishikawa's basic tools of quality. Ishikawa's seven basic tools include flow charts; check sheets, the histogram and control charts, scatter diagrams, cause and effect diagrams and Pareto charts. It is later followed by the new seven quality tools (N7) for quality are introduced and discussed, including the affinity diagram, the interrelationship digraph, tree diagrams, prioritization grids, matrix diagrams, process decision program charts, and activity network diagrams. It also covers various problem solving methods such as Statistical Process Control (SPC) and Acceptance Sampling. The tools are essential to improve processes and products quality.

REFERENCES
1. Dale H. Besterfield, "Quality Control", 7th Edition, Prentice Hall, 2004
2. Douglas C. Montgomery, "Introduction to Statistical Quality Control, 5th Edition,John Wiley and Sons, 2005
3. Dona C. S. Summers, "Quality", 3rd Edition, Prentice Hall, 2003
4. Mark A. Fryman, "Quality and Process Improvement", Thomson Learning, 2002
5. Amiyata Mitra, "Fundamentals of Quality Control", 2nd Edition, Prentice Hall, 1998

BETI 4823
HIGH VOLTAGE TECHNOLOGY /
TEKNOLOGI VOLTAN TINGGI

LEARNING OUTCOMES

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

1. Explain the concept of high voltage technology appropriately.
2. Describe the methods of HVAC, HVDC and impulse voltage generation properly.
3. Distinguish between different types of high voltage diagnostics and testing technique accurately.
4. Apply measurement methods of high voltages and high currents precisely.
5. Define overvoltage phenomena and insulation coordination in electrical power systems appropriately.
6. Exhibit soft skills such as critical thinking and problem solving skills.

SYNOPSIS

This subject is explaining about overview of high voltage technology and its standards. This subject also focuses on coordination of insulation in gases, solid and liquids and its coordination. It also describes on generation of HVAC, HVDC and impulse voltage and also the measurement methods of high voltage. The students are also exposed to diagnostic and testing techniques testing and explain about overvoltage phenomena in electrical power systems. Explain the procedure for design the lightning protection and its components.

REFERENCES

1. M S Naidu and V Kamaraju, High Voltage Engineering, McGraw Hill 2004.
2. High Voltage Engineering Fundamentals, Newnes, 2000.
3. Dieter Kind & Kurt Feser, 1st publication, High Voltage Test Techniques
4. Hussain Ahmad, Kilat dan Perlindungan, Penerbit UTM,1998.
5. E. Kuffel, W.S. Zaengl & J. Kuffel, High Voltage engineering Fundamentals

BETR 4813
INDUSTRIAL PROCESS CONTROL /
KAWALAN PROSES INDUSTRI

LEARNING OUTCOMES

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

1. describe the process variables in the process control industries
2. evaluates the process variables, elements and instruments for pressure, temperature, level, flow and analytical process
3. analyze the control loops characteristics in the process control industries
4. apply an appropriate controllers for process control industries
5. apply an automation technologies for process control such as SCADA and DCS
6. identify, analyze, and solve critically the technical problems

SYNOPSIS

This subject will cover topic on introduction to industrial process control including basic terms and diagrams. It's also emphasized on process variables, elements, and instruments for temperature, level and flow of process control. The right controllers for process control are discussed and control loops in process control are analyzed. Applications of automation technologies such as SCADA and DCS for process control are also explained.

REFERENCES

1. Curtis D. Johnson, Process Control Instrumentation Technology, 8th ed. Pearson, 2014.
2. Dale E. Seborg, Process dynamics and control, 3rd ed,Hoboken, NJ: John Wiley & Sons, 2011.
3. Myke King, Process control : a practical approach, Chichester: John Wiley & Sons, 2011.

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.