APPENDIX A – SYLLABI

ELECTRICAL ENGINEEING STUDY PROGRAM

HASANUDDIN UNIVERSITY

COURSE SYLLABUS: **ELECTRIC CIRCUIT 1**

1. Course number: 101D4113.
   Course name: Electric Circuit 1

2. Credits: 3
   Contact hours: 42 hours

3. Instructors:
   a. Ir.Hj. Zaenab Muslimin, MT
   b. Dr.Ir. Hj. Sri Mawar Said, MT
   c. Hansiaty, ST., MT

4. Text book, title, author, publisher and year:
   a. Introductory Circuit Analysis, 12th edition, Robert L. Boylestad, Publisher: Prentice Hall, Pearson Education International, 2014.
   b. Principles of Electrical Circuits Electron Flow Version, Thomas L. Floyd, 6th edition, Publisher: Prentice Hall, Pearson Education International, 2003.

5. Specific course information:
   a. This course discusses about Basic understanding of electrical circuits, Series-Parallel Network, Source Conversions, Methods of Analysis, Circuit of Equation, Complex Numbers, Sinusoidal Alternating Waveforms, Phasor and Resonance
   b. Pre-requisite: Calculus I, Calculus II, Basic Physics I, Basic Physics II
   c. Course type: Required (R)

6. Specific goals for the course:
   a. The student will able to understand the basic understanding of DC electric power circuits and the basic law of electricity
   b. The student will able to analyze series and parallel circuits
   c. The student will able to analyze circuits with one source or two sources and are able to convert voltage sources into current sources and vice versa
   d. The student will able to understand the notion of AC electricity and are able to apply complex numbers to basic analysis of AC electrical circuits.
   e. The student will able to understand the meaning of phasor and are able to analyze resonance circuits.

7. Brief list of topics to be covered:
   a. Basic understanding of electrical circuits
   b. Series-Parallel Network
   c. Source Conversions
   d. Methods of Analysis

e. Circuit of Equation
f. Complex Numbers
g. Sinusoidal Alternating Waveforms
h. Phasor
i. Resonance

COURSE SYLLABUS: **LOGIC CIRCUITS**

1. Course number: 102D4112.
   Course name: Logic Circuits

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:
   a. Prof. Andani (Course Coordinator)
   b. Dr. Ing. Faizal Arya Samman
   c. Ida Sahali, S.T., M.T.
   d. Andini Dani Achmad, S.T., M.T.

4. Text book, title, author, publisher and year:
   a. Digital System Principle and Application, W. Tocci, Publisher: Prentice Hall International Edition, 1995.
   b. Digital Principles and Application, Leach Malvino, Publisher: Mc. Graw Hill, 1990.
   c. Switching Theory and Logical, F.J. Hill, G.R. Paterson, Publisher: John Willy & Sons, 1981.
   d. Digital Engineering Design, Richard F. Tinder, Publisher: Prentice Hall International Edition, 1991.

5. Specific course information:
   a. This course discusses about Boolean Algebra, de Morgan Theory, Binary Codes, Basic Logic Gates, Simplification of Circuits, Designing Combinational Digital Circuits
   b. Pre-requisites: N/A
   c. Course type: Required (R)

6. Specific goals for the course
   a. The student will able to understand about Binary Codes
   b. The student will able to understand about Boolean Algebra and de Morgan Theory
   c. The student will able to design simple logic circuit
   d. The student will able to understand working principle of several combination circuits

7. Brief list of topics to be covered
   a. Introduction: Logic Circuit and Digital System
   b. Digital Number System
   c. Logic Gates
   d. Boolean Algebra
   e. Simplification of Boolean
   f. Combinational Circuit

COURSE SYLLABUS: **ELECTRIC CIRCUIT 2**

1. Course number: 121D4123
   Course name: Electric Circuit 2

2. Credits: 3
   Contact hours: 42 hours

3. Instructors:
   a. Dr.Ir.Hj. Sri Mawar Said, MT
   b. Ir. Hj. Zaenab Muslimin, MT
   c. Hansiaty, ST., MT

4. Text book, title, author, publisher and year:
   a. Introductory Circuit Analysis, Robert L. Boylestad, 12th Edition, Publisher: Prentice Hall, Pearson Education International, 2014.
   b. Principles of Electrical Circuits Electron Flow Version, Thomas L. Floyd, 6th Edition, Publisher: Prentice Hall, Pearson Education International, 2003.

5. Specific course information:
   a. This course discusses about real and reactive power of an electrical circuit, Thevenin's and Norton's theorem, analysis transient in electrical circuit using differential equation, using transformation Laplace, and three phase circuits.
   b. Pre-requisites: Calculus I, Calculus II, Basic Physics I, Basic Physics II, Electric Circuit I
   c. Course type: Required (R)

6. Specific goals for the course:
   a. The student will able to calculate real and reactive power of an electrical circuit.
   b. The student will able to using Thevenin's and Norton's theorem of an electrical circuit.
   c. The student will able to analyze transient in electrical circuit using differential equation, and using transformation Laplace.
   d. The student will able to use three phase circuits.

7. Brief list of topics to be covered:
   a. Real and reactive power
   b. Thevenin's and Norton's theorem
   c. Analyze transient
   d. Three phase circuits

COURSE SYLLABUS: **ADVANCED PHYSICS**

1. Course number: 206D4112.
   Course name: Advanced Physics

2. Credits: 2
   Contact hours: 27 hours

3. Instructors: Dr. Indar Chaerah Gunadin, ST., M.T

4. Text book, title, author, publisher and year:
   a. *Konsep Fisika Modern* (Translated by The Houw Liong), Arthur Beiser, Publisher: Erlangga, 1981.
   b. Modern Physics, Serway, Moses dan Moyer. Publisher: Saunders College Publishing, 1997.
   c. Modern Physics from α to Z, William J. Rohlf, Publisher: John Wiley & Sons Inc., 1994.

5. Specific course information
   a. This course discusses about the field of physics specifically in themes related to modern physics.
   b. Pre-requisite: N/A
   c. Course type: Required (R)

6. Specific goals for the course
   a. The student will able to understand the basic theory of relativity. Relativity includes special relativity, the principle of light-propagating relativity, experimentation Michelson-Morley, special relativity postulate, the consequences of special relativity: dilated time, long contractions, twin paradoxes; Galileo Galilei's transformation, Lorentz transformation, relativistic momentum, relativistic energy, mass as a measure energy, the law of conservation of relativistic, mass and energy.
   b. The student will able to distinguish the Quantum theory from light includes Hertz experiments, black body radiation, Rayleigh & Jeans lawand Planck's law, quantization of light and photoelectric effects, Compton effects and x-rays, wave complement - particles.
   c. The student will able to understand the atomic model includes atoms as constituent matter, the composition of atoms (the price of elementary charge) the atomic model of Rutherford, atoms Bohr (spectral line, Bohr quantum model of atoms), correspondence principle, experiment Frank Hertz
   d. The student will able to understand the wave of material includes the de Broglie postulate and explanation de Broglie about quantization in the Bohr model, the Davisson-Germer experiment, group wave and dispersion, Heisenberg's uncertainty principle, material wave function, duality of electron diffraction particle wave descriptions in function terminology wave of matter.
   e. The student will able to understand the atomic structure includes magnetic orbitals and Zeeman effects normal, electron spin, spin orbit interaction and

other magnetic effects, symmetry exchange and the exclusion principle, periodic table, x-ray spectrum and Moseley's law.

f. The student will able to understand the Structure of molecules include bonding mechanisms (ionic, covalent, Hewidinger, Van der Waals), molecular and vibration rotation, molecular spectrum.
g. The student will able to understand about the solid substances include: bonds in substances solid, classical free electron models, Ohm's Law, energy band theory, and devices semiconductor.
h. The student will able to understand the core structure includes: mass and charge, structure and core size core stability, core spin and magnetic moment, bond energy and core force, core model radioactivity, decay processes (alpha, beta, and gamma), natural radioactivity.
i. The student will able to understand the applications of core physics include: core reactions, cross-sectional reactions, nuclear fission, reactors nuclear, nuclear fusion, particle interaction with matter, and radiation detector.

7. Brief list of topics to be covered
    a. Explanation of descriptions and syllabi, special relativity, the principle of relativity, Michelson-Morley experiment, special relativity postulate the consequences of special relativity.
    b. Galileo Galilei's transformation, Lorentz transformation, momentum relativistic, relativistic energy, mass as a measure of energy, law eternity: relativistic, mass, and energy momentum. Transformer: Principle of transformer operation, transformer connections.
    c. Quantum Theory of light
    d. Atomic model: atom as the constituent of matter, atomic model Thompson, Rutherford's atomic model, atomic spectrum.
    e. Bohr florets model of atoms, correspondence principle, experiment Frank – Hertz.
    f. The nature of the wave from the material.
    g. Magnetic orbitals and normal Zeeman effect, electron spin, spin orbit interactions and other magnetic effects
    h. Symmetry exchange and the exclusion principle, table periodic, spectrum light x and Moseley's law.
    i. Molecular structure: the mechanism of bonding atoms in molecules, levels molecular rotational energy level
    j. Level of molecular vibrational energy level, molecular spectrum.
    k. Solid substances: bonds in solids, classical free electron models
    l. Core structure: mass and particle loading of the core, structure and core size, core stability, bond energy and core style
    m. Core model, radioactivity, decay process, natural radioactivity
    n. Core physics application: core reaction, cross section reaction, nuclear fission
    o. Nuclear reactors, nuclear fusion, particle interactions with matter, detectors radiation

COURSE SYLLABUS: **ADVANCED MATHEMATICS 1**

1. Course number: 201D4113.
   Course name: Advanced Mathematics 1

2. Credits: 3
   Contact hours: 42 hours

3. Instructors:
   a. Dr. Ir. Ingrid Nurtanio, MT
   b. Dr. Eng. Intan Sari Areni, ST., MT
   c. Dr.Eng. Ir. Dewiani, MT
   d. Andini Dani Achmad, ST., MT

4. Text books, title, author, publisher and year:
   a. Advanced Engineering Mathematics, 10th edition, Kreyszig Erwin, Publisher: John Wiley & Sons, Inc, 2011.
   b. Matematika Teknik, 5th edition, K.A. Stroud, Publisher: Erlangga, 2004.

5. Specific course information:
   a. This course discusses about Differential Equations (1st, 2nd and higher order), Phasa Plane, Laplace Transformation, Vector and Vector Algebra, Matrix, and Linear Equation.
   b. Pre-requisite: Calculus I, Calculus II
   c. Course type: Required (R)

6. Specific goals for the course:
   a. The student will be able to understand and apply the theory of ordinary differential equations, differential equation systems, Laplace transforms, matrices, linear systems, vector differential calculus, eigenvalue problems, integral vector calculus
   b. The student will be able to use mathematics as a basis for analyzing, formulating and solving problems in the electrical engineering field.

7. Brief list of topics to be covered:
   a. First Order Differential Equations
   b. Second Order Differential Equations
   c. Higher Order Differential Equations
   d. Differential Equation System – Phase Plane
   e. Laplace Transforms
   f. Matrices, Linear Systems
   g. Eigenvalue problems
   h. Vector differential calculus
   i. Vector Integral calculus

COURSE SYLLABUS: **BASIC ELECTRICAL POWER ENGINEERING**

1. Course number: 202D4112.
   Course name: Basic Electrical Power Engineering

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:
   a. Dr. Ir. Sri Mawar Said, M.T (course coordinator)
   b.

4. Text books, title, author, publisher and year:
   a. Introduction to Electrical Power Systems, Mohamed E. El-Hawary, Pubisher: IEEE Press, 2008.
   b. Dasar Teknik Tenaga Listrik dan Elektronika Daya, Zuhal, Publisher: PT Gramedia, 2000.

5. Specific course information:
   a. This courses material discusses about the principles and basics of electrical power system in general including basic theory of electric energy system, structure of power systems, power generation, transformer, transmission, distribution system, and electricity load/ electricity energy consumption.
   b. Pre-requisite: -
   c. Course type: Required (R)

6. Specific goals for the course:
   a. The student will understand the basic theory of electric energy system and structure of power systems.
   b. The student will be able to distinguish the principle process of electricity generation from thermal power plants and power plants based renewable energy (RE).
   c. The student will understand the working principle of transformer and its connection.
   d. The student will understand the importance of transmission network, line parameters, transmission voltages and line models.
   e. The student will understand the purpose of distribution system, distribution network, distribution equipments and protection system.
   f. The student will understand the working principle and characteristics of electric machines (DC and AC generators; and DC and AC motors).
   g. The student will understand types of electricity loads, characteristics, and load drivers.
   h. The student will be able to calculate electricity energy consumption.
   i. The student will understand the general theory/ basic concept and working principle of the components in an electric power system.

7. Brief list of topics to be covered:
    a. Introduction: basic theory for electric energy system, components of a power system.
    b. Power generation: working principles of electricity generation (thermal power plants and electricity production based renewable energy sources).
    c. Transformer: principle of transformer operation, transformer connections.
    d. Electric power transmission: purpose of transmission network, standard transmission voltages, line parameters, transmission line models.
    e. Electric distribution system: purpose of distribution system, distribution network, distribution systems (overhead and underground), distribution equipments, distribution system protection.
    f. Generator: types of generators, working principles and characteristics of DC and AC generators.
    g. Electric motor: types of motors, working principle and characteristics of DC and AC motors.
    h. Electrical load: types of electrical loads (residential, commercial, industrial), load characteristics, load drivers, electricity energy usage.

COURSE SYLLABUS: **BASIC ELECTRONICS**

1. Course number: 233D4102.
   Course name: Basic Electronics

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:
   a. Prof. Dr. Ir. Andani Achmad (course coordinator)
   b. Dr.-Ing. Ir. Faizal Arya Samman
   c. Dr. Eng. Wardi
   d. Dr. Ejah Umraeni Salam
   e. Muhammad Anshar, PhD.

4. Text books, title, author, publisher and year:
   a. Electronic Devices and Circuit Theory, 11th edition, Robert C. Boylestad, Publisher: Pearson Education, 2013.
   b. Principles of Electronics, 8th edition, Albert Paul Malvino, David Bates, Publisher: McGraw-Hill Education, 2016.
   c. Microelectronic Circuit Design, 4th edition, Richard C. Jaeger, Travis N. Blalock, Publisher: McGraw-Hill, 2011.

5. Specific course information:
   a. The course material discusses about the characteristics of electronic devices such as diode, bipolar junction transistor (BJT) and field effect transistor (FET), as well as their applications in basic electronic circuits.
   b. Pre-requisite: Electric Circuits I, Electric Circuits II
   c. Course type: Required (R)

6. Specific goals for the course:
   a. The student will be able to explain the use of electronic circuits in many embedded and consumer electronic applications
   b. The student will be able to explain the voltage-current characteristics of diode, bipolar junction transistor (BJT) and field effect transistor (FET), especially metal-oxide silicon field effect transistor (MOSFET)
   c. The student will be able to explain the basic applications of diode such in rectifier, clamping and clipping circuits
   d. The student will be able to analyses a simple electronic circuit with a DC bias voltage configuration, such fixed-bias, collector feedback bias, voltage-divider bias, etc.
   e. The student outcomes listed in Criterion 3 are addressed by the course

7. Brief list of topics to be covered:
    a. Electronic devices overviews: diode (PN junction, zener, schottky, LED, photodiode), bipolar junction transistor (BJT) and field effect transistor (FET), especially metal oxide silicon FET or MOSFET
    b. Diode characteristics and applications in rectifier, clipping and clamping circuits.
    c. BJT's VI characteristics: NPN and PNP types.
    d. BJT circuit biasing techniques: DC load curves, DC operating points.
    e. MOSFET's VI characteristics: N-channel MOS (NMOS) and P-channel MOS (PMOS).
    f. MOSFET circuit DC biasing techniques: DC load curves, DC operating points.
    g. BJT small signal operation: AC and DC signal analysis.
    h. BJT applications in power amplifier: class A, class B, class AB and class C power amplifier.
    i. BJT applications in simple voltage regulator: shunt regulator, series regulator.
    j. Operational amplifier (Op-Amp): basic model and its applications as integrators, inverting and non-inverting amplifier, filter and etc.
    k. Transistors in digital domain: resistor-transistor logic (RTL) and transistor-transistor logic (TTL).

COURSE SYLLABUS: **BASIC ELECTRONICS LABORATORY**

1. Course number: 209D4112.
   Course name: Basic Electronics Laboratory

2. Credits: 1
   Contact hours: 14 hours

3. Instructors:
   a. Prof. Dr. Ir. Andani Achmad (course coordinator)
   b. Dr.-Ing. Ir. Faizal Arya Samman
   c. Dr. Eng. Wardi
   d. Dr. Ejah Umraeni Salam
   e. Muhammad Anshar, PhD

4. Text books, title, author, publisher and year
   a. Electronic Devices and Circuit Theory, 11th edition, Robert C. Boylestad, Publisher: Pearson Education, 2013.
   b. Principles of Electronics, 8th edition, Albert Paul Malvino, David Bates, Publisher: McGraw-Hill Education, 2016.
   c. Microelectronic Circuit Design, 4th edition, Richard C. Jaeger, Travis N. Blalock, Publisher: McGraw-Hill, 2011.
   d. SPICE for Power Electronics and Electric Power, 2nd edition, Muhammad H. Rashid, Hasan M. Rashid, Publisher: CRC Taylor & Francis, 2006.

5. Specific course information
   a. The course material contains some lab works on how to use measurement instrumentation such as oscilloscope, multi tester, function generator, etc. and how to analyze in practice some basic electronic circuit.
   b. Pre-requisite: Electric Circuits I, Electric Circuits II
   c. Course type: Required (R)

6. Specific goals for the course
   a. The student will be able to use instrumentations to measure electric or electronic signals.
   b. The student will be able to design and analyze in practice some basic electronic circuits using electronic devices such as diode, transistor (BJT), etc.
   c. The student will be able to explain the role of the electronic device in the practiced circuit.

7. Brief list of topics to be covered:
    a. The calibration of measurement instrumentations.
    b. The use of measurement instrumentations to measure electronic signals in a basic electronic circuit.
    c. Diode application in rectifier, clamping and clipping circuits.
    d. BJT transistor biasing technique.
    e. Transistor application in a simple power amplification circuit.
    f. Transistor application in a simple DC regulator circuit.
    g. Transistor application as an electronic switch.
    h. Transistor application in digital regime: Resistor-Transistor Logic, Transistor-Transistor Logic (TTL).

COURSE SYLLABUS: **BASIC ELECTRONICS LABORATORY**

1. Course number: 209D4112.
   Course name: Basic Electronics Laboratory

2. Credits: 1
   Contact hours: 14 hours

3. Instructors:
   a. Prof. Dr. Ir. Andani Achmad (course coordinator)
   b. Dr.-Ing. Ir. Faizal Arya Samman
   c. Dr. Eng. Wardi
   d. Dr. Ejah Umraeni Salam
   e. Muhammad Anshar, PhD

4. Text books, title, author, publisher and year
   a. Electronic Devices and Circuit Theory, 11th edition, Robert C. Boylestad, Publisher: Pearson Education, 2013.
   b. Principles of Electronics, 8th edition, Albert Paul Malvino, David Bates, Publisher: McGraw-Hill Education, 2016.
   c. Microelectronic Circuit Design, 4th edition, Richard C. Jaeger, Travis N. Blalock, Publisher: McGraw-Hill, 2011.
   d. SPICE for Power Electronics and Electric Power, 2nd edition, Muhammad H. Rashid, Hasan M. Rashid, Publisher: CRC Taylor & Francis, 2006.

5. Specific course information
   a. The course material contains some lab works on how to use measurement instrumentation such as oscilloscope, multi tester, function generator, etc. and how to analyze in practice some basic electronic circuit.
   b. Pre-requisite: Electric Circuits I, Electric Circuits II
   c. Course type: Required (R)

6. Specific goals for the course
   a. The student will be able to use instrumentations to measure electric or electronic signals.
   b. The student will be able to design and analyze in practice some basic electronic circuits using electronic devices such as diode, transistor (BJT), etc.
   c. The student will be able to explain the role of the electronic device in the practiced circuit.

7. Brief list of topics to be covered:
    a. The calibration of measurement instrumentations.
    b. The use of measurement instrumentations to measure electronic signals in a basic electronic circuit.
    c. Diode application in rectifier, clamping and clipping circuits.
    d. BJT transistor biasing technique.
    e. Transistor application in a simple power amplification circuit.
    f. Transistor application in a simple DC regulator circuit.
    g. Transistor application as an electronic switch.
    h. Transistor application in digital regime: Resistor-Transistor Logic, Transistor-Transistor Logic (TTL).

COURSE SYLLABUS: **BASIC TELECOMMUNICATION**

1. Course number: 203D4112.
   Course name: Basic Telecommunication

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:
   a. Dr.Eng. Ir. Dewiani, MT
   b. Dr. Eng. Wardi
   c. Andini Dani Achmad, S.T., M.T.

4. Text book, title, author, publisher and year:
   a. Electronic Communication, Dennis Roddy, John Coolen, Translated by: Kamal Idris,IR, Publisher: Erlangga,1990
   b. Electronic Communication, Rodden, Publisher: Prentice Hall,1985
   c. Martin, Telecommunication and Computer
   d. Data Network Concept,Theory and Practice, Uyless Black, Publisher: PHI, 1989.
   e. Sistem Telekomunikasi, PH Smale, Translated by: Chris Timotius, Publisher: Erlangga, 1995.
   f. Fundamentals of Telecommunications, Roger L. Freeman, Publisher: John Wiley & Sons, Inc, New York, 1999.
   g. Telecommunications and Networks, K.M. Hussain D.S. Hussan, Publisher: Butterworth-Heinemann, Oxford, 1997.

5. Specific course information:
   a. The course material discusses about recognize the principles and basics of telecommunication system in general including signals, frequency spectrum, modulation and demodulation systems, quality system, types of telecommunication system, and future telecommunication technology.
   b. Prerequisite: -
   c. Course type: Required (R)

6. Specific goals for the course:
   a. The student will understand the basic concept of telecommunication
   b. The student will understand the classification of transmission media of telecommunication and kinds of the transmission media
   c. The student will understand types of topology telecommunication network
   d. The student will understand frequency spectrum, antenna working principle, and types of radio propagation
   e. The student will understand analog modulation and demodulation techniques

f. The student will be able to calculate the quality of telecommunication system
g. The student will understand working principle several kinds of system telecommunication
h. The student will understand the basic concept of data communication
i. The student will understand the future technology of telecommunication
j. The student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

7. Brief list of topics to be covered:
    a. Basic Concepts of Telecommunication
    b. Telecommunication Transmission Media
    c. Topology Telecommunication Network
    d. Antenna and Radio Wave Propagation
    e. Analog Modulation and Demodulation
    f. Decibels Concept
    g. Introduction of Quality Telecommunication System
    h. Introduction of Cable Network Telecommunication System
    i. Introduction of Optic Telecommunication System
    k. Introduction of Radio Telecommunication System
    l. Introduction of Satellite System
    m. Basic Concepts of Data Communication and Network Classification
    n. Future Technology of Telecommunication

COURSE SYLLABUS: **ELECTRIC CIRCUIT LABORATORY**

1. Course number: 101D4121.
   Course name: Electric Circuit Laboratory

2. Credits: 1
   Contact hours: 14 hours

3. Instructors:
   a. Ir.Hj. Zaenab Muslimin, MT
   b. Dr.Ir. Hj. Sri Mawar Said, MT
   c. Hansiaty, ST., MT

4. Text book, title, author, publisher, and year
   a. Introductory Circuit Analysis, Robert L. Boylestad, 12th edition, Publisher: Prentice Hall, Pearson Education International, 2014.
   b. Principles of Electrical Circuits Electron Flow Version, Thomas L. Floyd, 6th edition, Publisher: Prentice Hall, Pearson Education International, 2003.

5. Specific course information
   a. This course discusses about Electricity Basic Law Laboratory, Laboratory Superposition Theorem, Thevenin-Northon Theorem Laboratory, Star – Delta Equivalent Laboratory
   b. Pre-requisites: Electric Circuit I
   c. Course type: Required course

6. Specific goals for the course
   a. The student will able to apply the basic laws of electricity
   b. The student will able to apply the superposition theorem
   c. The student will able to apply Thevenin-Northon theorem
   d. The student will able to apply a series of equivalent stars-Delta

7. Brief list of topics to be covered:
   a. Electricity Basic Law Laboratory
   b. Superposition Theorem Laboratory
   c. Thevenin – Northon Theorem Laboratory
   d. Star – Delta Equivalent Laboratory

COURSE SYLLABUS: **ELECTRIC CIRCUIT LABORATORY**

1. Course number: 101D4121.
   Course name: Electric Circuit Laboratory

2. Credits: 1
   Contact hours: 14 hours

3. Instructors:
   a. Ir.Hj. Zaenab Muslimin, MT
   b. Dr.Ir. Hj. Sri Mawar Said, MT
   c. Hansiaty, ST., MT

4. Text book, title, author, publisher, and year
   a. Introductory Circuit Analysis, Robert L. Boylestad, 12th edition, Publisher: Prentice Hall, Pearson Education International, 2014.
   b. Principles of Electrical Circuits Electron Flow Version, Thomas L. Floyd, 6th edition, Publisher: Prentice Hall, Pearson Education International, 2003.

5. Specific course information
   a. This course discusses about Electricity Basic Law Laboratory, Laboratory Superposition Theorem, Thevenin-Northon Theorem Laboratory, Star – Delta Equivalent Laboratory
   b. Pre-requisites: Electric Circuit I
   c. Course type: Required course

6. Specific goals for the course
   a. The student will able to apply the basic laws of electricity
   b. The student will able to apply the superposition theorem
   c. The student will able to apply Thevenin-Northon theorem
   d. The student will able to apply a series of equivalent stars-Delta

7. Brief list of topics to be covered:
   a. Electricity Basic Law Laboratory
   b. Superposition Theorem Laboratory
   c. Thevenin – Northon Theorem Laboratory
   d. Star – Delta Equivalent Laboratory

COURSE SYLLABUS: **BASIC CONTROL SYSTEMS**

1. Course number: 246D4102.
   Course name: Basic Control Systems

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:
   a. Prof. Dr. Ir. Nadjamuddin Harun (course coordinator)
   b. Dr. Ir. Rhiza S. Sadjad, MSEE
   c. Dr.-Ing. Ir. Faizal Arya Samman
   d. Dr. Indar Chaerah Gunadin

4. Text books, title, author, publisher and year
   a. Basic Control System, Faizal Arya Samman, Publisher: IESTA, 2016.
   b. Automatic Control Systems, Benjamin C. Kuo, Publisher; Prentice-Hall, 1995.
   c. Modern Control Engineering, Katsuhiko Ogata, Publisher: Prentice-Hall, 2010.

5. Specific course information
   a. The course material discuss about the basic principles of control system engineering analysis including the introduction of control system components.
   b. Pre-requisite: Advanced Mathematics
   c. Course type: Required (R)

6. Specific goals for the course
   a. The student will be able to explain the use of control engineering in many industrial applications
   b. The student will be able to explain an open loop and closed loop control system, and main components of a control systems
   c. The student will be able to find the transfer function of a closed loop control system and then analysis it stability, its time domain and frequency domain characteristic as well as its root locus characteristic
   d. The student outcomes listed in Criterion 3 are addressed by the course.

7. Brief list of topics to be covered:
   a. Overview of control engineering applications in manufacture industries, process industries, automotive, aircraft, power system generations, etc.
   b. Mathematical foundations: Laplace Transform, differential equation and its solution using Laplace Transform.

c. Control system components introductions: sensor, actuators, control unit, signal conditioner.
d. Transfer functions and block diagrams.
e. Closed loop transfer function analysis using block diagram algebra, signal flow graphs and Mason gain formulas.
f. Control system stability analysis based on characteristic equation of a control system using Routh-Hurwitz method.
g. Time domain analysis: time domain specification, transient response and steady-state response analysis.
h. Frequency domain analysis: Bode plot and Nyquist plot, relative stability analysis based on gain and phase margins presented on the Bode and/or Nyquit curves of a control system.
i. Root locus analysis

COURSE SYLLABUS: **INTEGRATED ELECTRONICS**

1. Course number: 214D4122.
   Course name: Integrated Electronics

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:
   a. Dr.-Ing. Ir. Faizal Arya Samman (course coordinator)
   b. Andreas Vogel, Dipl.-Ing.
   c. Dr. Ejah Umraeni Salam

4. Text books, title, author, publisher and year
   a. CMOS VLSI Design A Circuits and Systems Perspective, Neil H. E. Weste, David M. Harris, Publisher: Addison-Wesley, 2011.
   b. Principles of Electronics, 8th edition, Albert Paul Malvino, David Bates, Publisher: McGraw-Hill Education, 2016.
   c. Microelectronic Circuit Design, 4th edition, Richard C. Jaeger, Travis N. Blalock, Publisher: McGraw-Hill, 2011.

5. Specific course information
   a. The course material covers the topics about principles techniques to design, simulate and layout integrated circuit using a computer-aided design (CAD) software
   b. Pre-requisite: Basic Electronics
   c. Course type: Required (R)

6. Specific goals for the course
   a. The student will be able to use a CAD software to design, simulate and layout CMOS analog and digital integrated circuits
   b. The student will be able to explain CMOS transistor characteristics
   c. The student will be able to explain CMOS integrated circuit design methodologies
   d. The student will be able to design CMOS logic circuit
   e. The student outcomes listed in Criterion 3 are addressed by the course

7. Brief list of topics to be covered:
   a. CMOS design methodologies: Full-custom and Semi-Custom design (Standard-cell technology)
   b. Integrated circuit design rules
   c. NMOS and PMOS transistor layout and their characteristics
   d. Differential amplifier circuit configuration

e. Current mirror circuit.
f. CMOS operational amplifier circuit
g. CMOS logic gates
h. Stick diagram and CMOS logic circuit
i. Digital integrated circuit design using standard-cell design methodology
j. Case study: digital adder, multiplier, etc.
k. Case study: memory cell design

COURSE SYLLABUS: **INTEGRATED ELECTRONICS**

1. Course number: 214D4122.
   Course name: Integrated Electronics

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:
   a. Dr.-Ing. Ir. Faizal Arya Samman (course coordinator)
   b. Andreas Vogel, Dipl.-Ing.

4. Text books, title, author, publisher and year
   a. CMOS VLSI Design A Circuits and Systems Perspective, 4th edition, Neil H. E. Weste, David M. Harris, Publisher: Addison-Wesley, 2011.
   b. Digital Integrated Circuits: A design perspective, 2nd edition, Jan M. Rabaey, et al., Publisher: Pearson, 2002.
   c. CMOS Circuit Design, Layout, and Simulation, 3rd edition, R. Jacob Baker, Publisher: Wiley & IEEE Press, 2010.

5. Specific course information
   a. The course material covers the topics about principles techniques to design, simulate and layout integrated circuit using a computer-aided design (CAD) software
   b. Pre-requisite: Basic Electronics, Integrated Electronics
   c. Course type: Required (R)

6. Specific goals for the course
   a. The student will be able to use a CAD software to design, simulate and layout CMOS analog and digital integrated circuits
   b. The student will be able to explain CMOS transistor characteristics
   c. The student will be able to explain CMOS integrated circuit design methodologies
   d. The student will be able to design CMOS logic circuit

7. Brief list of topics to be covered:
   a. CMOS design methodologies: Full-custom and Semi-Custom design (Standard-cell technology)
   b. Integrated circuit design rules
   c. NMOS and PMOS transistor layout and their characteristics
   d. Differential amplifier circuit configuration
   e. Current mirror circuit.
   f. CMOS operational amplifier circuit

g. CMOS logic gates
h. Stick diagram and CMOS logic circuit
i. Digital integrated circuit design using standard-cell design methodology
j. Case study: digital adder, multiplier, etc.
k. Case study: memory cell design

COURSE SYLLABUS: **LINEAR SYSTEM**

1. Course number: 241D4102.
   Course name: Linear System

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:
   a. Dr.Ir..Rhiza S. Sadjad, ST.,MT (coordinator)
   b. Dr.A.Ejah Umraeni Salam,ST.,MT

4. Text books, title, author, publisher and year
   a. Linear System Theory, Wilson J.Rugh".
   b. A Linear Systems Primer Panos J Ansaklis, Anthony N Mitchel.
   c. Linear State Space, Robert L William II, Douglas W. Lawrence.

5. Specific course information
   a. The Catalog description: Understanding of the System, System Linear and Nonlinear Systems, Linearization, Character Transfer Modeling, Modeling of Transfer Function, State Space Modeling, Relationship of Transfer Ratio
   b. Pre-requisite: Basic Control System, Basic Mathematics
   c. Course type: Required (R)

6. Specific goals for the course
   a. The student will be able to understanding the meaning of the system, input, output, signal, noise, disturbance
   b. The student will be able to Understand system representations in a diagram block, diagram block algebraic
   c. The student will be able to understanding memory/ non-memory system, casual and non-casual system, invertible/ non-invertible system systems, time-varying/ time-invariant system, linear and non linear system and examples
   d. The student will be able to using the linearization method to change the nonlinear system to linear
   e. The student will be able to understand the importance of system modeling
   f. The student will be able to model the system in the transfer character model
   g. The student will be able to model the system in the transfer function modeling using Laplace transforms for the concept of Impedance
   h. The student will be able to model the system in state space modeling
   i. The student will be able to explain the relationship of the transfer function modeling to the state space modeling

7. Brief list of topics to be covered:
    a. Understanding of systems and signals, representing a system as diagram block, as a differential equation and as a difference equation and System Represents.
    b. System Types: Understand about causal and non-causal systems, invertible and non- invertible, time-varying and time invariant, linear and non-linear and capable of linearizing nonlinear systems, linear and nonlinear systems
    c. Linearization
    d. Character Transfer Modeling
    e. Transfer Function Modeling
    f. State Space Modeling
    g. Relationship of Transfer Function

COURSE SYLLABUS: **MICROPROCESSOR AND INTERFACE SYSTEMS LABORATORY**

1. Course number: 205D4121
   Course name: Microprocessor and Interface Systems Laboratory

2. Credits: 2
   Contact hours: 27 hours

3. Instructors: Muh. Anshar, ST, MSc, PhD (Course coordinator)

4. Text book, title, author, publisher and year:
   a. Mazidi, M.A., McKinlay, R.D., Causey, D. and Microcontroller, P.I.C., 2008. Embedded Systems. Pearson, New Jersey.
   b. Kumar N. S., Saravanan, M., Jeevananthan, S. and Shah, S.K. 2012. Microprocessors and Interfacing 8086, 8051, 8096, and advanced processors. Oxford University Press, India.

5. Specific course information:
   a. This course discusses about Early Classes in Microprocessor and Microcontroller, Class of MCS-51, Project Oriented-based MCS-51 Programming
   b. Pre-requisite: Logic Circuit, Digital System
   c. Co-requisite: Basic Electronics, Basic Control System
   d. Course type: Required (R)

6. Specific goals for the course:
   a. The student will able to understand and have the ability to differentiate between General Purpose Microprocessor and Microcontroller
   b. The student will able to develop the programming for a simple project utilizing microcontroller simulator
   c. The student will able to utilize microcontroller-based SDK, which covers MCS-51, AVR Class, Arduino and Raspberry Pi
   d. The student will able to apply knowledge of digital components and processors into applied electronic projects

7. Brief list of topics to be covered
   a. History of microprocessor and microcontroller
   b. Development stage and variety of MCS-51 Class
   c. Features of MCS-51 and Programming approaches, particularly assembly language
   d. Simple project using MCS-51 Simulator
   e. Real project circuit, covering the programming, simulation and integration to chip downloading process
   f. Features of AVR microcontroller class, and SDK utilization
   g. Simple project demonstration, demonstrating input, output, interfacing with

external sensor

h. Integration with electronic loads
i. Aduino SDK, program development to circuit applications
j. Various basic projects implementation
k. Introduction to utilization of Raspberry PI
l. Integrating OS into Raspberry PI

COURSE SYLLABUS: **ACCESS NETWORK TECHNOLOGY**

1. Course number: 322D4113
   Course name: Access Network Technology

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:
   a. Merna Baharuddin, M.Tel.Eng., Ph.D
   b. Andini Dani Achmad, S.T., M.T.

4. Text book, title, author, publisher and year:
   a. Local Access Network Technologies, Paul France, Publisher: The Institution of Engineering and Technology, London, United Kingdom, 2004.
   b. End-to-End DSL Architectures, Wayne C. Vermillion, Publisher: Cisco Press, 2003.
   c. WCDMA for UMTS, Harri Holma, Antti Toskala, Publisher: John Wiley and Sons, Ltd., 2004.
   d. Fundamentals of WiMAX: Understanding Broadband Wireless Networking, Jeffrey G. Andrews, Arunabha Ghosh, Rias Muhamed, Publisher: Pearson Education, 2007.
   e. Ethernet Passive Optical Networks, Glen Kramer, Publisher: The McGraw-Hill Companies, Inc., 2005.

5. Specific course information:
   a. This course discusses about access network in telecommunication technology which cover multiple access technology and duplexing technology, Digital Subscriber Line technology, UMTS, WCDMA, Wi-MAX, PON, and HFC.
   b. Pre-requisite: Basic Telecommunication
   c. Course type: Required (R)

6. Specific goals for the course
   a. The student will understand the concept of multiple access technology and duplexing technology
   b. The student will understand the Digital Subscriber Line Technology and its types
   c. The student will understand UMTS, WCDMA, and Wi-Max Technology
   d. The student will understand technology of optic telecommunication: PON and HFC
   e. The student will understand the technology of network telecommunication

7. Brief list of topics to be covered:
    a. Concept of Multiple Access Technology and Duplexing Technology
    b. Digital Subscriber Line
    c. Universal Mobile Telecommunication System (UMTS) and Wideband Code Division Multiple Access (WCDMA)
    d. Worldwide Interoperability Microwave Access (WIMAX)
    e. Passive Optical Network (PON) and Hybrid Fiber Coaxial (HFC)

COURSE SYLLABUS: **ANALOG AND DIGITAL FILTERS**

1. Course number: 388D4102.
   Course name: Analog and Digital Filters

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:
   a. Dr. Eng. Intan Sari Areni, ST., MT
   b. Merna Baharuddin, ST., M.TelEng., Ph.D

4. Text book, title, author, publisher and year:
   a. Passive and Active Filters: Theory and Implementation, Wai Kai Chen, Publisher: Wiley and Sons, 1986.
   b. Analog and Digital Filter Design, 2nd edition, Steve Winder, Publisher: Elsevier Science, 2002.

5. Specific course information:
   a. This course discusses about examples of filter applications, explanation the importance of filter design, a description of the limitations of filter types (active, passive, and digital), terminology of basic filter, overview design process, description of the frequency response characteristics of filters, both ideal and practical, descriptions on how to design active or passive lowpass, high-pass, bandpass, and band stop filters to meet most desired specifications. Explanation the basic concept of digital filter, FIR and IIR filters. Description on how to design FIR and IIR filters.
   b. Prerequisites: Basic Telecommunication, Advanced mathematics, Electric Circuit.
   c. Course type: Required (R)

6. Specific goals for the course:
   a. The student will able to understand the examples of filter applications.
   b. The student will able to learn the importance of filter design.
   c. The student will able to describe the limitations of filter types (active, passive, and digital), terminology of basic filter, overview design process.
   d. The student will able to explain frequency response characteristics of filters, both ideal and practical.
   e. The student will able to design active or passive lowpass, high pass. bandpass, and band stop filters to meet most desired specifications.
   f. The student will able to understand the basic concept of digital filter.
   g. The student will able to design FIR filter.
   h. The student will able to design IIR filter.
   i. The student will able to have an ability to apply knowledge of mathematics, science, and engineering.

7. Brief list of topics to be covered:
    a. Filter type and specification
    b. Filter Transfer Function
    c. Butterworth and Chebyschef Filters
    d. Active and Passive Filter Design
    e. Basic concept of digital filter
    f. FIR filter
    g. IIR filter

COURSE SYLLABUS: **POWER SYSTEMS ANALYSIS**

1. Course number: 306D4112.
   Course name: Power Systems Analysis

2. Credits: 2
   Contact hours: 27 hours

3. Instructors: Ardiaty Arief, ST., MTM., Ph.D. (Course coordinator)

4. Text book, title, author, publisher and year:
   a. Power System Analysis and Design, J. Duncan Glover, Mulukutla S. Sarma and Thomas J. Overbye, Publisher: Cengage Learning, 2011.

5. Specific course information:
   a. This course discusses about History of electric power systems, power system structure, Per Unit systems, Systems modelling, iterative solutions to algebraic equations, power flow analysis, symmetrical faults, symmetrical components and unsymmetrical faults
   b. Pre-requisite: Alternating current transmission
   c. Co-requisite: Engineering mathematics, Basic of electric systems, Electric circuits.
   d. Course type: Required (R)

6. Specific goals for the course:
   a. The student will be able to understand the history of electric power systems and power systems structure
   b. The student will be able to understand the per unit systems
   c. The student will be able to understand the power systems modelling
   d. The student will be able to analyze the power flow with iterative solutions
   e. The student will be able to analyze and calculate the current of symmetrical faults
   f. The student will be able to understand the symmetrical components
   g. The student will be able to analyze and calculate the current of unsymmetrical faults.

7. Brief list of topics to be covered:
   a. History of electric power systems
   b. Power systems structure
   c. Per Unit systems and systems modelling
   d. Iterative solutions to algebraic equations
      - Gauss Elimination
      - Jacobi and Gauss–Seidel
      - Newton–Raphson
   e. Power flow analysis
      - Power flow solution by Gauss–Seidel
      - Power flow solution by Newton–Raphson

- Fast Decoupled Power Flow

f. Symmetrical faults
g. Symmetrical components
h. Unsymmetrical faults
    - Single line-to-ground fault
    - Line-to-line fault
    - Double line-to-ground fault
    - Sequence bus impedance matrices

COURSE SYLLABUS: **PROBABILITY AND STATISTICS**

1. Course number: 302D4112.
   Course name: Probability and Statistics

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:
   a. Prof. Andani Achmad (Course coordinator)
   b. Dr. Eng. Dewiani
   c. Dr. Eng. Zulfadjri B. Hasanuddin

4. Text book, title, author, publisher and year:
   a. *Metode Statistika*, Sudhjana, Publisher: Tarsito, 1995.
   b. *Teknik Analisis Regresi dan Korelasi*, Sudjana, Publisher: Tarsito, 1988.
   c. *Stastistika untuk Penelitian*, Sugiono, Publisher: Alfa Beta, 2001.
   d. Statistics, M. Spiegel, Publisher: Schoums Outline Series, 1983.
   e. *Statistika Jilid I dan II*, Suprian AS., Publisher: FPTK IKIP, 1992.
   f. *Prosedur Penelitian suatu Pendekatan Praktik*, Suharsimi Arikunto, Publisher: Rineka Cipta, 1998.
   g. *Statistik Non Parametrik*, Sugiyono, Publisher: Tarsito, 1999.

5. Specific course information:
   a. This course discusses the table of frequency distribution, central symptom size and location size, deviation size, slope moment and kurtosis, opportunity theory, sampling, hypothesis test, regression and correlation analysis and non-parametric statistics.
   b. Pre-requisites: N/A
   c. Course type: Required (R)

6. Specific goals for the course:
   a. The student will be able to create and calculate the concept of calculation of frequency distribution table
   b. The student will be able to calculate central symptom and location size
   c. The student will be able to calculate deviation size
   d. The student will be able to calculate slope and kurtosis moments
   e. The student will be able to calculate opportunity theory, sampling, hypothesis testing, regression and correlation analysis
   f. The student will be able to use non-parametric statistics

7. Brief list of topics to be covered:
   a. Introduction to statistics and probability
   b. Table of Frequency Distribution and Graphics
   c. Size of Central Symptoms
   d. Size Deviation
   e. Slopes and Kurtosis

f. Opportunity Theory
g. Distribution of Sampling
h. Testing Hypotheses
i. Regression Analysis
j. Correlation Analysis
k. Non-Parametric Statistics

COURSE SYLLABUS: **TELECOMMUNICATION TRANSMISSION LINE**

1. Course number: 312D4112.
   Course name: Telecommunication Transmission Line

2. Credits: 2
   Contact hours: 100 minutes

3. Instructors:
   a. Merna Baharuddin, M, Tel., Eng., Ph.D.
   b. Andini Dani Achmad, S.T., M.T.
4. Text books, title, author, publisher and year
   a. Magnusson, Philip C., "*Transmission Lines and Wave Propagation*", Allyn and Bacon Series in Electrical Engineering, 1965.
   b. Mithal, GK, "*Network Analysis*", McGraw-Hill, California, 1951.
   c. Alaydrus, M., "*Saluran Transmisi Telekomunikasi*", Graha Ilmu, 2009.
   d. RE Collins, "*Foundations for Microwave Engineering*", Mc. Graw Hill, USA, 1992.
   e. C. Charles Casimiro, C. Ricardo Fialho, and B. Paulo Cezar, "Telecommunications: Advances and Trends in Transmission, Networking and Applications", Unifor, Brazil, 2006.

5. Specific course information
   a. This course discusses about primary constants, infinite channels, reflective channels on SWR, impedance transformation, matching circuit, wire channels, smith diagrams, wave guides, and optical dielectric wave guide.
   b. Pre-requisite: Basic of Telecommunication, Electromagnetic Field.
   c. Course type: Elective Course.

6. Specific goals for the course
   a. The student will be able to understanding transmission media in line transmission.
   b. The student will be able to understanding wave propagation in line transmission.
   c. The student will be able to understanding UMTS, WCDMA, and Wi-Max Technology.
   d. The student will be able to understanding technology of optic telecommunication: PON and HFC.
   e. The Student will be able to implement a channel system of Smith Diagrams.
7. Brief list of topics to be covered:
   a. Transmission Line
   b. Reflection and Reflection Factor

c. Impedance Transformation
d. Matching Circuit
e. Transient
f. Maxwell Equation and Solution
g. Coaxial and Double Parallel Cable
h. Waveguides
i. Optical Dielectric Wave Guides

COURSE SYLLABUS : **ENERGY CONVERSION**

1. Course number: 251D4102.
   Course name: Energy Conversion

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:
   a. Prof. Dr.Eng. Syafaruddin, S.T, M.Eng (course coordinator)

4. Text books, title, author, publisher and year
   a. Energy Conversion, D. Yogi Goswami, Frank Kreith, Publisher: CRC Press-Taylor & Francis Group, 2017.

5. Specific course information
   a. Catalog description: Solar energy resources, Solar Thermal Energy Conversion: Photovoltaics Fundamentals, Technology and Application, Wind energy resources, Biomass Energy, Biomass Conversion Processes For Energy Recovery, Ocean Energy Technology, Geothermal Energy, Fuel Cells, Direct Energy Conversion.
   b. Prerequisite: Basic Electric Power, C-minimum grade
   c. Co-requisite: Electric Machines, C-minimum grade
   d. Course type: Required (R)

6. Specific goals for the course:
   a. The student will understand and be able to explain the classification and types of energy.
   b. The student will be able to explain the principle process of energy conversion of solar energy, wind energy, biomass energy, ocean energy, geothermal energy
   c. The student will be able to distinguish the principle process of thermionic converters, thermoelectric converters, fuel cells.
   d. The student will be able to do some parameter measurements in solar energy, wind energy, biomass energy, ocean energy, geothermal energy
   e. The student will be able to quantify some parameter measurements in thermionic converters, thermoelectric converters, fuel cells.
   f. The student will be able to develop hybrid systems of energy conversion in the electrical grid network.
   g. The student outcomes addressed by the course. An ability to apply knowledge of mathematics, science and technology related to the energy conversion process.

7. Brief list of topics to be covered:
   a. Solar energy resources: Solar Energy Availability, Earth–Sun Relationships, Solar Time, Solar Radiation on a Surface, Solar Radiation on a Horizontal Surface, Solar Radiation on a Tilted Surface, Solar Radiation Measurements, Solar Radiation Data
   b. Solar Thermal Energy Conversion: Active Solar Heating Systems, Solar Heat for Industrial Processes, Passive Solar Heating, Cooling, and Daylighting, Solar

Cooling

c. Photovoltaics Fundamentals, Technology and Application: Photovoltaics, Thin-Film PV Technology, Concentrating PV Technologies
d. Wind energy resources: Wind Origins, Wind Power, Wind Shear, Wind Energy Resource, Wind Characterization, Wind Energy Potential
e. Biomass Energy: Biomass Feedstock Technologies, Biomass Conversion Technologies
f. Biomass Conversion Processes For Energy Recovery: Energy Recovery, Power Generation, Biofuels
g. Ocean Energy Technology: Ocean Thermal Energy Conversion, Tidal Power, Wave Power
h. Geothermal Energy: Heat Flow Types of Geothermal Systems, Geothermal Energy Potential, Geothermal Applications, Environmental Constraints, Operating Conditions, Management of the Geothermal Resource for Power Production, Geothermal Steam Supply, Geothermal Power Production-Steam Turbine Technologies
i. Fuel Cells: Principle of Operation for Fuel Cells, Typical Fuel Cell Systems, Performance of Fuel Cells Fuel Cell Electrode Processes, Cell connection and Stack Design Considerations, Six Major Types of Fuel Cells
j. Direct Energy Conversion: Thermionic Energy Conversion, Thermoelectric Power Conversion, Magnetohydrodynamic Power Generation

COURSE SYLLABUS: **NUMERICAL METHOD**

1. Course number:
   Course name: Numerical Method

2. Credits: 2
   Contact hours: 27 hours

3. Instructors: Prof. Dr.Eng. Syafaruddin, S.T, M.Eng

4. Text books, title, author, publisher and year:
   a. Fundamental Numerical Methods for Electrical Engineering, Stanisław Rosłoniec, Publisher: Springer,

5. Specific course information
   a. This courses material discusses about the methods for numerical solution of linear equations, methods for numerical solving the single nonlinear equations, methods for numerical solution of nonlinear equations, methods for the interpolation and approximation of one variable function, methods for numerical integration of one and two variable functions, methods for numerical integration of ordinary differential equations.
   b. Prerequisite: (Mathematics I, C-minimum grade), (Mathematics II, C-minimum grade)
   c. Course type: Required (R)

6. Specific goals for the course
   a. The student will understand the principle of numerical solution in electrical engineering problem
   b. The student will be able to solve linear and non-linear equations using numerical methods.
   c. The student will understand the difference between interpolation and approximation techniques in engineering problems.
   d. The student will be able to implement certain interpolation and approximation algorithms in engineering problems.
   e. The student will be able to solve mathematical integration problems based numerical methods.
   f. The student will be able to compute mathematical differentiation cases using numerical methods.
   g. The student will have an ability to apply knowledge of engineering mathematics and calculus to solve problems in engineering process with numerical methods.

7. Brief list of topics to be covered
   a. Direct Methods: Gauss Elimination Method, Gauss–Jordan Elimination Method, LU Matrix Decomposition Method, Method of Inverse Matrix
   b. Indirect or Iterative Methods: Direct Iteration Method, Jacobi and Gauss–Seidel Methods
   c. Determination of the Complex Roots of Polynomial Equations: Lin’s Method,

Bairstow's Method, Laguerre Method

d. Iterative Methods Used for Solving Transcendental Equations: Bisection Method of Bolzano, Secant Method, Method of Tangents (Newton–Raphson), Optimization Methods
e. Method of Direct Iterations: Iterative Parameter Perturbation Procedure, Newton Iterative Method
f. Fundamental Interpolation Methods: Piecewise Linear Interpolation, Lagrange Interpolating Polynomial, Aitken Interpolation Method, Newton–Gregory Interpolating Polynomial
g. Fundamental Approximation Methods for One Variable Functions: Equal Ripple (Chebyshev) Approximation, Maximally Flat (Butterworth) Approximation
h. Fundamental Methods for Numerical Integration of One Variable Functions: Rectangular and Trapezoidal Methods of Integration, Romberg Integration Rule, Simpson Method of Integration
i. Calculating the Derivatives of One Variable Function Differentiation of the Corresponding Interpolating Polynomial: Differentiation of the Newton–Gregory Polynomial and Cubic Spline Functions
j. Methods for Numerical Integration of Ordinary Differential Equations: Euler Method and its Modified Version, Heun Method, Runge–Kutta Method (RK 4), Runge–Kutta–Fehlberg Method (RKF 45)

COURSE SYLLABUS: **POWER LINE CARRIER FOR COMMUNICATION TRANSMISSION**

1. Course number: 318D4112.
   Course name: Power Line Carrier for Communication Transmission

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:
   a. Dr.Eng. Intan Sari Areni, ST., MT
   b. Prof. Dr. Ir. Syafruddin Syarif, MT

4. Text book, title, author, publisher and year:
   a. J. Anatory & N. Theethayi, "Broadband Power-line Communication Systems: Theory and Applications", WITPress, 2010.
   b. H. Hrasnica, A. Haidine, R. Lehnert, "Broadband Powerline Communications: Network", Wiley, 2004.

5. Specific course information:
   a. This course discusses about the communication system through power lines (PLC), PLC standardization, characteristics of power line channels and PLC applications.
   b. Pre-requisites: Basics telecommunications
   c. Course type: Required (R)

6. Specific goals for the course
   a. The student will be able to understand about the communication system through power lines (PLC)
   b. The student will be able to explain PLC standardization
   c. The student will be able to understand the characteristics of power line channels
   d. The student will be able to describe the applications of PLC system

7. Brief list of topics to be covered
   a. Introduction of power line communication system
   b. PLC standardization
   c. Characteristics of power line channel : attenuation and noise
   d. PLC system architecture
   e. Types of electric power transmission lines
   f. PLC applications

COURSE SYLLABUS: **POWER SYSTEMS OPERATION**

1. Course number: 350D4122.
   Course name: Power Systems Operation

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:
   a. Muhammad Bachtiar Nappu, ST., MT., M.Phil., Ph.D. (Course coordinator)

4. Text book, title, author, publisher and year:
   a. Allen J. Wood and Bruce F. Wollenberg and Gerald B. Sheble "Power Generation Operation and Control", John Wiley & Sons, Inc., 2014

5. Specific course information:
   a. This course discusses about Economic importance of power systems operation, new and old problems in economic dispatch, power generation characteristics, economic dispatch and the general economic dispatch problem, thermal unit economic dispatch and methods of solution and optimization with constraints.
   b. Pre-requisite: Power systems analysis
   c. Co-requisite: Engineering mathematics, Basic of electric systems, Electric circuits, Alternating current transmission.
   d. Course type: Required (R)

6. Specific goals for the course:
   a. The student will able to understand the principle of power generations systems
   b. The student will able to explain the new and old problems in economic dispatch
   c. The student will able to understand the characteristics for thermal and hydroelectric power generation
   d. The student will able to solve the economic dispatch problems with mathematical optimization methods
   e. The student will able to perform systems optimization with constraints
   f. The student will able to explore the current issue around power systems operation.

7. Brief list of topics to be covered:
   a. Economic importance of power systems operation
   b. New and old problems in economic dispatch
   c. Electric power industry as a business
   d. Power generation characteristics
   e. Economic dispatch and the general economic dispatch problem
      - Economic dispatch by neglecting network losses and generations constraints
      - Economic dispatch by considering generations constraints
      - Economic dispatch by considering network losses and generations

constraints

f. Thermal unit economic dispatch and methods of solution
g. Optimization with constraints
h. Optimal power flow techniques