

SYLLABUS: ELECTRICAL ENGINEERING 1

Date / Revision 15 August 2017 / Rev 03-15-08-17 / MaS
Faculty Engineering and Lifesciences
Study Program AVE, MEE, INE, ELE, COS, MTE, FTE, CHE, BME

SUBJECT: Electrical Engineering & Laboratory 1

1 Basic Information

1.01	Subject Name	Electrical Engineering and Laboratory 1
1.02	Semester	1
1.03	Level	1
1.04	SKS	3
1.05	Mandatory / Curriculum	Mandatory / F-07
1.06	Subject Code	ELEE
1.07	Subject Code	ENG-F-ELEE-1107
Life1.08	Year	2017 (7)
1.09	Quality Control	Final Test, OFSE, see evaluation
1.10	Limitations	Min 12 and Max 32 students in one class
1.11	Combined with	AVE, MEE, INE, ELE, COS, MTE, FTE, CHE, BME
1.12	Perquisite	None
1.13	Responsible	Mr. Dipl. Ing.- Maralo Sinaga
1.14	Revision	Rev 03-15.08.17 / MaS

2 Description of Subject

The subject introduces the theory, analysis and design of electric circuits, voltage, current, power, energy, resistance, capacitance, inductance. Kirchhoff's laws node analysis, mesh analysis, Thevenin's theorem, Norton's theorem, DC, phasors, operational amplifiers, transfer functions and gain

3 Objectives

- Introduce fundamental circuit theory.

- Develop ability for solving problems involving electric circuits.
- Develop skills for experimentation on electric circuits.
- Develop skills for circuit simulation using Electronics Workbench Software.
- Impart relevant skills and knowledge for independent learning of other subjects that require such skills and knowledge.

4 Competency

- After having the course, students are expected to:
- Explain basic electrical concepts, including electric charge, current, electrical potential, electrical power, and energy;
 - Apply concepts of electric network topology: nodes, branches, and loops to solve circuit problems, including the use of computer simulation;
 - Analyze circuits with ideal, independent, and controlled voltage and current sources;
 - Apply Ohm’s-, Kirchoff’s current- and voltage-laws to the analysis of DC electric circuits.
 - Determine the Thevenin or Norton equivalent of a given linear network that may include passive devices, dependent sources, and independent sources in combination.
 - Derive relations for and calculate the gain and input resistance of a given Operational Amplifier (Op-Amp) circuit for DC circuits using an ideal operational amplifier model.
 - Explain the relationship of voltage and current in capacitors, inductors, and mutual inductors.
 - Use
 - Apply Kirchoff’s current and voltage laws to the analysis of AC electric circuits.
 - Apply computer mathematical and simulation programs to solve DC and AC - circuit problems.

5 Learning Approach / Methodology

- Lectures/ Class contact (time-tabled) supplemented with interactive questions and answers;
- Circuit simulation using Electronic Workbench Software;
- Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing;
- Student Study Effort: homework/assignment; preparation for test/quizzes/ examination.

6 Evaluation

5.1	Absence maximum	25%
5.2	Participation in Discussion	05 Points
5.3	Homework / Classwork	10 Points
5.4	Presentation /Simulation	00 Poins
5.5	Daily Quiz	25 Points
5.6	Final Examination	60 Points
	Total	100 Points

7 Text Book and Reference

1	<p>Main Text Book: <i>“Principle and Application of Electrical Engineering- 6th Edition”</i>, Author: Giorgio Rizzoni and James Kearns, Publisher: McGraw Hill Higher Education, ISBN: 9780073529592</p>
2	<p>Supplement Textbooks:</p> <ul style="list-style-type: none"> • <i>“Circuit Analysis: Theory and Practice, Fifth Edition – 2013”</i>, Authors: Allan H. Robbins and Wilhelm C. Miller, Publisher: Delmar, Cengage Learning, ISBN: 13: 978-1-1332-8100-9 • <i>“Introductory circuit analysis / Robert L. Boylestad.—11th ed, 2007”</i>, Authors: Boylestad, Robert L., Publisher: Pearson Education, Inc, ISBN 0-13-173044-4 • <i>“Fundamentals of electric circuits 5th Edition, 2013”</i>, Authors: Charles K. Alexander, Matthew N. O. Sadiku, Publisher: McGraw – Hill Higher Education, ISBN: 978-0-07-338057-5

8 Content / Topics of Lecture

Week	Content/ Topics of Lecturing	Text Book	Remark
1	<p>Introduction to Electrical Engineering /Basic Concept: Introduction to electrical engineering, historical background, SI System of Units, Converting Units, Power of Ten Notation, Prefixes, Engineering Notation, and Numerical Results, Circuit Analysis Using Computers and Calculators</p>	Ch1	
2	<p>Charge, Current, Voltage, Power, and Energy: Atomic Theory Review, The Unit of Electrical Charge: The Coulomb, Current, Voltage, Practical DC Voltage Sources, Measuring Voltage and Current, Switches, Fuses, and Circuit Breakers</p>	Ch2	HW
3	<p>Circuit elements and Resistive Electric Circuit : Conductor, Insulator and Semiconductor material, resistivity, Resistance and conductance, Resistance of conductor, wire tables, Resistors, Resistor color codes, Effect of temperature on resistance, Thermistors, varistors, superconductor, problem solving.</p>	Ch3:	Quiz
4-5	<p>Basic Laws /The Ohm’s Law and Kirchoff’s Law: Ohm’s Law, Voltage Polarity and Current Direction, Power, Power Direction Convention, Energy, Efficiency, Nonlinear and Dynamic Resistances, Computer-Aided Circuit Analysis</p>	Ch3	HW Quiz
6-7	<p>Basic DC Analysis: Series Circuits, Kirchoff’s Voltage Law, Resistors in Series, Voltage Sources in Series, Interchanging Series Components, The Voltage Divider Rule, Circuit Ground, Voltage Subscripts, Internal Resistance of Voltage Sources, Voltmeter Design, Ohmmeter Design, Ammeter Loading Effects, Circuit Analysis Using Computers</p>	Ch3	HW Quiz

8	MIDTERM SEMESTER BREAK		
9-10	Method of Analysis and Circuit Theorems: The Node Voltage Analysis, Mesh Current Analysis, Superposition Theorem, Thévenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Bridge Networks, Circuit Analysis Using Computers	Ch3	HW Quiz
11-12	Operational Amplifiers (Op-Amps): Ideal Op-Amp, inverting-, Noninverting-, Summing, Difference-Amplifiers, Cascade Op-Amp circuits, Applications.	Ch8	HW Quiz
13	Storage Circuit Elements (Capacitor and Inductors): Capacitors, series and parallel capacitors, Inductors, series and parallel inductors, Applications	Ch4	HW
14-15	AC-Circuits / Sinusoidal and Phasors: Sinusoidal signals, Phasors, Phasors relationships for circuit elements, Impedance and Admittance, Kirchoff's Laws in frequency domain, Applications	Ch 4	HW Quiz
16	Final Examination		