

EE 301/301L: *Introductory Circuits, Machines, and Systems*

CATALOG DATA:

EE301/301L – *Introductory Circuits, Machines, and Systems*: (3-1) 4 Credits

Prerequisite :Math 125 completed with a “C-“ or better, and Math321 completed or concurrent. Not for majors in electrical engineering or computer engineering. Introduces the essential concepts of electrical engineering concerning circuits, machines, electronics, and systems.

TEXTBOOK:

Principles and Applications of Electrical Engineering, (5th ed.). Rizzoni, 2005.

COORDINATOR:

Elaine Linde, Instructor

GOALS:

The objective of this course is to provide non-electrical engineering students with a solid understanding of circuit analysis as well as overview knowledge of a wide range of electrical engineering topics. The laboratory instruction is used to link theoretical concepts with experimental results as well as gaining ability to use electrical engineering laboratory equipment.

CLASS SCHEDULE:

Lecture: 3 hours per week. (11:00 – 11:50 MWF, EP254)

Laboratory: 2 hours per week (1 cr. hr.) Thurs. 8:00-9:50, 10:00-11:50, or 12:00 – 1:50 EP342.

INSTRUCTOR INFORMATION:

E-mail: Elaine.Linde@sdsmt.edu

Office: EP 316; Phone: 394-5196

Office Hours: 12– 2 MWF, 9-12 Tues., 2-4 Thurs. , any time my door is open or by appointment

ADA INFORMATION:

Students with special needs or requiring special accommodations should contact the instructor, Elaine Linde at 394-5196 and/or the campus ADA coordinator, Jolie McCoy at 394-1924 at the **earliest** opportunity.

TENTATIVE TEST SCHEDULE:

- One short quiz each week,
 - Quizzes can only be made up with prior approval and are taken after the class.
 - Two quizzes will be dropped for grade calculations.
- 3 exams during the semester and a final exam.

TENTATIVE GRADING POLICY:

- Homework 10% - See Expectations document for late penalties.
- Labs 15% - See Expectations document for behavior policy.
 - Points will be deducted for not completing pre-lab.
 - All Labs must be completed to pass the class. Make-up labs for unexcused absences are scheduled for 6 am.
- **Quizzes 10%
- **Laboratory Exam 10%
- **Exams 30%
- **Final Exam 25%

** A passing grade **MUST** be obtained as a weighted average of these measures to pass the class..

ELECTRONIC DEVICE POLICY:

Unless otherwise specified, no electronic devices are to be used in class. An exception to this is a notebook computer that can be use for taking notes. It must be flat on the desk in note-taking configuration using that function only and must not be a distraction to other students.

FREEDOM IN LEARNING:

Under Board of Regents and University policy student academic performance may be evaluated solely on an academic basis, not on opinions or conduct in matters unrelated to academic standards. Students should be free to take reasoned exception to the data or views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled. Students who believe that an academic evaluation reflects prejudiced or capricious consideration of student opinions or conduct unrelated to academic standards should contact the dean of the college which offers the class to initiate a review of the evaluation.

Topics:

1. Fundamentals of Electric Circuits:
 - a. Ohm's Law
 - b. Kirchhoff's Current Law
 - c. Kirchhoff's Voltage Law
 - d. Voltage Division
 - e. Current Division
2. DC Circuit Analysis Techniques:
 - a. Node Analysis
 - b. Mesh Analysis
 - c. Thevenin Equivalent Circuits
 - d. Norton Equivalent Circuits
 - e. Operational Amplifiers:
 - i. Inverting, Non-inverting, Summing, Differential Amplifiers
 - ii. Limitations of Real Op-amps
 - iii. Applications for Operational Amplifiers
3. AC Circuit Analysis:
 - a. Phasor Notation
 - b. Conversion of Time Domain Sinusoidal Voltages and Currents
 - c. Extension of DC analysis techniques to AC.
4. Transient Analysis:
 - a. Characteristics of First Order Transients
 - b. Characteristics of Second Order Transients
 - c. Applications of Transient Analysis
5. Frequency Analysis:
 - a. Fourier Series
 - b. Bode Plots
 - c. Filtering
 - d. Applications of Frequency Domain Analysis
6. Semiconductors
 - a. Diodes
 - b. LED's
 - c. BJT's
7. Digital Logic
 - a. Logic Gates (AND, OR, NOT, NAND, NOR, XOR)
 - b. Applications and Links to Other Technologies
8. Electrical Machines and AC Power (time permitting)
 - a. Types of Motors and Generators
 - b. Ideal Transformers
 - c. Three-phase Power

LABORATORY:

A one credit hour laboratory EE 301L accompanies this course. The laboratory meets for two hours every week. The following laboratories are performed:

1. Introduction to EE Lab
 - a. Equipment Familiarization
 - b. Matlab Introduction
2. Ohm's Law
 - a. Series Circuit
 - b. Parallel Circuit
3. Voltage and Current Division
 - a. Series Circuit
 - b. Parallel Circuit
4. Voltage and Current Division Applications
 - a. Variable Resistors as Input Devices (potentiometer, thermistor)
 - b. Wheatstone Bridge
5. Nodal Analysis
6. Mesh Analysis
7. Thevenin and Norton Circuits
8. Use of the Signal Generator and Oscilloscope
 - a. Study of AC Signal Properties
9. Transient Response of a Circuit
 - a. First Order System
 - b. Second Order System
10. Low and High Pass Filtering
 - a. First Order Filter
 - b. Second Order Filter
11. Fourier Series and FFT
12. Diodes, Transistors and Op-Amps
 - a. Half-wave Rectifier
 - b. Full-wave Rectifier
 - c. Common-emitter BJT
 - d. Common-emitter BJT with Motor and Snubber Diode
 - e. Inverting Amplifier
13. Digital Logic
 - a. AND, OR, NOT, NAND, NOR circuits with switches and LED's
 - b. Cascaded circuit
14. Laboratory Practical Exam (individual)
 - a. Build Circuit
 - b. Measuring Critical Parameters
 - c. Equipment Identification and Knowledge of Uses

COMPUTER USAGE:

Students can use Mathcad, Matlab, or advanced calculator to solve systems of real and complex equations. Other analysis tools such as Excel are used for statistical analysis.

COURSE OUTCOMES:

Upon completion of this course, students should demonstrate the ability to:

1. Apply the fundamentals of electric circuits including Ohm's Law, Kirchhoff's Current and Voltage Laws, and voltage and current division to analyze and build circuits.
2. Use DC circuit analysis techniques such as node analysis, mesh analysis, and Norton and Thevenin equivalent circuits to solve for circuit parameters.
3. Extend DC analysis techniques to AC networks using phasor notation and conversion of time domain sinusoidal voltages and currents.
4. Identify the characteristics of first and second order transients.
5. Have an awareness of the advantages of using the frequency domain by way of Bode plot, Fourier series and filtering.
6. Use the basic operation and applications of operational amplifiers including inverting, non-inverting, summing, differential amplifiers using ideal analysis and the limitations of real op-amps.
7. Be familiar with the basic operation and applications of semiconductor devices such as diodes, LED's, and BJT transistors.
8. Be familiar with the basic operation of digital logic gates and their application and link to other technologies (PLC, microcontrollers).
9. Have an awareness of electric machines and AC power and their uses.
10. Use basic laboratory measurement equipment including the power supplies, digital multimeters, function generators, and oscilloscopes to conduct experiments.

RELATION OF COURSE TO PROGRAM OUTCOMES:

These course outcomes fulfill the following program outcomes:

- (a) An ability to apply knowledge of mathematics, science, and engineering.
- (b) An ability to design and conduct experiments, as well as to analyze and interpret data.
- (c) An ability to design a system, component, or process to meet desired needs.
- (d) An ability to function on multi-disciplinary teams
- (e) An ability to identify, formulate, and solve engineering problems.
- (f) An understanding of professional and ethical responsibility
- (g) An ability to communicate effectively
- (h) The broad education necessary to understand the impact of engineering solutions in a global and societal context
- (i) A recognition of the need for, and an ability to engage in life-long learning
- (j) A knowledge of contemporary issues
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The following table indicates the relative strengths of each course outcome in addressing the program outcomes listed above (on a scale of 0 to 4 where 4 indicates a strong emphasis)

		Course Outcomes										
		1	2	3	4	5	6	7	8	9	10	11
ABET Objectives	(a)	4	4	4	4	4	3	3	2	2	4	4
	(b)	2	2	2	2	2	2	2	1		4	4
	(c)	1	1	1	2	3	3	1	1	1	3	2
	(d)	2	2	2	1	1					1	
	(e)	1	1	2	2	2	2	2	1		2	2
	(f)										3	3
	(g)										2	4
	(h)				1			2	2			1
	(i)	2	2	2	2	2	2	2	2	2	3	2
	(j)				2	2		2				
	(k)	3	3	3	3	3	2	2	2	2	3	4

NOTES:

- Outcome (d) is emphasized in relation to teams that student will likely be a part of when on the job and how knowledge of other members' disciplines (EE in this case) can be of benefit.
- Outcome (i) is emphasized due to this being a course outside the students' discipline and discussions of how a basic knowledge could be turned into a deeper knowledge with further study

PREPARED BY:

Elaine Linde, Date: August 20, 2003 (revised for spring 2004 on Jan. 5, 2004, and Aug. 28 for Fall 2004)