**EECE 211**
**Linear Circuits I**

3 Units: 3 hours discussion (3 units Engineering Topics)

Course Supervisor/Main Instructor: David Silveira/Zahra Alavi and David Silveira

Required Textbook: *Fundamentals of Electric Circuits*, *6th Ed.*, Charles Alexander and Matthew Sadiku, McGraw Hill, ISBN 9780078028229.

Recommended Supplemental Materials:

- *Introduction to PSpice using OrCAD for Circuits and Electronics, 3rd Ed.,* M. Rashid, Prentice Hall, 2004.
- *Electric Circuits,* James Nilsson and Susan Riedel, Pearson, any edition.
- *Operational Amplifier Characteristics and Applications, 3rd Ed.,* Robert G. Irvine, Prentice Hall, 1994
- *Basic Operational Amplifiers*

Required Software:
Autodesk EAGLE
LTSpice

Course Description:

DC and sinusoidal circuit analysis, including resistive, capacitive, and inductive circuit elements and independent sources. Ideal transformer. Thevenin and Norton circuit theorems and superposition. Phasors, impedance, resonance, and AC power. Three-phase AC Circuit analysis. Prerequisites: MATH 121, PHYS 204B (may be taken concurrently)

Learning Objectives:
Upon successful completion of this course, students will be able to:

- Solve DC circuits to determine voltages, currents, and power using linear analysis methods such as nodal analysis, Kirchhoff's Laws, Ohm's Law, source transformations, and voltage/current division. (SO 1)
- Simplify resistive circuits using resistor combinations. (SO 1)
- Determine required conditions for maximum power transfer from a linear network to a load by finding the Thévenin Equivalent for the linear network. (SO 1 and SO 2)
- Analyze ideal operational amplifier circuits. (SO 1)
- Determine the solution describing the transient response for a first-order RL or RC circuit. (SO 1)
- Perform steady-state AC analysis of RLC circuits using phasors and frequency-domain analysis techniques. (SO 1)
- Use Autodesk EAGLE to perform a printed circuit board (PCB) layout according to given specifications. (SO 1, SO 2, and SO 6)
- Use LTSpice netlists to simulate both DC and AC circuits and solve for voltages and currents. (SO 1)

Grading Scheme:

| Graded Items | Percentage Weight |
|---|---|
| Homework and quizzes<br>lowest two scores dropped | 10% |
| PCB Design Project | 15% |
| Exam #1 | 22.5% |
| Exam #2 | 22.5% |
| Final Exam | 30% |

Course Topics:

| **Week #** | **Course Topics and Reading List/Activities** | **Chapter** |
|---|---|---|
| 1 | Physics overview: voltage, current, power, energy, resistance, conductors, insulators | 1.1-1.5 |
| 2 | Circuit elements: sources, resistors, grounding and symbols, circuit terminology, circuit analysis with Kirchhoff's Laws | 1.6<br>2.1-2.4 |
| 3 | Lab #1 discussion. Series and parallel connections, voltage and current division. Nodal Analysis. | 2.5-2.6<br>3.1.-3.3 |
| 4 | Lab #2 discussion. Source Transformations, Thévenin/Norton equivalent circuits, maximum power transfer. | 4.1-4.2<br>4.4-4.8 |
| 5 | Lab #3 discussion. Circuit simulation with LTSpice. Ideal operational amplifiers. | 5.1-5.7 |
| 6 | Lab #4 discussion: PCB boards and soldering. Ideal operational amplifiers (continued) | 5.1-5.7 |
| 7 | Finish ideal op-amps. Design project discussion. Capacitance and inductance. | 6.1-6.5 |
| 8 | Lab #5 discussion. Exam #1. | |
| 9 | Lab #6 discussion, overview of security system. 1$^{st}$-order transient response of RL and RC circuits. | 7.1-7.3<br>7.5-7.6 |
| 10 | Lab #7 discussion. 1$^{st}$-order transient response. Review of complex numbers. | Appendix B |
| 11 | Sinusoids, phasors, impedance, circuit elements in frequency domain. | 9.1-9.5 |
| 12 | Lab #8 discussion. Exam #2. | |
| 13 | Lab #9 discussion. Equivalent impedance, AC steady-state analysis. | 9.6-9.7<br>10.1-10.2 |
| 14 | AC steady-state analysis continued. Superposition. | 4.3<br>10.4-10.5 |
| 15 | Final Exam Review | |
| 16 | Final Exam | |