

San Francisco State University
Electrical Engineering

Course Outline for Engr 205 Electric Circuits
Fall 2009

Bulletin Description:

Engr 205 Electric Circuits (3)

F,S

Prerequisites: PHYS 230. Must be taken concurrently with MATH 245 and Engr 206. Circuit analysis, modeling, equivalence, circuit theorems, PSpice simulation. Ideal transformers and operational amplifiers. Transient response of 1st-order circuits. AC response, phasor analysis, AC impedance, AC power.

Textbook:

S. Franco, *Electric Circuits Fundamentals*, Oxford University Press, 1995.

Coordinator:

Sergio Franco, Professor of Electrical Engineering

Prerequisites by Topic:

1. Basic electricity and magnetism
2. Basic calculus and analytic geometry
3. Solution of systems of linear algebraic equations
4. Basic linear differential equations
5. Complex numbers

Course Objectives¹:

1. Present fundamental circuit analysis techniques [A.1, B.1]
2. Introduce circuit equivalence and modeling [A.1, B.1]
3. Develop physical insight and intuition for problem solving [A.1, B.1]
4. Use of PSpice simulation as a verification tool [B.3]

¹Indices in brackets refer to educational objectives and outcomes of the School of Engineering.

Topics:

1. Electricity, signals, and circuits
2. Circuit analysis techniques
3. Network theorems and circuit modeling
4. Dependent sources, ideal transformers, amplifiers
5. Op amps and basic instrumentation applications
6. Energy-storage elements
7. Natural, forced, transient, and steady-state responses
8. Phasor algebra, impedance, and AC circuit analysis
9. Power calculations
10. PSpice simulation examples.

Professional Component:

- 1 Engineering Sciences: 67%
- 2 Engineering Design: 33%

Evaluation:

1. Thirteen weekly homework assignments, 10% of overall grade
2. Three 1-hour midterm exams, 4 problems each: 20% each (60% of overall grade)
3. One 2.5-hour final exam. 5 problems: 30% of overall grade

Performance Criteria²:Objective 1

- 1.1 The student will demonstrate an ability to formulate circuit equations and solve for multiple unknowns. [1, 2, 3]
- 1.1 The student will demonstrate an ability to perform transient analyses of 1st-order circuits. [1, 2, 3]
- 1.2 The student will demonstrate an ability to extend resistive-circuit analysis techniques to AC circuits using phasor algebra. [1, 3]

Objective 2

- 2.1 The student will demonstrate an understanding of the i - v characteristics of sources and basic R , L , and C elements, their idealized models, and the practical limitations of such models. [1, 2]
- 2.2 The student will demonstrate a knowledge of how to apply ideal transformer and op amp models to the analysis of basic circuit configurations. [1, 2, 3]
- 2.3 The student will demonstrate how to apply circuit reduction techniques to simplify circuits or portions thereof. [1, 2, 3]

Objective 3

- 3.1 The student will demonstrate an understanding of terminology, concepts, and methodology common to engineering. [1, 2, 3]
- 3.2 The student will demonstrate an ability to apply a structured methodology to solve analytical as well as design-oriented problems. [1, 2]
- 3.3 The student will demonstrate an ability to recognize inadmissible circuit configurations and unrealistic results. [1, 2, 3]

Objective 4

- 4.1 The student will be aware of the limitations of computer simulation in engineering. [1]
- 4.2 The student will demonstrate a skill in inputting a circuit description to the computer. [1]
- 4.3 The student will demonstrate a skill in running successful simulations and compare with hand calculations. [1]

²Numbers in brackets refer to evaluation methods used to assess student performance.

Fall 09

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Class/Laboratory Schedule:

Three 50-minute lectures/week

Engr 205 – F09 - Lectures

1. Units and Notation, Basic Electric Quantities
2. Electric Signals and Circuits
3. Kirchhoff's Laws
4. Circuit Elements and Sources
5. Resistance, Series and Parallel Combinations
6. Basic Resistive Circuits
7. Practical Sources and Loading
8. Circuit Solution by Inspection
9. Nodal Analysis
10. Loop Analysis
11. The Superposition Principle
12. Source Transformations; PSpice Examples
Exam # 1: Mon, Sept 28, (4 probs covering up to Lecture #12 included)
13. One-Ports
14. Circuit Theorems
15. Circuit Theorem Applications
16. Power Calculations; PSpice Examples
17. Dependent Sources
18. Circuit Analysis with Dependent Sources
19. The Ideal Transformer
20. Amplifier Concepts; PSpice Examples
21. The Operational Amplifier, the Op Amp Rule
Exam # 2: Wed, Oct 21 (4 probs covering up to Lecture #21 included)
22. Summing and Difference Amplifiers
23. Instrumentation Amplifiers and I-V Converters
24. V-I Converters, Current Amps; PSpice Examples
25. Capacitance and Inductance
26. Natural response
27. Response to DC and AC forcing Functions
28. Basic RC and RL Circuits
29. Transients in First-Order Networks
30. RC Circuits Using Op Amps; PSpice Example
Exam # 3: Mon, Nov 16 (4 probs covering up to Lecture #30 included)
31. Sinusoids and Phasors
32. AC Responses of the Basic Elements
33. Time-Domain Analysis of First-Order AC Circuits
34. Phasor Algebra
35. Phasor Algebra Applications
36. AC Impedance
37. Frequency-Domain Analysis
38. AC Circuits Using Op Amps; PSpice Examples
39. AC Power and Maximum Power Transfer

Final Exam: Fri, Dec 18, 8:00-10:30 am, (5 probs focusing on ac circuits)

Notes on Evaluation:

1. No late homework accepted. Solutions to the homework assignments are posted in the solution window across Sci 144. For each assignment, two randomly selected problems will be graded, each with a subjective grade of 0, 1, or 2 points.
2. All exams are closed book. One standard (8½" × 11") double-sized sheet of notes allowed.
3. **No make-up exams** and **no incomplete** grades without a serious and verifiable medical justification. **No changes** in the exam dates. **No exceptions.**
4. **Midterm Exams: #1, Mon, Sept 28; #2, Mon, Oct 19; #3: Mon, Nov 16.**
5. **Final exam:** Fri, Dec 18, 8-10:30am, in the lecture room.
6. Grading criteria (Example: 55% to 60% results in a grade of C):

0<F<35<D-<40<D<45<D+<50<C-<55<C<60<C+<65<B-<70<B<75<B+<80<A-<85<A<100

Relationship to Other Courses:

This is a required course of all engineering students. Concurrent enrollment in Engr 206, *Circuits and Instrumentation*, is strongly recommended. **Important note:** *If you are taking Engr 205 and Engr 206 concurrently, and decide to withdraw from Engr 205, you will automatically be dropped also from Engr 206.* Engr 205 is a prerequisite to Engr 300, Engr 305, Engr 306, Engr 353, and Engr 356. Mastery of the Engr 205 material is essential for good performance in the EE curriculum in general. Some upper division courses require a grade of C or better in this course, as specified in the bulletin.

Note to CE and ME Majors:

Engr 205 meets the ABET³ requirement that you take at least one course in a non-major engineering subject. Moreover, the material you learn in this course will prove extremely useful when you will take the EIT exam – something students tend close to graduation, when their minds are still fresh from their undergraduate studies. In the past, the accompanying lab, Engr 206, used to be mandatory for all SFSU engineering majors, but now CE majors are exempt. However, if you envision pursuing a CE career that will require field measurements, you may wish to take also Engr 206 to gain hands-on experience with standard instrumentation and measurements (oscilloscopes, signal generators, multimeters, etc.)

³ABET (Accreditation Board for Engineering and Technology) is the agency responsible for accrediting college programs such Engineering at SFSU.