**Las Positas College**
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**Course Outline for ENGR 44**

**INTRODUCTION TO CIRCUIT ANALYSIS**

**Effective: Fall 2007**

I. CATALOG DESCRIPTION:
ENGR 44 — INTRODUCTION TO CIRCUIT ANALYSIS — 4.00 units

Analysis of introductory engineering AC and DC circuits. Natural, forced, and complete circuit response. Prerequisite: Physics 8A (completed with a grade of "C" or higher). 3 hours lecture, 3 hours laboratory.

3.00 Units Lecture 1.00 Units Lab

**Grading Methods:**
Letter Grade

**Discipline:**

| | MIN |
|---|---|
| **Lecture Hours:** | 54.00 |
| **Lab Hours:** | 54.00 |
| **Total Hours:** | 108.00 |

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT:

III. PREREQUISITE AND/OR ADVISORY SKILLS:

IV. MEASURABLE OBJECTIVES:

**Upon completion of this course, the student should be able to:**

1. analyze circuits using mesh current and node voltage simultaneous equations
2. apply circuit theorems to simplify introductory engineering dc and ac networks with independent and dependent sources
3. apply circuit theorems to analyze introductory engineering dc and ac networks with independent and dependent sources
4. determine the natural components of network responses
5. determine the forced component of network responses
6. demonstrate capability to analyze circuits with the appropriate diagnostic instruments, e.g. oscilloscope, DVM, etc.
7. determine equivalent lumped magnitudes for r, l, c, y and z circuit combinations

V. CONTENT:

A. Charge and current
B. Voltage and power
C. Circuits, nodes and branches
D. Kirchhoff's voltage law
E. Kirchhoff's current law
F. Independent current and voltage sources
G. Resistance
H. Capacitance
I. Industance
J. Switches
K. Circuit analysis techniques
    1. Combing series elements
    2. Parallel elements
    3. Voltage dividers
    4. Current dividers
    5. Thevenin equivalents
    6. Norton equivalents
L. Resistive circuit analysis
M. Power and energy relationships
N. Representation of digital signals with voltage levels
O. CMOS inverter
P. CMOS implementations of NAND and NOR gates
Q. NMOS and PMOS circuit models
    1. Non-ideal switches
R. Cascaded inverter switching model
    1. RC transients
S. First-order RC circuits
T. Inverter pull-down and pull-up

U. General case and switching speed optimization
V. Energy and power dissipation and its system implications
W. Power dissipation and its system implications
X. Distributed R-C model and lumped models for interconnects

VI. METHODS OF INSTRUCTION:
A. **Discussion** - Review and discussion of lecture topics
B. **Lecture** -
C. **Lab** - Lab projects
D. Group problem solving

VII. TYPICAL ASSIGNMENTS:
A. Reading: 1. Read “Fundamental Circuit Laws; Kirchhoff’s Laws,” section 1-7, Chapter 1, Fitzgerald, et. al. Be prepared to discuss the application of Kirchhoff’s laws to circuit analysis. B. Practical Exercises: 1. Read “Driving-point Impedance and Admittance,” section 4-4, Chapter 4, Fitzgerald, et al. Calculate the input impedance Z(s) of the network of Figure 4-13. C. Laboratory performance: 1. Introduce students to RLC electronic components and explain how they function. Build up circuit on ? board. Calculate the answer to the circuit problem, and verify with an ohm-meter, voltmeter, etc., the calculations performed for the circuit analysis, and input the problem into “Electronic Work Bench” also verifying the calculated result.

VIII. EVALUATION:
A. **Methods**

1. Exams/Tests
2. Quizzes
3. Home Work
4. Lab Activities
5. Final Performance
6. Other:
    a. Methods:
        1. Assignments (to the graded at instructor’s discretion)
        2. Laboratory performance
        3. Examinations
            a. Quizzes
            b. Midterm
        4. Final Examination
    b. Typical problems
        1. Analyze a non-linear circuit and describe how it functions, e.g. thyristor
        2. Given the parallel and series circuits, empirically determine the values of the electronic components from which the circuits are made.
        3. Given a black box circuit, empirically determine the circuit characteristics of the box.
        4. Diagram and explain the difference between a natural response circuit and a forced response circuit.

B. **Frequency**

1. Weekly assignments
2. Quizzes if needed
3. Examinations at appropriate intervals throughout the semester
4. Final examination

IX. TYPICAL TEXTS:
1. Reed, Michael and Ron Rohrer *Applied Introductory Circuit Analysis for Electrical and Computer Engineers.*, Macmillan Publishing, 1999.
2. Schwarz, Steven E. and William G. Oldham *Electrical Engineering: An Introduction.*, Oxford University Press, 1984.

X. OTHER MATERIALS REQUIRED OF STUDENTS:
A. Scientific calculator with coordinate conversion capability, Engineering paper.