ENGR 16 Course Outline as of Spring 2003

CATALOG INFORMATION

Dept and Nbr: ENGR 16 Title: ELEC CIRC & DEVICES
Full Title: Electric Circuits & Devices
Last Reviewed: 1/25/2021

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	4.00	Lecture Scheduled	3.00	17.5	Lecture Scheduled	52.50
Minimum	4.00	Lab Scheduled	3.00	17.5	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	6.00		Contact Total	105.00
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 105.00 Total Student Learning Hours: 210.00

Title 5 Category:	AA Degree Applicable
Grading:	Grade Only
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	

Catalog Description:
Fundamental principles of engineering circuit analysis and an introduction to the theory and use of common electronic devices. Subjects covered include node and loop analysis, circuit simplification techniques, natural and forced response, op amp behavior and circuits, semiconductor theory and behavior, transistor biasing, modeling, small signal analysis, and digital circuits. Mathematical concepts reviewed and applied include: matrices and determinants, binary and hexadecimal numbers, Fourier and Laplace transforms, complex numbers and phasors. Lab will be selected from those topics in the above list not duplicated in the Physics 4C (Electricity and Magnetism). Students are required to have a graphing calculator.

Prerequisites/Corequisites:
PHYS 4C completed or in progress and MATH 2B completed or in progress.

Recommended Preparation:

Limits on Enrollment:

Schedule of Classes Information:
Description: Fundamental principles of DC and AC circuit analysis and an introduction to the

theory and use of common analog and digital electronic devices, circuits, and systems. (Grade Only)
Prerequisites/Corequisites: PHYS 4C completed or in progress and MATH 2B completed or in progress.
Recommended:
Limits on Enrollment:
Transfer Credit: CSU;UC. (CAN ENGR6)
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**	Effective:	Inactive:
CSU GE:	**Transfer Area**	Effective:	Inactive:
IGETC:	**Transfer Area**	Effective:	Inactive:

CSU Transfer:	Transferable	Effective:	Fall 1981	Inactive:
UC Transfer:	Transferable	Effective:	Fall 1981	Inactive:

CID:

Certificate/Major Applicable:
Not Certificate/Major Applicable

COURSE CONTENT

Outcomes and Objectives:
The student will:
1. Draw schematic circuit diagrams, labeling the voltages and currents according to standard conventions.
2. Find the voltages and currents in complex DC circuits using node and loop analysis.
3. Use voltage and current dividers and Thevenin and Norton equivalents to simplify circuits.
4. Analyze simple circuits containing dependent sources.
5. Calculate power in a circuit element with 2 or more terminals.
6. Perform simple calculations and manipulations on sinussoids.
7. Construct and interpret Bode plots of simple circuits.
8. Perform algebraic manipulations on complex numbers given in rectangular, polar, and exponential form.
9. Use phasor analysis and impedance to find a circuit's output for a given sinusoidal input.
10. Identify the poles and zeros of a circuit, and predict the form of the transient response from the poles.
11. Find the transient response of a first order circuit with given initial conditions.
12. Analyze diode circuits using the ideal diode and large signal diode models.
13. Bias and model a bipolar junction transistor.
14. Perform small signal analysis on simple CE BJT amplifier circuits.

15. Perform analysis and basic design of ideal op amp circuits.
16. Identify whether a particular op amp circuit will operate in an ideal manner.
17. Use Bode plots to design and understand op amp circuits.
18. Predict the output voltage of digital circuits composed of gates and simple flip-flops.
19. Model circuits using Electronic WorkBench or similar circuit modeling software.
20. Solder components on to a printed circuit board.
21. Breadboard and debug circuits on a protoboard.
22. Set up and run lab experiments using equipment such as scopes, multimeters, frequency counters, & signal generators.

Topics and Scope:

1. Principles and Techniques of DC Circuit Analysis.
   a. circuit elements and Kirchhoff's Laws
   b. voltage and current dividers
   c. mesh and nodal circuit analysis
   d. power calculations
   e. Network Theorems (Thevenin's, Norton's, and Max Power)
   f. graphical solutions for nonlinear circuit elements
   g. measurement instrumentation (Voltmeter, ammeter, scope)
2. AC Circuit Analysis
   a. amplitude (RMS & Peak), period, phase, and frequency
   b. sinusoidal voltages and currents
   c. periodic signals (e.g. square wave, sawtooth, ...)
   d. review of complex numbers
   e. phasors
   f. impedance
   g. AC power
   h. frequency response and Bode plots
   i. natural response
   j. total response
   k. pole-zero diagrams
   l. practical applications (resonant circuits, impedance matching three-phase circuits, etc.)
3. Analog Building Blocks.
   a. analog signals and systems
   b. dependent sources
   c. modeling concepts
   d. input and output resistance
   e. open-circuit voltage amplification
   f. practical application (voltage, current and power amps)
4. Semiconductors.
   a. physical and chemical properties of doped semiconductors
   b. diodes, ideal and non-ideal behavior
   c. transistors behavior and manufacturing
   d. transistor biasing and modeling
   e. graphical circuit analysis for non-linear elements
5. Operational Amplifiers and Applications.
   a. characteristics of operational amplifiers

b. circuit analysis assuming ideal op amps
c. non-ideal op amp behavior
d. op amp realizations
e. practical applications (op amp math circuits, etc.)

6. Digital Building Block.
   a. digital signals and binary numbers
   b. logic gates (function and realization)
   c. logic chips (function, realization, and manufacture)
   d. digital systems (combinational logic and memory)
   e. practical applications (state machines, computers, etc)

Assignment:

1. Weekly problem sets.
2. At least two 50 minute examinations.
3. Lab reports covering all lab work.
4. Comprehensive final examination.
5. Periodic short quizzes.

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

None, This is a degree applicable course but assessment tools based on writing are not included because problem solving assessments and skill demonstrations are more appropriate for this course.	Writing 0 - 0%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework problems, Lab reports	Problem solving 25 - 40%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

soldering and Breadboarding	Skill Demonstrations 1 - 5%

Exams: All forms of formal testing, other than skill performance exams.

PROBLEM SOLVING	Exams 45 - 75%

Other: Includes any assessment tools that do not logically fit into the above categories.

ATTENDANCE	Other Category 0 - 10%

Representative Textbooks and Materials:

Schwartz & Oldham. ELECTRICAL ENGINEERING, AN INTRODUCTION. Holt, Rinehart, & Winston, 1993

R.J. Smith, CIRCUITS, DEVICES, AND SYSTEMS. Fifth Edition, John Wiley and Sons, 1992

Rizzoni: Principals and Applications of Electrical Engineering, 3rd ed. McGraw-Hill, 2000