COLLEGE OF THE DESERT

Course Code PH-006A

Course Outline of Record

1. Course Code: PH-006A
2. a. Long Course Title: Electric Circuits for Engineering & Science
   b. Short Course Title: ELECTRIC CIRCUITS
3. a. Catalog Course Description:
   This course is designed to provide students with a broad knowledge of the theoretical background and experimental application of modern electronic devices and circuitry. It covers basic electronic concepts, solid state devices such as diodes and transistors and an introduction to basic analog and digital circuit design and analysis emphasizing practical applications including Ohm's Law and Kirchhoff's laws; nodal and loop analysis; analysis of linear circuits; network theorems; transients in RLC circuits; sinusoidal steady-state analysis and application of PSPICE to circuit analysis. (Equivalent to ENGR-006A.)
   b. Class Schedule Course Description:
   This course is designed to provide students with a broad knowledge of the theoretical background and experimental application of modern electronic devices and circuitry.
   c. Semester Cycle (*if applicable*): Fall semester
   d. Name of Approved Program(s):
   - ENGINEERING AS Degree and Transfer Preparation
4. Total Units: 4.00 Total Semester Hrs: 108.00
   Lecture Units: 3 Semester Lecture Hrs: 54.00
   Lab Units: 1 Semester Lab Hrs: 54.00
   Class Size Maximum: 35 Allow Audit: No
   Repeatability No Repeats Allowed
   Justification 0
5. Prerequisite or Corequisite Courses or Advisories:
   Course with requisite(s) and/or advisory is required to complete Content Review Matrix (CCForm1-A)
   Prerequisite: MATH 001A
6. Textbooks, Required Reading or Software: *(List in APA or MLA format.)*
   a. J. Nilsson and S. Riedel (2014). *Electric Circuits* (10th /e). Saddle River, NJ Prentice Hall. ISBN: 0133760030
   College Level: Yes
   Flesch-Kincaid reading level: 12
   b. Irwin, J.D., R.M. Nelms (2015). *Basic Engineering Circuit Analysis* (11th/e). Hoboken NJ Prentice Hall. ISBN: 111853929X
   College Level: Yes
   Flesch-Kincaid reading level: 12.5
   c. Boylestad, R.L., Kousourou, G.. Laboratory Manual to Accompany Introductory Circuit Analysis. Prentice Hall , 01-14-2010.
7. Entrance Skills: *Before entering the course students must be able:*
   a. Differentiate and antidifferentiate the sum, difference, product, quotient and composition of functions.
   - MATH 001A - Compute derivatives using differentiation formulas;
   - MATH 001A - Apply integration to find area.

   b.
   Applying problem-solving techniques to new situations and be able to anticipate and check their proposed solutions.

   - MATH 001A - Use differentiation to solve applications such as related rate problems and optimization problems;

c. Independently analyze, anticipate and define problems involving applications of the definite integral and the derivative.

- MATH 001A - Use differentiation to solve applications such as related rate problems and optimization problems;
- MATH 001A - Evaluate integrals using the Fundamental Theorem of Calculus; and

d. Develop an intuitive grasp of the concept of the limit, definition of the derivative and integral. As well as geometrically and intuitively understand selected major theorems: i. Mean value theorem, ii. Extreme value theorem, iii. Intermediate value theorem and iv. First fundamental theorem of calculus.

- MATH 001A - Compute the limit of a function at a real number;
- MATH 001A - Construct the derivative of a function as a limit;
- MATH 001A - Evaluate a definite integral as a limit;
- MATH 001A - Evaluate integrals using the Fundamental Theorem of Calculus; and

8. Course Content and Scope:

Lecture:

1. CIRCUITS (DC)
    1. PRINCIPLES
        1. QUANTITIES; Units
        2. CIRCUITS; Wires, Branches, Nodes, Series, Parallel
        3. LAWS; KCL, KVL
    2. ANALYSIS
        1. SOURCES; V & I, DC, Time
        2. RESISTORS; Ohms Law, Series, Parallel, Power
        3. NODAL EQUATIONS
        4. LOOP EQUATIONS
        5. DIVIDERS; Voltage, Current
        6. MEASUREMENTS; Ammeter, Voltmeter, Oscilloscope
    3. TECHNIQUES
        1. THEOREMS; Thevenin, Norton
        2. NON-LINEAR; Elements, Solutions, Graphical methods
        3. POWER; Algebraic sign, Instantaneous & average, Multi-terminal
2. CIRCUITS (TIME)
    1. CAPACITORS & INDUCTORS
        1. I-V RELATIONSHIPS
        2. CONNECTIONS; Series, Parallel
        3. ENERGY STORAGE
        4. PARASITICS
    2. SINUSOIDAL
        1. PROPERTIES; Amplitude, Phase, Frequency
        2. COMPLEX ARITHMETIC; Real, Imaginary, Rectangular, Polar
        3. PHASORS
        4. POWER; Average, RMS
    3. PHASORS
        1. IMPEDANCE; Dividers, Thevenin
        2. FREQUENCY RESPONSE; Bode Diagram, Decibels
        3. APPLICATIONS; Maximum Power Transfer, Resonance
    4. TRANSIENTS
        1. FIRST ORDER; Initial Conditions, Time Constants, Pulse Response
        2. HIGHER ORDER; Roots, Oscillatory Behavior, Damping
        3. RESPONSE; Complete, Forced, Natural
3. ANALOG ELECTRONICS
    1. ACTIVE CCTS.
        1. DEPENDENT SOURCES
        2. IDEAL AMPS; Models, Gain Calculations
        3. OP AMPS; Properties of Ideal Op Amps; Limitations, Circuits
    2. SEMICONDUCTOR DEVICES
        1. DIODES; DC Characteristics, Models, Rectifier circuits
        2. TRANSISTORS; BJT's, MOSFETS, Models, Circuits

Lab: *(if the "Lab Hours" is greater than zero this is required)*

1. CIRCUITS (DC)
    1. PRINCIPLES
        1. QUANTITIES; Units
        2. CIRCUITS; Wires, Branches, Nodes, Series, Parallel
        3. LAWS; KCL, KVL
    2. ANALYSIS
        1. SOURCES; V & I, DC, Time
        2. RESISTORS; Ohms Law, Series, Parallel, Power
        3. NODAL EQUATIONS
        4. LOOP EQUATIONS
        5. DIVIDERS; Voltage, Current
        6. MEASUREMENTS; Ammeter, Voltmeter, Oscilloscope
    3. TECHNIQUES
        1. THEOREMS; Thevenin, Norton
        2. NON-LINEAR; Elements, Solutions, Graphical methods
        3. POWER; Algebraic sign, Instantaneous & average, Multi-terminal
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9. Course Student Learning Outcomes:
    1. Analyze circuits containing basic electronic components.
    2. Use simulation software to model and analyze circuits.
    3. Utilize test and measurement equipment to measure characteristics of circuits and diagnose circuit problems.
    4.

    Construct working circuits containing basic electronic components working from a schematic diagram.

10. Course Objectives: *Upon completion of this course, students will be able to:*
    a. Explain the underlying assumptions and fundamental principles of circuit analysis.
    b. Apply the passive sign convention to describe voltage, current and power for ideal basic circuit elements.
    c. Apply Ohm's Law and Kirchhoff's Laws to analyze simple resistive circuit models.
    d. Explain the utility of standard analytic techniques and apply them to more complicated resistive circuit models.
    e. Explain the voltage, current and energy relationships for inductors and capacitors.
    f. Determine the transient response of first-order RL and RC circuit models.
    g. Determine the natural and step responses of series and parallel RLC circuit models.
    h. Apply the phasor concept to determine the sinusoidal steady-state response of RLC circuits.
    i. Derive voltage transfer functions and construct Bode diagrams to analyze the frequency response of simple RLC circuits.
    j. Apply standard measurement techniques to verify that mathematical circuit models adequately represent practical electric circuits.
    k. Explain the limitations of measurement devices and their effect on experimental results.
    l. Demonstrate an understanding of the basic circuit configurations and applications of power supply circuits.
    m. Explain the characteristics and applications of basic amplifier configurations
    n. Identify the major steps in the engineering approach to problem solving.
    o. Apply software tools to engineering design problems.
    p. Identify basic relationships and units utilized in fields of mechanical, electrical, energy, chemical, and materials engineering.

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*
    a. Collaborative/Team
    b. Discussion
    c. Laboratory
    d. Lecture
    e. Participation

12. Assignments: *(List samples of specific activities/assignments students are expected to complete both in and outside of class.)*
    In Class Hours: 108.00
    Outside Class Hours: 108.00
    a. In-class Assignments
        1. Complete in-class worksheets and assignment
        2. Weekly supervised laboratory assignments.
        3. Completion of a project-laboratory. A project-laboratory involves designing and building an electronics project of considerable complexity and the resulting project must address a clearly defined goal, must be well-documented and shown to accomplish the desired objective.
    b. Out-of-class Assignments
        1. Do all reading assignments (text, study guides)
        2. Complete assigned homework assignments.
        3. Submit completed weekly supervised laboratory assignments.
        4. Complete weekly independent laboratory projects.
        5. Completion of a project-laboratory. A project-laboratory involves designing and building an electronics project of considerable complexity and the resulting project must address a clearly defined goal, must be well-documented and shown to accomplish the desired objective.

13. Methods of Evaluating Student Progress: *The student will demonstrate proficiency by:*
    - Written homework
      Weekly homework assignments.
    - Laboratory projects

A. Weekly laboratory projects will be examined for correct functionality. B. Students will submit their completed project laboratory. Grade is assigned on adherence to required form, style, contents and usability of completed project.

- Computational/problem solving evaluations
- Mid-term and final evaluations
  A comprehensive final on all course material. This will include the practical design of several electronic devices with grading based on performance versus known devices.
- Student participation/contribution
- Other
  Several Periodic examinations on subject material. These examinations will all be essay; practical parts, short answer or fill ins.

14. Methods of Evaluating: Additional Assessment Information:

15. Need/Purpose/Rationale -- *All courses must meet one or more CCC missions.*
IGETC Area 5: Physical and Biological Sciences (mark all that apply)
A: Physical Science with Lab
CSU GE Area B: Physical and its Life Forms(mark all that apply)
B1 - Physical Science
PO-GE C1-Natural Sciences
Draw a connection between natural sciences and their own lives.
Demonstrate knowledge of the use of technology in scientific investigation and human endeavors, and the advantages and disadvantage of that technology.
Use college-level mathematical concepts and methods to understand, analyze, and explain issues in quantitative terms.
IO - Scientific Inquiry
Collect and analyze data. Skills of data collection include an understanding of the notion of hypothesis testing and specific methods of inquiry such as experimentation and systematic observation.
Predict outcomes utilizing scientific inquiry: using evidence and assertions determine which conclusions logically follow from a body of quantitative and qualitative data.
Analyze quantitative and qualitative information to make decisions, judgments, and pose questions.

16. Comparable Transfer Course

University System	Campus	Course Number	Course Title	Catalog Year
UC	UC Riverside	EE 001A	Engineering Circuit Analysis I	2015
CSU	California Polytechnic University, Pomona	ECE 109	Introduction to Electrical Engineering	2015
UC	UC Irvine	EECS70A	Network Analysis I	2015

17. Special Materials and/or Equipment Required of Students:

18. Materials Fees: ☐ Required Material?

Material or Item	Cost Per Unit	Total Cost

19. Provide Reasons for the Substantial Modifications or New Course:

Course periodic review.

20. a. Cross-Listed Course *(Enter Course Code)*: ENGR-006A
    b. Replacement Course *(Enter original Course Code)*: *N/A*

21. Grading Method *(choose one)*: Letter Grade Only

22. MIS Course Data Elements
    a. Course Control Number [CB00]: CCC000189157
    b. T.O.P. Code [CB03]: 190200.00 - Physics, General
    c. Credit Status [CB04]: D - Credit - Degree Applicable
    d. Course Transfer Status [CB05]: A = Transfer to UC, CSU
    e. Basic Skills Status [CB08]: 2N = Not basic skills course
    f. Vocational Status [CB09]: Not Occupational
    g. Course Classification [CB11]: Y - Credit Course
    h. Special Class Status [CB13]: N - Not Special
    i. Course CAN Code [CB14]: *N/A*
    j. Course Prior to College Level [CB21]: Y = Not Applicable
    k. Course Noncredit Category [CB22]: Y - Not Applicable
    l. Funding Agency Category [CB23]: Y = Not Applicable
    m. Program Status [CB24]: 1 = Program Applicable

    Name of Approved Program *(if program-applicable)*: ENGINEERING
    Attach listings of Degree and/or Certificate Programs showing this course as a required or a restricted elective.)

23. Enrollment - Estimate Enrollment
    First Year: 0
    Third Year: 0

24. Resources - Faculty - Discipline and Other Qualifications:
    a. Sufficient Faculty Resources: Yes
    b. If No, list number of FTE needed to offer this course: *N/A*

25. Additional Equipment and/or Supplies Needed and Source of Funding.
    N/A

26. Additional Construction or Modification of Existing Classroom Space Needed. *(Explain:)*
    N/A

27. FOR NEW OR SUBSTANTIALLY MODIFIED COURSES
    Library and/or Learning Resources Present in the Collection are Sufficient to Meet the Need of the Students Enrolled in the Course: Yes

28. Originator Carl Farmer Origination Date 03/07/16