METROPOLITAN STATE UNIVERSITY OF DENVER
Office of Academic and Student Affairs

REGULAR COURSE SYLLABUS

College of: Professional Studies

Department: Engineering and Engineering Technology

Prefix & Course Number: CPE 1150 **Crosslisted With*:** ____

Course Title: AC Circuit Fundamentals

Transcript Course Title (30 characters): AC Circuit Fundamentals

Check All That Apply: Required for Major: X Required for Minor: Specified Elective: _____

Required for Concentration: _____ Elective: ___ Service Course:

To receive Title IV financial aid funds, all institutions of higher education must comply with the federal definition of a credit hour. The Higher Learning Commission requires institutions to maintain policies and procedures for verifying compliance with this definition.

> ***Federal Credit Hour Definition:*** *A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than:*
> *(1) one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or (2) at least an equivalent amount of work as required in paragraph (1) of this definition for other activities as established by an institution, including laboratory work, internships, practica, studio work, and other academic work leading toward to the award of credit hours. 34CFR 600.2 (11/1/2010)*

Credit Hours: 4 (3+2) **Schedule Type**: B **Grade Mode**: L

Face-to-Face or Equivalent Hours per course:

Lecture 45 Lab 30 Internship _____ Practicum _____ Other (please specify type and hours):_____

Additional Student Work Hours per course: 120

Variable topics umbrella course: No X **Yes** _____ If yes, number of credits/repeats allowed _____

Specified repeatable course: No X **Yes** _____ If yes, number of credits/repeats allowed _____

Prerequisite(s): CPE 1140 and (MTH 1120 or MTH 1400 or higher level math course (with a grade of "C" or better for all prerequisites)

Corequisite(s): _____

Prerequisite(s) or Corequisite(s): _____

Banner Enforced Coding:

Prerequisite(s): CPE 1140 and (MTH 1120, or MTH 1400 or MTH 1410, or MTH 2410 (with a grade of "C" or better for all prerequisites)

Corequisite(s): _____

Prerequisite(s) or Corequisite(s): _____

Registration restrictions: Level _____ **Class** _____**Program/Major** _____ **Student attribute** _____

Catalog Course Description:

This course is a continuation of CPE 1140, using trigonometry and complex algebra. Studies include single time constant circuits, phasors, and the j operator, RLC circuits with sinusoidal, steady-state sources, impedance and admittance, AC formulation of classic network theorems, complex network equations, complex power, frequency response, transformers, and two-port network models.

Specific Variable Topics Course Description (if applicable, umbrella course description included above):

Required Reading and Other Materials will be equivalent to:

Robbins. (2006). *Circuit Analysis, 4th Edition or latest edition*. Thompson Delmar Learning

Specific, *Measurable* Student Behavioral Learning Objectives:

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

1. Utilize Ohm's law, Kirchhoff's Voltage and Current Laws, Superposition, Thevenin and Norton conversions to analyze single and three phase AC circuits using phasors
2. Determine the theoretical value for current, voltage, power and impedance in various series, parallel and series/parallel circuits consisting of transformers, and impedance components utilizing calculators and computer simulation programs for single and three phase AC circuits
3. Determine the impact of various frequencies on impedance circuits related to resonance and cutoff frequencies and develop the appropriate transfer function
4. Work with a team to construct circuits and validate theoretical findings utilizing analog and digital meters, function generators, oscilloscopes, power supplies, breadboards and electrical components
5. Write laboratory finding in a concise document comparing theoretical and actual data with computer generated models

Detailed Outline of Course Content or Outline of Field Experience/Internship (experience, responsibilities and supervision):

I. AC Fundamentals
- A. AC Waveforms
- B. Trigonometric Functions
- C. Waveform Parameters
- D. Phase Relations
- E. Oscilloscope
- F. Average and Effective Values
- G. AC Voltage and Current in R
- H. AC Voltage and Current in Land C
- I. Average Power

II. General A.C. Laboratory Equipment Familiarization
- A. Oscilloscope
- B. Digital Multimeter
- C. Frequency Counter

III. Computer-Aided A.C. Circuit Analysis

IV. Complex Algebra and Phasors
- A. Complex Numbers
- B. Complex Plane
- C. Arithmetic Operations
- D. Phasors
- E. Phasor Form of Impedance

V. Series and Parallel AC Circuits
- A. Series Equivalent Impedance
- B. Series R-L Circuits
- C. Series R-C Circuits
- D. Series R-L-C Circuits
- E. Voltage Divider Rule
- F. Admittance and Susceptance
- G. Parallel AC Circuits
- H. Current Divider Rule

VI. Series Parallel Circuits
- A. Simplified Equivalent Networks
- B. Power in Series-Parallel Circuits
- C. Ladder Networks
- D. Reactive and Apparent Power

VII. AC Network Transformations
- A. Source Conversions
- B. Series & Parallel Sources
- C. AC Mesh Analysis
- D. AC Nodal Analysis

VIII. AC Network Theorems
- A. Superposition
- B. Controlled Sources
- C. Thevenin
- D. Norton
- E. Maximum Power Transfer

IX. Filter & Resonant Circuits
- A. RC Filters
- B. Series RLC Circuits
- C. Parallel RLC Circuits
- D. Decibels & Logarithmic Plots

X. Transformers
- A. Basic Principles
- B. Ideal Transformers
- C. Impedance Transformation
- D. Types & Applications
- E. Losses
  - I. Copper
  - 2. Eddy Currents
  - 3. Hysteresis
  - 4. Efficiency
- F. Limitations
  - I. Leakage Flux
  - 2. Coupling Coefficients
  - 3. Loading Effects
  - 4. Frequency Response
  - 5. Mutual Inductance

XI. L, C, R Measurements
- A. Impedance Bridge
- B. Vector Z-Meter

Evaluation of Student Performance:

1. Examinations
2. Written Assignments
3. Lab Reports
4. Laboratory Exam