



RICHLAND COLLEGE
School of Engineering Technology

COURSE SYLLABUS

CETT 1405
AC Circuits

Fall 2018

Richland College is determined to prepare the student with the knowledge and skills you need to succeed in today's dynamic work environment. Towards this end, foundation skills and workplace competencies (SCANS skills) have been designed into the curriculum for Engineering Technology and Semiconductor Manufacturing.

CATALOG DESCRIPTION

A study of the fundamentals of alternating current including series and parallel AC circuits, phasors, capacitive and inductive networks, transformers, and resonance. (3 Lec., 3 Lab)

COURSE LEARNING OUTCOMES

The student will analyze AC circuits from simple to complex, construct and make measurements for AC circuits from simple to complex; describe in technical terms an AC signal on an oscilloscope; and describe the difference between an AC and DC signal. In addition, the student will calculate the phase relationships of current, voltage, and impedance using trigonometry, j-factor, and vector analysis. The student will analyze and construct filters and networks so as to analyze the effects of varying the applied signal and frequency, especially at the frequency approaching, at, and above resonance. Static and magnetic fields will be analyzed and studied.

COURSE DESCRIPTION:

Course Number: CETT 1405

Course Title: AC Circuits

Credit Hours: 4 **Lecture Hours:** 3 **Lab Hours:** 3

Suggested Prerequisites:

DC Circuits, College or Technical Algebra

Suggested Co-Requisites:

Plane or Technical Trigonometry

TEXTBOOK:

GROB’S BASIC ELECTRONICS, By Mitchell E. Schultz. Glencoe-McGraw Hill, Ed. 12e

For the online course you must sign up for McGraw-Hill Connect. In Connect, you have three choices to pick from (you must choose one; all options include e-book access to the text book):

McGraw-Hill Connect Link: <http://connect.mheducation.com>

1. Access Code: ISBN 9781259229510
2. Access Code and loose leaf textbook: ISBN 9781259639586
3. Access Code and hard cover textbook: ISBN 9781259601927

SUPPLIES:

Scientific Calculator

COURSE REQUIREMENTS:

Students are encouraged to take notes in class and will turn assigned materials in for grading. To receive full credit for your work, it must be turned in on the specified due date. Late work will not be accepted except for extraordinary circumstances that are approved in advance by the instructor.

METHOD OF EVALUATION:

Evaluation will be based upon completion of all assigned work. The course average will be computed as follows:

McGraw-Hill Connect Assignments	20%
Laboratory/NIDA	40%
Test 1	10%
Test 2	10%
Test 3	10%
Final Exam	10%

Unless otherwise specified by the instructor, the grading system will be:

90 – 100	A
80 – 89	B
70 – 79	C
60 – 69	D
≤ 59	F

ATTENDANCE POLICY:

In order to be successful students must attend and participate in enrolled courses. You are expected to attend all classes and are fully responsible for your attendance. If at any time you wish to drop this course, or to withdraw from the college, initiate that action yourself. Do not assume that if you stop attending class you will be automatically dropped. It is the student's responsibility to drop or withdraw. You must withdraw from this course before the drop date specified to receive a grade of "W".

STOP BEFORE YOU DROP:

For students who enrolled in college level courses for the first time in the fall of 2007, Texas Education Code 51.907 limits the number of courses a student may drop. You may drop no more than 6 courses during your entire undergraduate career unless the drop qualifies as an exception. Your campus counseling/advising center will give you more information on the allowable exceptions.

Remember that once you have accumulated 6 non-exempt drops, you cannot drop any other courses with a "W". Therefore, please exercise caution when dropping courses in any Texas public institution of higher learning, including all seven of the Dallas County Community Colleges. For more information, you may access

<https://www1.dcccd.edu/catalog/cattoc.cfm?loc=RLC>

WITHDRAWAL POLICY:

If you are unable to complete this course, it is your responsibility to withdraw formally. The withdrawal request must be received in the Registrar's Office by

Thurs, November 15th 2018 (COURSE DROP DATE). Failure to do so will result in your receiving a performance grade, usually an "F".

If you drop a class or withdraw from the college before the official drop/withdrawal you will receive a "W" (Withdraw).

CLASSROOM POLICIES:

Use of telephones and other personal communication/entertainment devices is not allowed in the classroom. Computers may be used only when specifically permitted by the instructor. Behavior that is respectful of both the instructor and fellow class mates is expected.

ACADEMIC HONESTY:

Scholastic dishonesty is a violation of the Code of Student Conduct. Scholastic dishonesty includes, but is not limited to, cheating on a test, plagiarism, and collusion. As a college student, you are considered a responsible adult. Your enrollment indicates acceptance of

the DCCCD Code of Student Conduct published in the DCCCD Catalog at

<https://www1.dcccd.edu/cat1819/ss/code.cfm>

You are encouraged to collaborate on all assignments, but the work you hand in must be your own. This includes computer programming assignments. If a substantial amount of identical work is submitted by two or more students, both students will receive a grade of zero on the entire assignment.

Collaboration on exams is not allowed. Books, notes, and other materials are not allowed to be used during exams, unless specifically approved in writing. Any calculator may be used on exams. Failure to comply with examination standards will result in a score of

zero on the exam.

Occurrence of academic dishonesty will result in your dismissal from the course, with a grade of F.

CLASSROOM FOOD AND DRINK POLICY:

Food, drink, and tobacco use are not allowed in the classroom, in accordance with OM EJ-801.

INSTITUTION POLICIES:

For Institution Policies, please refer to:

<https://www.richlandcollege.edu/syllabipolicies>

ACADEMIC PROGRESS:

Students are encouraged to discuss academic goals and degree completion with their instructors. Specific advising is available throughout the semester. Check Success Tools for more details.

<https://www.richlandcollege.edu/services/academic-support/pages/successtools.aspx>

SYLLABUS CHANGE DISCLAIMER:

The instructor reserves the right to amend a syllabus as necessary

COURSE OBJECTIVES

1.0 Magnetism

- 1.1 Define the basic terminology of magnetism and the magnetic circuit.
- 1.2 Define the magnetic units.
- 1.3 State the Ohm's Law of the magnetic circuit and perform basic calculations.
- 1.4 State Coulomb's Law and perform basic calculations.
- 1.5 Describe the basic process of magnetic induction.

2.0 AC Voltage and Current

- 2.1 Develop and use basic vocabulary of AC.
- 2.2 Describe the generation of a sine wave in a magnetic field.
- 2.3 Calculate instantaneous values of the sine wave in degrees and radians.
- 2.4 Calculate instantaneous values of current and voltage.

3.0 Inductance

- 3.1 Develop and use the basic vocabulary of inductance and inductive circuits.
- 3.2 Calculate the inductance of a coil using physical measurements.
- 3.3 Describe the generation of counter emf.
- 3.4 Explain how an inductor opposes any change in current.
- 3.5 Describe the effects of magnetic coupling.
- 3.6 Draw and label the components of a transformer.
- 3.7 Calculate power, current, voltage, and impedance transformations that occur in a transformer.
- 3.8 Draw schematics for different types of transformers.
- 3.9 Calculate total inductance for series and parallel circuits.
- 3.10 Calculate inductive reactance for given values of inductance and frequencies.
- 3.11 Draw the response curves for a series LR circuit.
- 3.12 Calculate phase shift and impedance of an LR circuit using vector notation and trigonometry.
- 3.13 Calculate the Q of a coil.
- 3.14 Calculate total impedance for series and parallel LR circuits.

4.0 Capacitance

- 4.1 Define and use basic terms related to capacitance.
- 4.2 Explain how a charge is stored in the dielectric.
- 4.3 Relate the physical construction of a capacitor to its capacitance.
- 4.4 Draw the schematic of a capacitor and an electrolytic capacitor.
- 4.5 Explain the construction of typical capacitors by their dielectric.
- 4.6 Determine the value of capacitance by the color code.

- 4.7 Calculate the total capacitance of capacitors in series and in parallel.
- 4.8 Calculate the voltage drops across capacitors in series.
- 4.9 Check capacitors using electronic test equipment, such as an ohmmeter.
- 4.10 Describe the AC current in a capacitive circuit.
- 4.11 Calculate capacitive reactance of capacitance vs. frequency.
- 4.12 Draw the response curve of a capacitor vs frequency.
- 4.13 Explain the charging and discharging current of a sine wave signal in a capacitive circuit.
- 4.14 Explain that a capacitor opposes any change in voltage.
- 4.15 Explain the phase shift that occurs in a capacitive circuit.
- 4.16 Calculate the impedance of a series and a parallel RC circuit using vectors and trigonometry.
- 4.17 Calculate the phase shift across components in an RC circuit.
- 4.18 Calculate the voltages developed across capacitive voltage dividers.
- 5.0 RC and LR Time Constants
 - 5.1 Define a time constant for the RC circuit.
 - 5.2 Draw the charging current vs time (in time constants) for an RC circuit.
 - 5.3 Draw the voltages developed across C and R for a given number of time constants.
 - 5.4 Draw the discharge current vs time for an RC circuit.
 - 5.5 Explain what is occurring during charge and discharge in an RC circuit.
 - 5.6 Draw the current and voltage with respect to the time of an input square wave for an RC circuit.
 - 5.7 Draw the transient response curve of an LR circuit.
 - 5.8 Calculate the current and voltage vs time in an LR circuit.
 - 5.9 Explain why an inductive kick or high voltage appears when opening an LR circuit.
 - 5.10 Draw and explain the Universal Time Constant graph.
- 6.0 Alternating Current Circuits
 - 6.1 Calculate and describe the effects of AC on series and parallel circuits containing only resistors.
 - 6.2 Calculate and describe the effects of AC on series and parallel circuits containing only capacitors.
 - 6.3 Calculate and describe the effects of AC on series and parallel circuits containing only inductors.
 - 6.5 Draw the vectors for circuits containing L, R, and C in series.
 - 6.6 Calculate impedance, phase shift, current, voltage distribution, apparent power, and real power for a series RLC circuit using vector analysis and trigonometry.
 - 6.7 Calculate impedance, phase shift, current distribution, voltage drops, apparent and real power in a parallel RLC circuit utilizing vector analysis and trigonometry.
 - 6.8 Calculate the impedance, phase shift, current distribution, voltage drops, apparent and real power in a complex RLC circuit using vector analysis and trigonometry.

7.0 Complex Numbers for AC Circuits

7.1 Explain the j factor or operator.

7.2 Write the impedance of a series circuit using complex numbers.

7.3 Write the total current of a parallel circuit using complex numbers.

7.4 Solve series, parallel, and complex circuits using the j factor.

7.5 Convert rectangular form to polar form and convert polar to rectangular form.

7.6 Draw the vectors as related to the j factor solutions.

8.0 Resonance

8.1 Explain what occurs in the circuit as you approach resonance, reach resonance, and go above resonance.

8.2 Define resonance and write the formula.

8.3 Calculate the frequency of resonance.

8.4 Draw the frequency response curve for a series resonant circuit, marking the cutoff frequency, resonant frequency, bandwidth, and phase shifts at those points.

8.5 Draw the frequency response curve of a parallel resonant circuit, marking the cutoff frequencies, bandwidth, and phase shifts at those points.

8.6 Calculate the Q of series and parallel resonant circuits.

9.0 Filters

9.1 Define and use basic vocabulary related to filters.

9.2 List the purposes for filtering.

9.3 Explain the superpositioning effect of combining a DC and AC signal.

9.4 Describe the output of a transformer that has a DC and AC composite input signal.

9.5 Describe the operation of capacitive coupling.

9.6 Draw a low pass frequency RC filter and its frequency response curve.

9.7 Draw a high pass frequency RC filter and its frequency response curve.

9.8 Draw a low pass frequency response LR filter and its frequency response curve.

9.9 Draw a high pass frequency response LR filter and its frequency response curve.

9.10 Draw a bandpass filter and its frequency response curve.

9.11 Draw a bandstop filter and its frequency response curve.

9.12 Calculate the db loss in a filter at the frequency of cutoff.

10.0 General Objectives

10.1 Select and utilize the proper meters to measure current, voltage, and resistance.

10.2 Setup and use an oscilloscope to measure voltages and other signals.

10.3 Compare the readings of the scope and multimeter to determine accuracy of readings.

- 10.4 Demonstrate the limitations of the test equipment related to frequency.
- 10.5 Observe safety practices when using capacitors at high voltage.
- 10.6 Demonstrate an awareness of the polarity of electrolytic capacitors when building circuits.

NIDA Module Mapping

Week #	Date	Textbook	NIDA Module	Expmt
1	27 Aug	Ch13: Magnetism	Magnetism and Electromagnetism Magnetism, Relays, and Meters [0, —]	
2	03 Sep	Ch 14: Electromagnetism	Magnetism and Electromagnetic Principles [0, □] Magnetic Calculations [0, —]	X
3	10 Sep	Ch 15: Alternating Voltage & Current	Introduction to AC Alternating Current [0, —] Generating AC Electricity [0, —] Non-Sinusoidal Waves [0, —] Resistance in AC Circuits [0, —] Introduction to AC Post-Test (Theory) [0, —]	
			AC Test Equipment Introduction to Oscilloscopes [0, —] Oscilloscope Use [—, □] Oscilloscope Use with Function Generator [—, □] Introduction to the Function Generator [0, —] Function Generator Use [—, □] Introduction to the Frequency Counter [0, —] Frequency Counter Use [—, □] AC Test Equipment Post-Test (Theory) [0, —]	X X X X X
4	17 Sep	Ch 19: Inductance	Inductance and RL Circuits Introduction to Inductors [0, —] Inductor Identification [—, □] RL Series Circuits [0, —] RL Series Circuit Operation [—, □] RL Series Circuit Troubleshooting Experiment [—, □] RL Parallel Circuits [0, —] RL Parallel Circuit Operation [—, □] RL Parallel Circuit Troubleshooting Experiment [—, □] RL Filters —, □ Inductance and RL Circuit Post-Test (Theory) [0, —]	X X X X X X X
5	24 Sep	Ch 20 & 21 Inductive Reactance	Transformers Introduction to Transformers [0, —] Transformer Operation [—, □] Troubleshooting Transformers [—, □] Transformers Post-Test (Theory) [0, —]	X X
6	01 Oct	Exam 1 (Chapters 13, 14, 15, 19, 20, & 21)		

Week #	Date	Textbook	NIDA Module	Expm't
7	08 Oct	Ch 16: Capacitance	Capacitance and RC Circuits	
			Introduction to Capacitors [0, —]	
			Capacitor Identification [—, □]	X
			RC Series Circuits [0, —]	
			RC Series Circuit Operation [—, □]	X
8	15 Oct	Ch 16: Capacitive Reactance & Ckts	RC Series Circuit Troubleshooting Experiment [—, □]	X
			RC Parallel Circuits [0, —]	
			RC Parallel Circuit Operation [—, □]	X
			RC Parallel Circuit Troubleshooting Experiment [—, □]	X
			RC Filters [—, □]	X
			Capacitance and RC Circuits Post-Test (Theory) [0, —]	
9	22 Oct	Exam 2 (Chapters 22, 23, & 24)		
10	29 Oct	Ch 22: RC and L/R Time Constants	RC Time Constants and Transients	
			RC and RL Time Constants [0, —]	
			RC Time Constants Operation [—, □]	X
			RC Circuit Transient Analysis [0, —]	
			RC Circuit Transient Experiment [—, □]	X
			RC Circuit Transient Troubleshooting Experiment [—, □]	X
			RC Time Constants and Transients Post-Test (Theory) [0, —]	
11	05 Nov	Ch 23: Alternating Current Circuits	Relays and Switches	
			Relays [0, —]	
			Relay Operation Experiment [—, □]	X
			Troubleshooting Relays and Switches [—, □]	X
12	12 Nov	Ch 24: Complex Number for Circuits	Electrical Circuits [0, —]	
			Electrical Circuit Experiment [—, □]	X
			Electrical Circuit Troubleshooting [—, □]	X
			Relays and Switches Post-Test (Theory) [0, —]	
13	19 Nov	Exam 3 (Chapters 22, 23, & 24)		
14	26 Nov	Ch 25: Resonance	Resonance	
			Capacitive/Inductive Reactance and LCR Circuits [0, —]	
			Series and Parallel LCR Circuit Experiment [—, □]	X
			LCR Circuit Troubleshooting [—, □]	X
			Series Resonance [0, —]	
			Series Resonance Circuits [—, □]	X
			Parallel Resonance [0, —]	
			Parallel Resonance Circuits [—, □]	X
			Resonant Circuit Troubleshooting Experiment [—, □]	X
			Resonance Post-Test (Theory) [0, —]	

Week #	Date	Textbook	NIDA Module	Expmt
15	03 Dec	Ch 26: Filters	Filters	
			Introduction to Filters [0, —]	
			High-Pass Filters [—, □]	X
			Low-Pass Filters [—, □]	X
			Bandpass Filters [—, □]	X
			Band-Reject Filters [—, □]	X
16	10 Dec	Final Exam (Chapters 25, 26, Cumulative)		

COURSE OUTLINE:SEMESTER / YEAR: **Fall / 2018**COURSE / SECTION: **CETT 1405 / 81400**INSTRUCTOR: **Jim Bradbury**OFFICE NUMBER: **Alamito A-110**PHONE NUMBER: **469-200-0236**EMAIL_(preferred) **jbradbury4@gmail.com**OFFICE HOURS: **By Appointment**

Wk Nbr	Date	Topic	Reading	Assignment Due
1	27 Aug	Introduction, Magnetism	Chapter 13	
2	03 Sep	Electromagnetism	Chapter 14	Ch. 13
3	10 Sep	Alternating Voltage and Current	Chapter 15	Ch. 14
4	17 Sep	Inductance	Chapter 19	Ch. 15
5	24 Sep	Inductive Reactance, Inductive Circuits	Chapter 20,21	Ch. 19
6	01 Oct	Exam 1 (Chapters 13, 14, 15, 19, 20, 21)		Ch. 20, 21
7	08 Oct	Capacitance	Chapter 16	
8	15 Oct	Capacitive Reactance, Capacitive Circuits	Chapters 17, 18	Ch. 16
9	22 Oct	Exam 2 (Chapters 16-18)		Ch. 17, 18
10	29 Oct	RC and L/R Time Constants	Chapter 22	
11	05 Nov	Alternating Current Circuits	Chapter 23	Ch. 22
12	12 Nov	Complex Numbers for AC Circuits	Chapter 24	Ch. 23
13	19 Nov	Exam 3 (Chapters 22-24)		Ch. 24
14	26 Nov	Resonance	Chapter 25	
15	03 Dec	Filters	Chapter 26	Ch. 25
16	10 Dec	Final Exam (Chapters 25, 26, Cumulative)		Ch. 26