ITT Technical Institute

ET145T

AC Electronics

Onsite Course

SYLLABUS

Credit hours: 4

Contact/Instructional hours: 60 (36 Theory Hours, 24 Lab Hours)

Prerequisite(s) and/or Corequisite(s):

Prerequisite: ET115T DC Electronics, Corequisite or Prerequisite: GE192T College Mathematics II or equivalent

Course Description:

This course covers an analysis of reactive components as they relate to an AC sine wave. Transformers, filters and resonant circuits are studied in this course. Laboratory supports the theory and continues the use of both physical components and computer-generated models.

Syllabus: AC Electronics

Instructor: _____

Office hours: _____

Class hours: _____

Major Instructional Areas

1. Alternating voltage and current
2. Capacitance and capacitive reactance
3. Inductance and inductive reactance
4. *RC*, *RL*, and *RLC* circuit analysis for AC and pulse response
5. Passive filter circuits including *RC*, *RL,* and resonant filters
6. Practical laboratory tests of AC circuits and Multisim simulations

Course Objectives

1. Mathematically analyze sinusoidal waveforms.
2. Use a function generator and an oscilloscope to set up and measure frequency, amplitude, and direct current (DC) offset of a sine wave and measure the phase shift with respect to another sine wave.
3. Determine the total capacitance and capacitive reactance of series and parallel capacitive circuits with AC signals.
4. Determine the response of a capacitor in a DC switching circuit.
5. Determine impedance and phase angle in series and parallel *RC* circuits.
6. Apply Ohm's Law, Kirchhoff's laws, and Watt's Law to combinational *RC* circuits with AC signals.
7. Determine the total inductance and inductive reactance of series and parallel inductive circuits with AC signals.
8. Determine the response of an inductor in a DC switching circuit.
9. Determine impedance and phase angle in series and parallel *RL* circuits.
10. Apply Ohm's Law, Kirchhoff's laws, and Watt's Law to combinational *RL* circuits with AC signals.
11. Analyze series and parallel *RLC* circuits including resonant circuits.
12. Describe the operation and applications of transformers, including power transformers, impedance matching transformers, and coupling transformers.
13. Describe the response of *RC* and *RL* integrator and differentiator circuits to pulse waveforms.
14. Use proper protoboard wiring and test procedures for AC passive circuit components, including using the function generator and oscilloscope.
15. Simulate and test AC circuits using the Multisim Electronic Circuit Simulator.

SCANS Objectives

SCANS is an acronym for Secretary's Commission on Achieving Necessary Skills. The committee, created by the National Secretary of Labor in the early 1990s, created a list of skills and competencies that the committee feels are necessary for employees to function in a high-tech job market.

1. Competently perform the tasks of acquiring data and evaluating information to determine specific information needs.
2. Determine which set of procedures, tools, or machines will produce the desired results.
3. Demonstrate competence in applying technology.
4. Approach practical problems by choosing appropriately from a variety of mathematical techniques.
5. Understand the overall intent and the proper procedures for setting up and operating machines.

6. Organize and process symbols, pictures, graphs, objects or other information.

Course Outline

Note: All graded activities, except the Laboratory Final and Final Exam, are listed below in the pattern of <Unit Number>.<Assignment Number>. For example, Labs: 1.2 refers to the 2nd lab activity in Unit 1.

Unit	Activities
1— Sinusoidal Waveforms	• Content Covered: DC/AC Fundamentals: A Systems Approach: o Chapter 8, "Introduction to Alternating Current and Voltage," pp. 320-333 • Assignments: 1.1-1.2 • Labs: 1.1-1.2
2— Laboratory Instruments for AC	• Read from DC/AC Fundamentals: A Systems Approach: o Chapter 8, "Introduction to Alternating Current and Voltage," pp. 333-352 • Assignments: 2.1-2.2 • Labs: 2.1-2.2 • Quizzes: 2.1
3— Capacitors	• Read from DC/AC Fundamentals: A Systems Approach: o Chapter 9, "Capacitors" • Assignments: 3.1 • Labs: 3.1-3.2 • Quizzes: 3.1
4— *RC* Circuits	• Read from DC/AC Fundamentals: A Systems Approach: o Chapter 10, "*RC* Circuits" • Assignments: 4.1-4.2 • Labs: 4.1-4.2 • Unit Exams: 4.1
5— Inductors	• Read from DC/AC Fundamentals: A Systems Approach: o Chapter 11, "Inductors" • Assignments: 5.1-5.2 • Labs: 5.1-5.2 • Quizzes: 5.1
6— *RL* Circuits	• Read from DC/AC Fundamentals: A Systems Approach: o Chapter 12, "*RL* Circuits" • Assignments: 6.1-6.2 • Labs: 6.1-6.2 • Quizzes: 6.1
7— Series *RLC* Circuits	• Read from DC/AC Fundamentals: A Systems Approach: o Chapter 13, "*RLC* Circuits and Resonance," pp. 565-587 • Assignments: 7.1-7.2 • Labs: 7.1-7.2 • Quizzes: 7.1
8— Parallel *RLC* Circuits	• Read from DC/AC Fundamentals: A Systems Approach: o Chapter 13, "*RLC* Circuits and Resonance," pp. 587-610 • Assignments: 8.1 • Lab: 8.1-8.2 • Quizzes: 8.1
9— Transformers	• Read from DC/AC Fundamentals: A Systems Approach: o Chapter 14, "Transformers"

Unit	Activities
	• Assignments: 9.1-9.2 • Labs: 9.1 • Unit Exams: 9.1
10— Integrators and Differentiators	• Read from DC/AC Fundamentals: A Systems Approach: o Chapter 15, "Time Response of Reactive Circuits" • Assignments: 10.1 • Laboratory Final • Quizzes: 10.1
11— Course Review and Final Exam	• Review Session • Final Exam

Instructional Methods

The course incorporates various learning strategies, such as quizzes, homework assignments, lab exercises, unit exams, and a final exam, to help you understand the concepts taught in class. Many units include a homework assignment and a quiz. Homework assignments are based on the course objectives relative to that unit's objectives and you should submit each one to your instructor in the first unit after it is assigned. You will take a quiz in each unit that is based on the course objectives from the previous unit. These quizzes will help you analyze your learning and recall previously taught concepts. Each unit has a lab exercise in which you will construct circuits to reinforce theory and develop practical skills in circuit testing. Lab exercises are augmented with computer simulations using Multisim, a circuit design, analysis, and simulation tool. Unit 10 includes the laboratory final and Unit 11 the final exam; together these exams will evaluate your understanding of the core concepts covered in this course.

Instructional Materials and References

Student Textbook Package

The student textbook package for AC Electronics is exactly the same as the package for the prerequisite course, DC Electronics. Therefore, you will ***not*** be issued a new package for this course.

For both courses, the student package includes:
- Floyd, T. L., & Buchla, D. M. (2013). *DC/AC Fundamentals: A Systems Approach* (1st ed.).
- Buchla, D. M. (2013). *Experiments in DC/AC Fundamentals: A Systems Approach*.

Note: An additional CD comes with the textbook that contains files using older versions of Multisim. This CD will *not* be used for this course.

Equipment and Tools

- Computer and Electronics Engineering Technology (CEET) First-Year Parts Kit
- Scientific calculator [Sharp EL-506VB or equivalent]

References

ITT Tech Virtual Library

Log on to the ITT Tech Virtual Library at http://library.itt-tech.edu/ to access online books, journals, and other reference resources selected to support ITT Tech curricula.

Books

School of Study> School of Electronics Technology> Databases>.

- Ebrary>
  - Gibilisco, Stan. *Illustrated Dictionary of Electronics*. New York: McGraw-Hill Professional, 2001.

Reference Resources

You may access the reference resources from the following path:.

- School of Study> General Education Information> Recommended links> Mathematics>
  - Math.com
  - Math2.org

School of Study Links

You may click School of Study> School of Electronics Technology to find the following links.

- Professional organizations
  - IEEE: Institute of Electrical and Electronics Engineers
  - Society of Manufacturing Engineers
  - International Society of Certified Electronics Technicians
- Recommended Links
  - All About Circuits: LESSONS IN ELECTRIC CIRCUITS
  - Alternating Current Circuit Concepts
- Tutorial Links
  - Electronics for Beginners and Intermediate Electronics

Other References

The following resources may be found **outside** of the ITT Tech Virtual Library, whether online or in hard copy.

Book

- Horowitz, Paul and Winfield Hill. *The Art of Electronics*. 2nd ed. New York: Cambridge University Press, 1989.

Web sites

- Basic Electronics

http://science-ebooks.com/electronics/basic_electronics.htm (accessed February 8, 2016)
This link offers a complete basic electronics course with simulations; some chapters have MP3 audio lectures.

- International Association for Radio, Telecommunications and Electromagnetics

http://www.narte.org/ (accessed February 8, 2016)
This is the official Web site of iNarte, a worldwide, non-profit, professional telecommunications association that certifies qualified engineers and technicians in the fields of Telecommunications, Electromagnetic Compatibility/Interference (EMC/EMI), Product Safety (PS), Electrostatic Discharge control (ESD) and Wireless Systems Installation.

All links to Web references outside of the ITT Tech Virtual Library are always subject to change without prior notice.

Course Evaluation and Grading

Evaluation Criteria Table

The final grades will be based on the following categories:

CATEGORY	WEIGHT
Labs	30%
Assignments	25%
Quizzes	10%
Unit Exams	10%
Lab Final	10%
Final Exam	15%
Total	**100%**

Note: Students are responsible for abiding by the Plagiarism Policy.

Grade Conversion Table

The final grades will be calculated from the percentages earned in the course, as follows:

A	90–100%	4.0
B+	85–89%	3.5
B	80–84%	3.0
C+	75–79%	2.5
C	70–74%	2.0
D+	65–69%	1.5
D	60–64%	1.0
F	<60%	0.0

(End of Syllabus)