Discipline: Electronics

Degree Credit [X]
Non Credit [ ]
Nondegree Credit [ ]
Comm Service [ ]

Riverside Community College District
Integrated Course Outline of Record

Electronics 13

College: R___ M___ N_X_
Lecture Hours: 54
ELE-13: AC Electronics Lab Hours: 54
Units: 4.00

COURSE DESCRIPTION

Prerequisite(s): ELE 10: Survey Electronics or ELE 11: DC Electronics or ELE 21: DC-AC Electronics or ELE 23: Electronics Devices and Circuits
Alternating Current (AC) theory, devices, circuits and applications--will include: resistance, reactance, impedance, capacitance, inductance, Ohm's Law, Power Law, sinusoidal waveforms, Peak, Peak-to-Peak and Root-Mean-Square (RMS) measurements, using an oscilloscope, signal generator and meter; applications of series and parallel networks of resistors, capacitors, inductors, transformers and other AC components; J-Factors and phasor-vector solutions to both simple and complex AC circuits; transient reactor analysis; phase-shift, phase-angle, and power-factor calculations and measurements. 54 hours lecture and 54 hours laboratory.

SHORT DESCRIPTION FOR CLASS SCHEDULE

Alternating Current (AC) theory, devices, circuits, applications, calculations and measurements of various parameters.

ENTRY SKILLS

Before entering the course, students will be able to:

1. Solve basic series and parallel DC electronics problems involving current, voltage, resistance and power.
    - ELE 10 - Conduct direct circuit analysis and measurement.
    - ELE 23 - Describe the physical nature and electrical characteristics of materials which are classified as semiconductors.
    - ELE 21 - Solve basic electronic problems involving current, voltage, and power.

- ELE 11 - Solve basic, direct current, electronic problems involving resistance, current, voltage, and power, as applied to both simple and complex combinations of series and/or parallel circuit components, comprised of resistors, capacitors and coils, in a given network configuration.

STUDENT LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

Explain the basic principles of sinusoidal sources of Alternating Current (AC) and solve AC network circuit problems, involving resistors, capacitors, inductors and/or transformers.

- Breadth of Knowledge - Analyze experimental results and draw reasonable conclusions from them
- Information Skills - Locate, evaluate and use information effectively
- Breadth of Knowledge - Use the symbols and vocabulary of mathematics to solve problems and communicate the results
- Communication Skills - Write with precision and clarity to express complex thought
- Global Awareness - Demonstrate teamwork skills
- Application of Knowledge - Maintain and transfer academic and technical skills to workplace
- Communication Skills - Speak with precision and clarity to express complex thought
- Critical Thinking - Recognize and assess evidence from a variety of sources

Discuss the purpose and effects of resistors, capacitors, inductors and/or transformers in a given AC network problem, analyze it and diagram the solution to a posed problem by using J-Factors appropriately and accurately.

- Breadth of Knowledge - Use the symbols and vocabulary of mathematics to solve problems and communicate the results
- Communication Skills - Speak with precision and clarity to express complex thought
- Information Skills - Locate, evaluate and use information effectively
- Critical Thinking - Integrate knowledge across a range of contexts
- Application of Knowledge - Maintain and transfer academic and technical skills to workplace

Take meter and O-scope measurements of a given AC network of components and display and document the results, comparing and contrasting those measurements with predictions that you calculated before-hand. Explain the similarities and/or differences.

- Application of Knowledge - Be life-long learners, with ability to acquire and employ new knowledge
- Communication Skills - Speak with precision and clarity to express complex thought
- Critical Thinking - Recognize and assess evidence from a variety of sources
- Breadth of Knowledge - Analyze experimental results and draw reasonable conclusions from them

COURSE CONTENT

1. Alternating Current Theory
    a. Definitions
    b. Parametric Values
    c. AC Sources
    d. AC Loads
    e. various AC Waveforms
2. Sine-wave parameters
    a. Amplitude
    b. Period
    c. Frequency
    d. Wavelength
3. Instrumentation
    a. Meters
    b. Oscilloscopes
    c. Signal Generators
4. AC Measurements
    a. Peak Voltage
    b. Peak-to-Peak Voltage
    c. Root-Mean-Square (RMS) Voltage
    d. Hertz
5. Characteristics & Calculations for AC Devices
    a. Resistors
    b. Capacitors
    c. Inductors
    d. Transformers
    e. Coil Resistance (copper losses)
    f. Reactance
        i. Capacitive
        ii. Inductive
    g. Impedance
6. AC Circuit Combinations
    a. Series
    b. Parallel
    c. Complex Series/Parallel
7. Ohm's Law & variations for AC
    a. Voltage
    b. Current
    c. Resistance
    d. Reactance
        i. Capacitive
        ii. Inductive
    e. Impedance
8. Power Law & variations for AC
    a. Voltage Derivations
    b. Current Derivations

   c. Resistance Derivations
   d. Reactance Derivations
      i. Capacitive VARs
      ii. Inductive VARs
   e. Impedance, Apparent Power (AP)
   f. Wattage (True-Power)
   g. Reactive Power, Volt-Amps (VA)
9. Schematics & Terminology
   a. Device Symbols and interconnections
   b. Definitions; proper use of terms
   c. Significant AC parameters
      i. Manufacturer Specifications
      ii. Data-sheets
      iii. Physical Characteristics
10. Additional AC Components, Parameters & Relationships
   a. Relays
   b. Solenoids
   c. Contactors
   d. Motor-Starters
   e. AC Induction Motors
      i. Squirrel Cage
      ii. Wound Rotor
   f. Transformers
      i. Efficiency
      ii. Step-Up
      iii. Step-Down
      iv. Isolation
      v. Phasing
      vi. Constant Voltage
11. Transient analysis
   a. RC-Circuits
   b. RL-Circuits
   c. RCL-Circuits
12. J-Factor solutions to AC network problem
   a. Low-Pass
   b. High-Pass
   c. Resonant
13. Filter Circuits, passive
   a. Low-Pass
   b. High-Pass
   c. Phaser Diagrams
   d. Phase-Angle
   e. Power-Factor
14. Resonant Circuits
   a. Band-Accept (pass)
   b. Band-Reject (traps)
   c. Series Voltages
   d. Parallel Currents

METHODS OF INSTRUCTION

Methods of instruction used to achieve student learning outcomes may include, but are not limited to:

- Interactive Lab demonstrations of AC measurements, test equipment and circuits reinforce theory from the lecture class to the students.
- Class lectures and discussions on alternating current theory, devices and circuits to help students gain an understanding of relevant course content, as applied to AC electronics.
- Writing assignments for situations and problems that involve AC electronics theory, symbols, circuit configurations and related formulas.
- Interactive problem solving tasks and activities where students reinforce their electronics vocabulary and circuit drawing skills, as well as AC formulas and calculations.
- Videos, films, PowerPoint presentations and on-line media content that focus upon industrial uses of AC electronic circuits, devices and calculations.
- Pair and small group activities, discussions, and exercises that promote discovery and enhance AC circuit solutions and problem solving skills.
- Guest speakers, who bring industry experience directly into the classroom and help students to appreciate how active professionals use AC electronics technology in their daily jobs.

METHODS OF EVALUATION

Students will be evaluated for progress in and/or mastery of learning outcomes by methods of evaluation which may include, but are not limited to:

- A comprehensive Final Examination designed to assess students' mastery of AC electronics theory, devices, circuits, networks, formulas and calculations, related to networks containing any combination of resistors, capacitors, inductors, solenoids, relays, contactors, motor starters and AC induction motors.
- Individual and group assignments, such as projects and oral/written reports, in both lecture and lab settings, designed to prove successful understanding and application of basic, AC circuit concepts and device definitions related to electronics.
- Oral question and answer sessions about AC electronics theory, devices, circuits, and applications, test students' understanding of the course content.
- Quizzes/examinations designed to assess students' ability to recall, critically analyze and apply key concepts of AC electronics. These will include pop-reading quizzes and a scheduled Mid-Term Exam.
- Active participation by students ensures their progress in mastering the AC electronics content of the course, as well as fruitful, collaborative learning projects.

SAMPLE ASSIGNMENTS

Outside-of-Class Reading Assignments

- Using a reading schedule, handed out in class, students will read and prepare for a weekly reading-quiz. The reading will also prepare students for lectures, discussions and laboratory experiments that involve AC electronic circuits, devices and calculations.

Outside-of-Class Writing Assignments

- Problems from the book, due back within one week of the given assignment date, focus on direct current applications. They require students to prove a working understanding of the AC electronics devices and circuit applications involved.

Other Outside-of-Class Assignments

- Internet research, as scheduled in class, in preparation for labs and lectures. Then, students return printouts to turn-in for credit, or send them electronically, as they prepare for lecture and lab work in AC electronics.

COURSE MATERIALS

All materials used in this course will be periodically reviewed to ensure that they are appropriate for college level instruction. Possible texts include:

Buchla, D.M.. Lab Manual for Electronics Fundamentals and Electronic Circuits Fundamentals, Electronics Fundamentals: Circuits, Devices & Applications. 8/E ed. New Jersey: Pearson/Prentice-Hall, 2010.
Floyd, T.L.. Electronics Fundamentals, Circuits, Devices And Applications. 8/E ed. New Jersey: Pearson/Prentice-Hall, 2010.

01/24/2012

4250