

Mercer County Community College

Division of Business and Technology

UTI 103

Fundamentals of Power Alternating Current

COURSE DESCRIPTION:

To provide participants with fundamentals of the energy utility industry alternating current theory; including, but not limited to, vector analysis of power (KW, KVARs & KVA), power factor, phase angles, polyphase loads (Wye & Delta) and control of system efficiency

Text: **References & Textbooks:**

“The Lineman’ and Cableman’s Field Manual” By T.M. Shoemaker & J.E. Mack,
McGraw-Hill Copyright 2000 (ISBN 0-07-135470-0)

Handout & Reference Guides

Prerequisites: EET 130 Fundamentals of Electronics

Credits: 3 Lecture Hours: 3 Studio/Lab Hours 0

Food and drink are strictly prohibited in classrooms as per health and safety laws. Students may not bring in chemicals or cleaning fluids without the appropriate MSD sheets.
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Course Coordinator: Dominick DeFino

Revised: 10/23/02

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Course Objectives:

- Describe the effects of resistance, inductance, and capacitance on voltage and current in series and parallel alternating current circuits.
- Determine the power factor, (expressed as a cosine, percentage, and phase angle), of series and parallel alternating current circuits that contain resistance, inductive reactance, and capacitive reactance.
- Apprentices will select, inspect, test, and use all necessary, and appropriate, approved personal protective equipment, test devices, and tools for each voltage measurement task as conditions require, including approved hard hat, flame retardant clothing, safety glasses with side shields intact, Class ‘0’ rubber gloves when working on, or in proximity to energized conductors, or conductors which could become energized at voltages between 50 and 600 volts.
- Calculate and measure voltage, current, and power in three phase, DELTA circuits.
- Calculate and measure voltage, current, and power in three phase, WYE circuits.
- Identify the following single-phase and three-phase Delta and Wye services using analog volt meters, digital volt meters, and test lamps.

Single-phase

120 volt, 2 wire
120/240 volt, 3 wire
120/208 volt, 3 wire

Three-phase

240 volt, 3 wire, Delta
120/240 volt, 4 wire, Delta
120/208 volt, 4 wire, Wye

- Identify typical lockout and safety tags - blocking, defective equipment, caution, permissive, and workers blocking tags.
- Correctly apply caution, defective equipment, and worker's blocking tags.

Evaluation Procedure:

Grading Criteria for Participants

The participants will be individual evaluated on the course content utilizing the following criteria:

- Attendance - Mandatory
- Average of Quizzes = 30 % of Total Grade
- Final Examination = 70 % of Total Grade

Course/Instructor Evaluation

The course and instructor evaluation will consist of the following:

- End of Course Reaction Survey which will ask the participant opinion of the course based on within the objectives and outline
- Overall performance of as indicated by participants completion of quizzes, practical & laboratory exercises and final exam
- Instructor observations by PSE&G – Technical Training team to ensure consistence of instructional quality

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Course: Fundamentals of Power Alternating Current ~ Topical Outline

- I. Introduction & Orientation Lecture/Discussion - 3 hours
- a. Course Objectives
 - b. Schedule (Lecture/Discussion & Laboratory Exercises)
 - c. Evaluation System & Grading Criteria
 - d. Power System AC – Oppositions
 - i. Resistance
 - ii. Inductive Reactance
 - iii. Impedance
- II. Power System AC – Voltages *Lecture/Discussion - 3 hours*
- a. Instantaneous
 - b. Effective (RMS)
 - c. Voltage Vectors
- III. Powers AC Loads *Lecture/Discussion - 3 hours*
- a. True Power
 - b. Reactive Power
 - c. Apparent Power
 - d. Power Vectors
 - e. Power Factor
- IV. Series Resistive & Inductive Reactive AC Loads *Lecture/Discussion - 3 hours*
- a. Oppositions
 - b. Voltages
 - c. Powers
 - d. Vector Analysis – Oppositions, Voltages, & Powers
 - e. Power Factor
 - f. Phase Angle
- V. Series Resistive & Capacitive Reactive AC Loads *Lecture/Discussion - 3 hours*
- a. Oppositions
 - b. Voltages
 - c. Powers
 - d. Vector Analysis – Oppositions, Voltages, & Powers
 - e. Power Factor
 - f. Phase Angle
- VI. Parallel Resistive & Inductive Reactive AC Loads *Lecture/Discussion - 3 hours*
- a. Oppositions
 - b. Voltages
 - c. Powers
 - d. Vector Analysis – Currents & Powers
 - e. Power Factor
 - f. Phase Angle

Continued

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Course: Fundamentals of Power Alternating Current ~ Topical Outline

- VII. Parallel Resistive, Inductive, Capacitive Reactive AC Loads *Lecture - 3 hours*
- Oppositions
 - Voltages
 - Powers
 - Vector Analysis – Oppositions, Currents, & Powers
 - Power Factor
 - Phase Angle
- VIII. Typical Customer Service & Capacities *Lecture/Discussion - 3 hours*
- Single Phase Services
 - Polyphase Services
- IX. Testing Single Phase Services *Lecture/Demonstration - 4 hours*
- Demonstration
 - Hands-on Exercise
- X. Testing Polyphase Services *Lecture/Demonstration - 4 hours*
- Demonstration
 - Hands-on Exercise
- XI. Three Power Systems - Wye *Lecture/Demonstration - 4 hours*
- Calculations with Resistive Loads
 - Voltage Testing on Typical Services
- XII. Three Power Systems - Delta *Lecture/Demonstration - 4 hours*
- Calculations with Resistive Loads
 - Voltage Testing on Typical Services
- XIII. Transmission & Distribution System *Lecture/Discussion - 3 hours*
- Voltage Regulation
 - Capacitor Applications
 - Voltage Drops
 - Power Losses
 - Power Factor Correction
- XIV. Transmission & Distribution System *Lecture/Calculations/Demonstration - 4 hours*
- Voltage Regulation
 - Capacitor Applications
 - Voltage Drops
 - Power Losses
 - Power Factor Correction
- XV. Final Exam *Lecture/Discussion - 3 hours*
- Complete Written Final Exam
 - Review Final Exam
 - Calculate Final Course Grades
 - Complete Course Evaluation