

Mercer County Community College

Division of Business and Technology

UTI 107

Introduction to Metering

COURSE DESCRIPTION:

Provides participants with fundamental knowledge and skills in the selection, installation & testing for self-continued Watthour electrical energy measurement.

Text: References & Textbooks:

Handouts Reference Guides
Service Requirement Guideline for Contractors
Metering & Wiring Inspection Manual

Prerequisites: UTI 103 Fundamentals of Power Alternating Current

Credits: 4 Lecture Hours: 3 Studio/Lab Hours 2

<p>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.</p>

Course Coordinator: Dominick DeFino

Revised: 10/23/02

Course Objectives:

- Accurately read 100 kilowatt-hour meter registers in 30 minutes
- Identify the six major components of the electro-mechanical kilowatt-hour meter, including; Cover, Base, Stator, Rotor, Frame and Magnets, and Register
- Describe the functions of the six major meter components
- Identify and describe the functions of electro-mechanical, kilowatt-hour meter calibration adjustments and compensations, including Full load adjustment, Light load adjustment, Lag load adjustment, Class I temperature compensation, Class II temperature compensation, and Overload compensation.
- Define the listed meter ratios and constants, including register ratio (Rr), shaft reduction (Rs), and Kilowatt-hour meter constant (Kh).
- Complete two (2) load tests using a stopwatch and the formula:

$$\text{watts} = \frac{\text{Kh} \times \text{disk revs.} \times 3600}{\text{time in seconds}}$$

- Participants will select, inspect, test, and use all necessary, and appropriate, approved personal protective equipment, test devices, and tools for each metering task as conditions require, including: approved hard hat, flame retardant clothing, safety glasses with side shields intact, work gloves, 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, Class '2' rubber gloves when proximity conditions exceed, or could exceed 600 volts, Dielectric footwear, and Rubber sleeves.
- Correctly identify fifteen (15) single phase, two and three wire services using a voltmeter, solenoid type voltage indicator, and a three wire lamp bank for
 - 2 wire, 120 volt
 - 3 wire, 120/240 volt
 - 3 wire, 120/208 volt
- Remove and reinstall twelve (12) 'C' type enclosure covers and security devices, including: Barrel locks, 'Fort Knox' locks, and Plastic padlock seals.
- In the meter lab, using approved methods, complete five (5) disconnects each, on single phase, 2 wire and 3 wire, 'A' base and 'S' base meters. All required checks and tests must be performed.
- In the meter lab, using approved methods, complete ten (10) reconnects each, on single phase, 2 wire and 3 wire, 'A' base and 'S' base meters. All required checks and tests must be performed.

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

Course Content Outline – Introduction to Metering UTI 107

- I. Introduction & Orientation *Lecture*
 - a. Course Objectives
 - b. Schedule (Lecture/Discussion & Laboratory Exercises)
 - c. Evaluation System & Grading Criteria
 - d. Review
 - i. DC/AC Fundamentals
 - ii. Power System AC
 - iii. Electrical Safety
 - iv. Personal Protective Equipment
 - e. Basic Concepts of Metering
- II. Watthour Meter Principles *Lecture*
 - a. Review & Quiz on previous content
 - b. Meter Components
 - c. Fluxes
 - d. Driving the disk
 - e. Lagging the potential coil flux
 - f. Controlling disk rotation
 - g. Meter design characteristics
 - h. Overload compensation
 - i. Voltage, temperature, and frequency compensations
 - j. Full load adjustment
 - k. Light load and power factor adjustment
- III. Security & Reading Meters
 - a. Review & Quiz on previous content *Lecture*
 - b. Security of Electrical Meters *Lecture*
 - i. Keys
 - ii. Seals
 - iii. Locks
 - c. Revenue Integrity *Lecture*
 - d. State Laws on Energy Theft *Lecture*
 - e. Application of Meter Security Devices Laboratory – 2 hours
 - f. Reading Meters *Lecture*

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| IV. | Testing of Watthour Meters & Customer Services | |
| | a. Review & Quiz on previous content | <i>Lecture</i> |
| | b. Testing Equipment | <i>Lecture</i> |
| | c. Testing Procedures | <i>Lecture</i> |
| | d. Demonstration & Exercise Testing | Laboratory – 3 hours |
| V. | Single Phase Meter Applications & Installations | |
| | a. Review & Quiz on previous content | <i>Lecture</i> |
| | b. Selection of Meters | <i>Lecture</i> |
| | c. Installation Procedures | <i>Lecture</i> |
| | d. Demonstration & Exercise on Installation Procedures | Laboratory - 5 hours |
| VI. | Disconnecting & Reconnections Single Phase Meters | |
| | a. Review & Quiz on previous content | <i>Lecture</i> |
| | b. Disconnecting Criteria (State Regulations) | <i>Lecture</i> |
| | c. Disconnecting Procedures | <i>Lecture</i> |
| | d. Reconnecting Procedures | <i>Lecture</i> |
| | e. Demonstration & Exercise on Disconnecting | <i>Laboratory – 3 hours</i> |
| | f. Troubleshooting Disconnecting & Reconnecting | <i>Lecture</i> |
| | g. Demonstration Troubleshooting | Laboratory – 1 hours |
| VII. | Disconnecting & Reconnections Single Phase Customer Services | |
| | a. Review & Quiz on previous content | <i>Lecture</i> |
| | b. Disconnecting Criteria | |
| | c. Disconnecting Procedures | <i>Lecture</i> |
| | d. Reconnecting Procedures | <i>Lecture</i> |
| | e. Demonstration & Exercise on Disconnecting | Laboratory – 3 hours |
| | f. Troubleshooting Disconnecting & Reconnecting | <i>Lecture</i> |
| | g. Demonstration Troubleshooting | <i>Laboratory – 1 hours</i> |
| VIII. | Energy Diversion & Load Testing | |
| | a. Review & Quiz on previous content | <i>Lecture</i> |
| | b. Tampering with meter components | <i>Lecture</i> |
| | c. Tampering with meter installations | <i>Lecture</i> |
| | d. Demonstration of tampering techniques | <i>Laboratory – 1 hours</i> |
| | e. Load Testing – Stopwatch Method | <i>Laboratory – 1 hours</i> |
| | f. Exercises Meters – setting, changing, disconnecting & reconnecting | <i>Laboratory – 3 hours</i> |
| IX. | Hands-on Exercises | |
| | a. Review & Quiz on previous content | <i>Lecture</i> |
| | b. Installing & Removing Various meters | <i>Laboratory – 2 hours</i> |
| | c. Converting Meters from A to S base | <i>Laboratory – 2.5 hours</i> |
| | d. Changing meter sockets | <i>Laboratory – 2.5 hours</i> |
| X. | Final Examination & Course Evaluations | |
| | a. Complete Written Final Exam | |
| | b. Complete Performance Testing | |
| | c. Review Final Exam | |
| | d. Calculate Final Course Grades | |
| | e. Complete Course Evaluation | |