

Mercer County Community College

Division of Business and Technology

UTI 106

Introduction to Energy Utility Engineering

COURSE DESCRIPTION:

Provide participants with the basic knowledge, skills & technical background in the construction, equipment, practices/procedures, design/layout and typical problems of electrical distribution engineering.

Text: **References & Textbooks:**

Handouts Reference Guides
Electrical Utility Engineering Construction Standards
Electric Service Installation Information & Requirements

Prerequisites: UTI 103 Fundamentals of Power Alternating Current

Credits: 5 Lecture Hours: 4 Studio/Lab Hours 2

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: 11/4/02

Course Objectives:

- Explain the energy flow & safety concerns for switching and substations, including potential hazards to personnel, transformers, buses, breakers/disconnects, regulation devices, graphic voltage/ current/power instruments, tie feeders, and set-up for work relays operations.
- Identify all appropriate personal protective equipment required by engineering technicians potential hazards when performing field duties, in accordance with Construction Handbooks - Safety Section.
- Conduct inspection & testing of personal protective equipment including, hard hat, safety glasses, flame retardant clothing, primary high voltage rubber gloves/ protectors, primary rubber sleeves, low voltage rubber gloves/ protectors, & dielectric footwear in accordance with Construction Handbook.
- Identify safety tags & tape/rope used to warn personnel of potential hazards, including (Red) Blocking, (Yellow) Permissive, (White) Caution, (Red/Yellow) Workers Blocking, & Defective Equipment tags, in accordance with Construction Handbooks - Tagging Section.
- Identify & verify accuracy of danger/caution signs and labels used on high voltage equipment, such as mat, & pad mount transformers, for the warning of personnel/general public using appropriate references in accordance with Construction Handbooks - Safety Section.
- Identify the different types of bus configurations utilized within Company substations and switching stations on one line diagrams using Substation Operations Handbooks - Tagging Section.
- Interpret, draw & field verify oneline diagrams and circuit prints: radial, radial with backfeed, loop, network, spot network, buried underground and throw-over types of distribution circuits using symbols reference in accordance with Operation Outside Plant Handbook - Section M and standard CADD symbols.
- Accurately identify secondary service voltages and service configurations through visual inspection of overhead transformer connections and use of appropriate Overhead Construction Handbooks Section - H-120, H-125 & J-15, J-45
- Calculate transformer loading & size (kva) for single & polyphase Underground, Overhead & B.U.D. customer service installations based on load estimates and guidelines with the Underground Construction Handbooks and Overhead Construction Handbooks Section - J.
- Use the Electric Service Installation Information & Requirements guidelines to accurately determine customers & contractors service equipment, installation configurations, clearances, metering, grounding requirements, pad specifications and customer verses PSE&G responsibilities.
- Conduct field look-ups to identify equipment & construction types & prepare damage reports using appropriate personal protective equipment, storm look-up reference guide and Overhead Construction Manual.
- Identify and locate reference data about overhead & underground (Conventional & BUD) distribution equipment and conductors, including poles, insulators, guy wires, conductors, transformers, reclosures, capacitors, switches, network protectors and street lighting.
- Explain procedure for manhole atmosphere testing & monitoring of combustible gas, hydrogen sulfide, carbon monoxide and oxygen deficiency using approved instruments and procedures in accordance with “Guidelines for Testing Manhole Atmosphere” in the Underground Construction Handbook.

- Identify requirements and setup for “Work Area Protection”, including wearing of vest, in accordance within Construction Handbooks.
- Explain markout procedure for Company underground facilities, including one number to call system, symbols/color codes, requests, areas of responsibility and using electromagnetic induction type detection instruments, in accordance with Underground Plant Protection Procedures in the Construction Handbook and New Jersey Underground Facilities Act.

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 Utility Engineering” UTI 106

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|---|----------------------------|
| <p>I Introduction & Orientation</p> <p>A. Program Objectives & Sequence</p> <p>B. Course Objectives</p> <p>C. Personnel - Learner & Instructor/Facilitators</p> <p>D. Facility Safety & Security</p> <p>E. General Safety</p> <p style="padding-left: 20px;">➤ Responsibilities</p> <p style="padding-left: 20px;">➤ Personal Protective Equipment Required</p> <p>F. Overview of Electrical Energy System</p> <p>G. Personal Safety Equipment</p> | <p><i>Lecture 100%</i></p> |
| <p>II. Safety Tag Identification & Definition</p> <p>A. Tagging Authority</p> <p>B. Tagging Log</p> <p>C. Types of Safety Tags</p> <p>D. Danger & Caution Signs/Label</p> <p>E. Bus Configurations</p> <p>F. Substation & Switching Station Safety</p> <p>G. Substation Types & Equipment</p> | <p><i>Lecture 100%</i></p> |
| <p>III. Types Distribution Systems</p> | <p><i>Lecture 100%</i></p> |

- A. One Line Diagram Concept
 - B. Radial
 - C. Radial with Backfeed
 - D. Loop
 - E. Buried Underground Distribution
 - F. Network
 - G. Spot Network
 - H. Primary Throw over
- IV. **Energy Supply & Distribution Equipment/Hardware - Overhead** *Lecture 100%*
- A. Poles
 - B. Cross arms
 - C. Conductors
 - D. Insulators
 - E. Hardware
 - F. Capacitors
 - G. Reclosers
 - H. Transformers
 - I. Disconnects
 - J. Switches
 - K. Surge Protections
 - L. Guy Wire & Anchors
 - M. Street Lights
- V. **Energy Supply & Distribution Equipment/Hardware -Underground** *Lecture 100%*
- A. Buried Underground Distribution
 - Riser Poles
 - Conductors
 - Transformers
 - Switches
 - Secondary
 - Street Lights
 - B. Conventional Underground
 - Conductors
 - Splicing
 - Links & Fuses
 - Transformers
 - Network Protectors
 - Switches
 - Secondary
 - Street Lights
 - C. Primary Throw over Systems
- VI. **Electric Service Installation & Requirements** *Lecture 100%*

- A. General Requirements
 - B. Characteristics**
 - C. Service Runs
 - D. Service Entrance Installations
 - E. Metering Equipment
 - F. Customer Installation
 - G. Theft of Service
 - G. Service Entrance Clearances
 - H. Typical Installations
- VII. **Transformers – Theory & Single Phase Applications** *Lecture 100%*
- A. Theory of Operation
 - B. Types & Construction
 - C. Transformer Loading
 - D. Transformer Connections Using Single Phase Unit Customer Services
- VIII. **Transformers –PolyPhase Applications & Voltage Testing**
- A. Transformer Connections - Polyphase *Lecture 100%*
 - B. Voltage Testing Procedures *Lecture 100%*
 - C. Phase Rotation Procedures *Lecture 100%*
 - D. Demonstration Testing Secondary Voltages *Laboratory 100%*
 - E. Demonstration Testing Phase Rotation *Laboratory 100%*
 - A. Practical Exercises *Laboratory 100%*
 - Hooking Up Single Phase Transformer for Various Services
 - Testing Single Phase Transformer for Various Services
- IX. **Field Notes & Print Reading Applications**
- A. High Voltage Proximity Act & Primary Clearances *Lecture 100%*
 - B. Purpose of Field Notes *Lecture 100%*
 - C. Practical Exercise Identifying Field Equipment & Recording Notes
- X. **Utility Easements & Final Exam**
- A. Utility Easements
 - B. Completion of Final Exam
 - C. Review & Re-enforcement of Final Exam
 - D. Communicate Final Grade
 - E. Course Evaluation