

SUBSTATION MAINTENANCE PROGRAM OUTLINE

UNIT ONE- Basic Math and Electricity

1. Electrical System Components
2. The Distribution System
3. Basic Mathematics
4. Electrical Circuits
5. Trigonometry and Vectors

This is the first of three self study modules. Students will receive a hard-copy workbook and test online at their own pace. This module is made up of 5 lessons covering the needed basics of math and electricity.

UNIT TWO - Fundamentals of Alternating Current

1. Alternating Current and Circuits Containing Resistance
2. Inductance in Alternating Current Circuits and Resistance and Impedance in Series Circuits
3. Capacitors are not only fun, they're Important Too!
4. Series Circuits: Resistance, Inductive Reactance, and Capacitive Reactance
5. AC Parallel Circuits and Series-Parallel Circuits
6. Three Phase Systems
7. AC Instruments and Meters
8. Alternating Current Generators
9. Transformers
10. Transformer Connections and Special Applications

This is the second of three self study modules. Students will receive a hard-copy workbook and test online at their own pace. This module is made up of 10 lessons covering the needed fundamentals of alternating currents.

UNIT THREE- Substation Operation and Maintenance

1. Substations and Switchyards
2. Safety in Substations and Switchyards
3. Power Transformers
4. Circuit Breakers
5. Relaying and Substation Infrastructure

This substation mechanical maintenance specialist course will cover in detail typical maintenance tasks needed to keep substation equipment healthy, maximize lifespan, and minimize failures. Some examination of typical preventative maintenance programs including transformer oil testing, temperature maintenance of transformers, circuit breaker mechanisms, characteristics of gas insulated switchgear and electrical busses. There will be a data application section that shows how various types of substation data can be used to predict failures so costly failures are avoided and reliability of the grid is increased.

LAB A Introductory- 5 Days

DC Circuits Review

AC Circuits Review

Electrical Measurements Equipment

Electrical Measurements

P-Polyphase Vectors

Power:

 Real Power

 Reactive Power

 Apparent Power

 Power Factor

Phase Sequence

Three Phase Connections

Lab Exercises:

 Phase Sequence Determination

 Three Phase Connections

 Phase Angle Determinations

LAB B Advanced - 5 Days

Insulation

Laboratory Training Exercises:

- Insulation Resistance Tests

- Power Factor Tests

- Dielectric Strength Tests

Transformers

Transformer Testing:

- Winding Resistance

- Insulation Resistance

- Polarity

- Insulation Power Factor

- Transformer Turns Ratio

- Combustible Gas

- Safety Factors

Tests on a Power Transformer

Circuit Breakers

Circuit Breaker Tests:

- Insulation Resistance

- Power Factor Testing

- Timing

- Contact Resistance

- Safety Factors

Tests on an Oil Circuit Breaker

Stand-By Batteries

Demonstration on Batteries

Lightening Arrestors

Substation Maintenance Safety Techniques

Substation Drawings:

- Substation Standard Device Numbers

- Substation Standard Device Symbols

- Single Line Diagram

- Three Line Diagram

- Schematic Diagram

- Wiring Diagrams

Training Exercise:

- Relay Logic Circuits

- Substation Drawing Exercise