

# Electrical Equipment & Control Systems

## INTRODUCTION

- This Electrical Equipment and Control Systems training seminar will emphasise that all electrical equipment and devices are vital in all electrical installation to ensure continuity and efficient operations. Equipment like transformers, motors, variable frequency drives, uninterruptible power supplies and batteries are today's common components in most electrical installations. Safe operations are essential as they are protected by modern and sophisticated relays and protection devices.
- Protection systems are installed to prevent faults from damaging electrical plant and to initiate isolation of faulted sections to maintain continuity of supply elsewhere on the system. Recent changes in technology, together with changes in the manner in which Utilities and Industrial organisations operate, has greatly emphasized the development of integrated protection and control.

This training seminar will highlight:

- The construction and operations of transformers and motors
- The characteristics of variable speed drives
- The importance and role of UPS and batteries
- The types of maintenance
- The functionalities of protection relays

## OBJECTIVES

At the end of this training seminar, participants will learn to:

- Describe the various types of transformer and motors
- Appreciate the importance of uninterruptible power supply and batteries
- Analyse the various transformer tests
- Explain the operation of the various types of testing instruments
- Recognise the symbols in electrical drawings

## **TRAINING METHODOLOGY**

- This Electrical Engineering course will ensure participants understand the electrical equipment control systems. Each seminar participant will receive a copy of the comprehensive seminar notes. The presenter will outline and discuss the topics using computer displays, videos and PowerPoint presentations.
- The training seminar is designed to have an interactive format to maximize delegate participation. Questions and answers are encouraged throughout and at the daily sessions. Needs-Based case-studies and examples will be discussed in problem-solving workshop sessions.

## **ORGANISATIONAL IMPACT**

Upon completion of the training course, the organizational impact would be:

- Developed a structured approach and understanding of the major electrical equipment installed
- Appreciation of the workforce in handling the troubleshooting, maintenance and repair of electrical equipment
- Correct handling of testing and measuring instruments
- Examples and case studies to illustrate the material being discussed
- Technical material appropriate to the organisations represented
- Ensure safe operations of the electrical installation

## **PERSONAL IMPACT**

- Understand the operations and characteristics of transformers and motors
- Better understand the design and functionality of variable speed drives, UPS and batteries
- Utilize single-line diagrams and schematics for troubleshooting
- Understand standard work practices plus be able to develop job plans and maintenance strategies
- Show a refreshed knowledge when using testing and measuring instruments
- Able to troubleshoot AC motors problems

## **WHO SHOULD ATTEND?**

- The technicians and maintenance staff will be able to comprehend the construction, operations, function of major electrical equipment components. This will enable them to carry out effective maintenance activities.

This training seminar is suitable to a wide range of professionals but will greatly benefit:

- Electrical Engineers
- Electrical Supervisors
- Maintenance Technicians
- Managers in-charge of Electrical Installations

## Course Outline

### The Technology of Electrical Equipment and Devices

- Power Transformers
- Power Supplies (UPS) and Batteries
- Generators - Switchgear - Disconnect Switches
- Grounding and Neutral Ground Resistors (NGR)
- Motor Control Centers (MCC)
- Variable Frequency / Speed Drives (VFD/VSD)
- Protection and Numerical Relays Functionalities
- Motor and Feeder Protection

### Transformer Tests and Analysis of Test Results

- Functional Tests for Transformer
- Site Acceptance Tests
- Transformer Cooling
- Transformer Vector Groups Selection
- Transformer Maintenance
- Sweep frequency response analysis for transformer diagnostics
- Ester base oil for new power and distribution transformers

### The Use of Test Equipment and Interpretation of Results

- Degradation of Solid and Liquid Insulation in Switchgears
- Digital Multimeter
- Insulation Resistance Tester
- Temperature Probes and Pyrometers
- Resistance Temperature Detection and Sensors
- Digital Hydrometers
- Cable Fault Locators

### The Interpretation of Electrical Drawings and Motor Control Systems

- Importance of Electrical Diagrams
- Single-line Diagrams Symbols and Interpretation
- Types of Control Circuits
- Methods of Starting AC motors
- Soft Starters
- Maintenance of AC motors
- Troubleshooting of AC motors
- Induction motors vs. Synchronous Motors

## Maintenance Strategies and Conditioned Based Maintenance

- Importance of Maintenance
- Maintenance Strategies
- Thermal Imaging
- Partial Discharge
- Variable Speed Drives Maintenance
- UPS Maintenance
- Battery Charging and Maintenance
- Wrap-up Session with Q&A