BOOST
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Electrical Engineering

Transformer Operational Principles, Selection & Troubleshooting

Course Introduction

Power and distribution transformers are essential devices in electricity supply. Their ratings can vary from small size distribution transformers of a few kVA up to very large power transformers of 1000 MVA or more. In terms of voltage ratings transformers can have operating voltages up to several hundreds of kilovolts. They represent a major asset of the power utility and any industrial plant. Failure of a transformer can be very costly and dangerous for other major equipment and personnel alike.

The design and operation of any transformer must fulfil certain requirements in order to withstand the electric, thermal and mechanical stresses during its service life. Tests and maintenance of transformers according to the relevant standards are intended to ensure that a transformer passing them will give trouble-free service for many years under the conditions it is likely to experience after its installation.

Target Audience

- Electrical Engineer
- Electrical Project Engineer

Learning Objectives

- Operational principles
- Design guidelines and different types
- Selection methodology
- Maintenance and commissioning procedures
- Troubleshooting checklists and failure analysis techniques
- Testing procedures

- Diagnostics and monitoring technologies
- Practical solutions for specifying, operating and maintaining power transformers in a utility or plant environment
- Comprehensive understanding of principles, selection, testing and commissioning, protection, maintenance and troubleshooting of distribution, and power transformers
- The necessary safe procedures relating to transformer operation and related circuitry
- Testing and maintenance of transformers
- How to care for your transformers

Course Outline

- **DAY 01**

MODULE (01): INTRODUCTION, GENERAL PRINCIPLES AND CLASSIFICATION

- 1.1 General Classification of Transformers:
- 1.1.1 Transformer Construction, Core-Type,
- 1.1.2 Shell-Type, Dry-type Transformers,
- 1.1.3 Oil-filled Transformers,
- 1.1.4 Cooling Techniques
- 1.2 Transformer Windings
- 1.2.1 Interconnection of Windings
- 1.2.2 Advantages and Disadvantages of Principal Connections.
- 1.2.3 Tertiary Windings
- 1.2.4 Autotransformers
- 1.3 Harmonics in Transformers
- 1.3.1 Parallel Operation of Transformers
- 1.3.2 Loadings of Transformers in Parallel
- 1.3.3 Paralleling Requirements
- 1.3.4 Polarity
- 1.4 Standards for Transformers, Types and Requirements
- 1.5 Transformer Tappings and Connections
- 1.6 Ability to withstand Short Circuit, Sound Level
- 1.7 Case Studies and Workshop Discussion

- **Day 02**

MODULE (02): TRANSFORMER CONSTRUCTIONAL DETAILS

  - 2.1 Transformer Oil:
  - 2.1.1 Characteristics
  - 2.1.2 Oil Oxidation
  - 2.1.3 Breakdown Voltage
  - 2.1.4 Water Content
  - 2.1.5 Acidity
  - 2.1.6 Oil and Field Oil Testing
  - 2.1.7 Dissolved Gas Analysis
  - 2.1.8 Treatment and Filtering of Oil
  - 2.2 Effect of Oil Expansion
  - 2.2.1 Breathing Action
  - 2.2.2 Buchholz Relay
  - 2.2.3 Explosion Vents
  - 2.3 Instrument Transformers
  - 2.4 Transformers for Industrial Applications:
  - 2.4.1 Electro-chemical,
  - 2.4.2 Arc and Induction Furnaces,
  - 2.4.3 Rectifier Transformers,
  - 2.4.4 High Voltage Testing Transformers,
  - 2.4.5 Precipitator Transformers,
  - 2.4.6 Dry Type Transformers
  - 2.5 Transformer Construction & Details
  - 2.5.1 Transformer Cooling
  - 2.5.2 Natural Cooling
  - 2.5.3 Forced Cooling
  - 2.6 Case Studies and Workshop Discussion

- **Day 03**

MODULE (03): TRANSFORMER FEATURES AND THERMAL PERFORMANCE

  - 3.1 Thermal performance and Cyclic Rating of Transformers.

- 3.2 Transformer Impedance,
- 3.3 Electromagnetic Forces
- 3.4 Transformer Construction:
- 3.5 Transformer Windings Construction:
- 3.5.1 Coil Types,
- 3.5.2 Disc Coils,
- 3.5.3 Cross-over Coils,
- 3.5.4 Concentric Coils,
- 3.5.5 Sandwich Coils,
- 3.5.6 Transpositions
- 3.6 Transformer Tanks and Radiators, Tank Losses, Paint Treatments
- 3.7 Transformer Fittings:
- 3.7.1 Lifting Lugs,
- 3.7.2 Undercarriages,
- 3.7.3 Jacking Pads,
- 3.7.4 Tie-Down Lugs,
- 3.7.5 Bleed Pipes,
- 3.7.6 Thermometers
- 3.8 Case Studies and Workshop Discussion

• **Day 04**

MODULE (04): TRANSFORMER OPERATION AND MAINTENANCE

- 4.1 Distribution Voltage Adjustment, Off-Load Tap Changing, On-Load Tap Changing
- 4.2 Switching of high voltage underground cables supplying Distribution Transformers
- 4.3 Earthling and Over-Current Protection of Distribution Transformers
- 4.4 Transformer Maintenance:
- 4.4.1 Oil p reservation,
- 4.4.2 Deterioration of oil,
- 4.4.3 Breathers,
- 4.4.4 Condition Monitoring,
- 4.4.5 Faults in Transformers,
- 4.4.6 Tappings and Windings
- 4.5 Advanced Transformer Maintenance
- 4.6 Guidelines on how to care for your Distribution Transformer
- 4.7 Case Studies and Workshop Discussion

- **Day 05**

MODULE (05): TRANSFORMER TESTING

- 5.1 Transformer Routine Tests
- 5.2 Measurement of winding resistance
- 5.3 Measurement of voltage ratio
- 5.4 Measurement of impedance voltage short-circuit impedance and load loss
- 5.5 Measurement of No-load loss and current
- 5.6 Insulation resistance
- 5.7 Harmonics testing
- 5.8 Separate-source power-frequency voltage withstand test
- 5.9 Induced overvoltage withstand test
- 5.10 Transformer Type Tests
- 5.11 Temperature–rise test
- 5.12 Lightning impulse test
- 5.13 Sound level
- 5.14 Special Tests:
- 5.14.1 Transformer Partial Discharge testing
- 5.15 Accuracy and Interpretation of test results and of test reports
- 5.16 Workshop and Tutorials
- 5.17 Questions and Case Studies

Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
June 16, 2025	June 20, 2025	5 days	4950.00 $	Ireland - Galway
Sept. 15, 2025	Sept. 19, 2025	5 days	4250.00 $	UAE - Dubai
Dec. 22, 2025	Dec. 26, 2025	5 days	4250.00 $	UAE - Dubai