

COURSE OUTLINE

POWER TRANSFORMER - THEORY, MAINTENANCE AND INSTALLATION

- 1 OVERVIEW OF COURSE.
- 2 BASIC ELECTRICAL THEORY.
 - 2.1 Current.
 - 2.2 Potential Difference.
 - 2.3 Resistance.
 - 2.4 Direct Current and Voltage.
 - 2.5 Alternating Currents and Voltages.
 - 2.6 Heating Effect Due to Resistance.
 - 2.7 Electromagnetism.
 - 2.7.1 Magnetic Field Due to an Electric Current.
 - 2.7.2 Magnetic Field of a Solenoid.
 - 2.7.3 Electromagnetic Induction.
 - 2.7.4 Direction of Induced E.M.F.
- 3 TRANSFORMERS
 - 3.1 Transformer Theory.
 - 3.1.1 Introductory.
 - 3.1.2 Principle of Action of a Transformer.
 - 3.1.3 E.M.F. Equation of a Transformer.
 - 3.1.4 Phasor Diagram for a Transformer on No Load.
 - 3.1.5 Phasor Diagram for a Loaded Transformer, Assuming the Voltage Drop in the Windings to be Negligible.
 - 3.1.6 Useful and Leakage Fluxes in a Transformer.
 - 3.1.7 Leakage Flux Responsible for the Inductive Reactance of a Transformer.

- 3.1.8 Methods of Reducing Leakage Flux.
- 3.1.9 Equivalent Circuit of a Transformer.
- 3.1.10 Phasor Diagram for a Transformer on Load.
- 3.1.11 Approximate Equivalent Circuit of a Transformer.
- 3.1.12 Voltage Regulation of a Transformer.
- 3.1.13 Efficiency of a Transformer.
- 3.1.14 Condition for Maximum Efficiency of a Transformer.
- 3.1.15 Open-Circuit and Short-Circuit Tests on a Transformer.
- 3.1.16 Calculation of the Voltage Regulation from the Short-Circuit Test.
- 3.1.17 Three-Phase Core-Type Transformers.
- 3.1.18 Auto-Transformers.

- 3.2 Types of Transformers.
 - 3.2.1 Categories.
 - 3.2.2 Cooling System Classifications.
 - 3.2.3 Designs.
 - 3.2.3.1 Open-Tank.
 - 3.2.3.2 Sealed-Tank.
 - 3.2.3.3 Conservator/Expansion Tank.
 - 3.2.3.4 Gas-Oil Seal.
 - 3.2.3.5 Automatic Gas Pressure.
 - 3.2.3.6 Dry Transformers (Air-Cooled).

 - 3.2.4 Distribution Transformers.

- 3.3 Transformer Nameplate Data.
 - 3.3.1 Introduction.
 - 3.3.2 Objectives.
 - 3.3.3 Electrical Ratings and Characteristics.
 - 3.3.3.1 Voltage Ratings.
 - 3.3.3.2 Basic Impulse Level (BIL).
 - 3.3.3.3 Phase.
 - 3.3.3.4 Frequency.
 - 3.3.3.5 Class.
 - 3.3.3.6 Temperature Rise.
 - 3.3.3.7 Capacity (kVA or MVA Rating).
 - 3.3.3.8 Impedance.
 - 3.3.3.9 Phasor Diagram.
 - 3.3.3.10 Schematic Connection Diagram.
 - 3.3.3.11 Tap Changer Voltage Charts.
 - 3.3.4 Insulating Fluid Characteristics.

- 3.3.4.1 Insulating Medium.
- 3.3.4.2 Fluid Capacities.
- 3.3.4.3 Liquid Level.

3.3.5 Constructional Characteristics.

- 3.3.5.1 Winding Conductor Material.
- 3.3.5.2 Operating Pressure.
- 3.3.5.3 Vacuum Filling.
- 3.3.5.4 Weights.

3.3.6 Auxiliary Equipment and Information Data.

- 3.3.6.1 Instrument Transformers.
- 3.3.6.2 Manufacturer's Serial Number.
- 3.3.6.3 Instruction Book Number.
- 3.3.6.4 Drawing Number.
- 3.3.6.5 Special Notes and Warnings.

3.3.7 Summary.

4. TRANSFORMER RECEIPTS & ACCEPTANCE.

- 4.1 Receiving Inspection and Testing.
- 4.2 Handling.
- 4.3 Storage.
- 4.4 Summary.

5 TRANSFORMER INSTALLATION & MAINTENANCE.

- 5.1 Introduction.
- 5.2 Transformer Installation and Maintenance.
 - 5.2.1 Dry-Type Transformer.

- 5.2.1.1 Installation.

- 5.2.1.2 Maintenance.
- 5.2.1.3 Drying out Methods.
- 5.2.1.4 Storage.

- 5.2.2 Liquid-Type Transformer.
 - 5.2.2.1 Installation.
 - 5.2.2.2 Maintenance.
 - 5.2.2.3 Drying-out Methods.
 - 5.2.2.4 Storage.
 - 5.2.2.5 Transformer Diagnostic Guide.

6 STANDARD TRANSFORMER CONNECTIONS.

6.1 Three Phase Connections.

6.2 Buck-Boost Transformer.

6.2.1 Three Phase Applications.

6.2.1 Buck-Boost Application Tables 1 to 6.