



# Transformer *Testing, Operation and Maintenance*



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16 Jul - 20 Jul



5800 SAR

## Course Overview

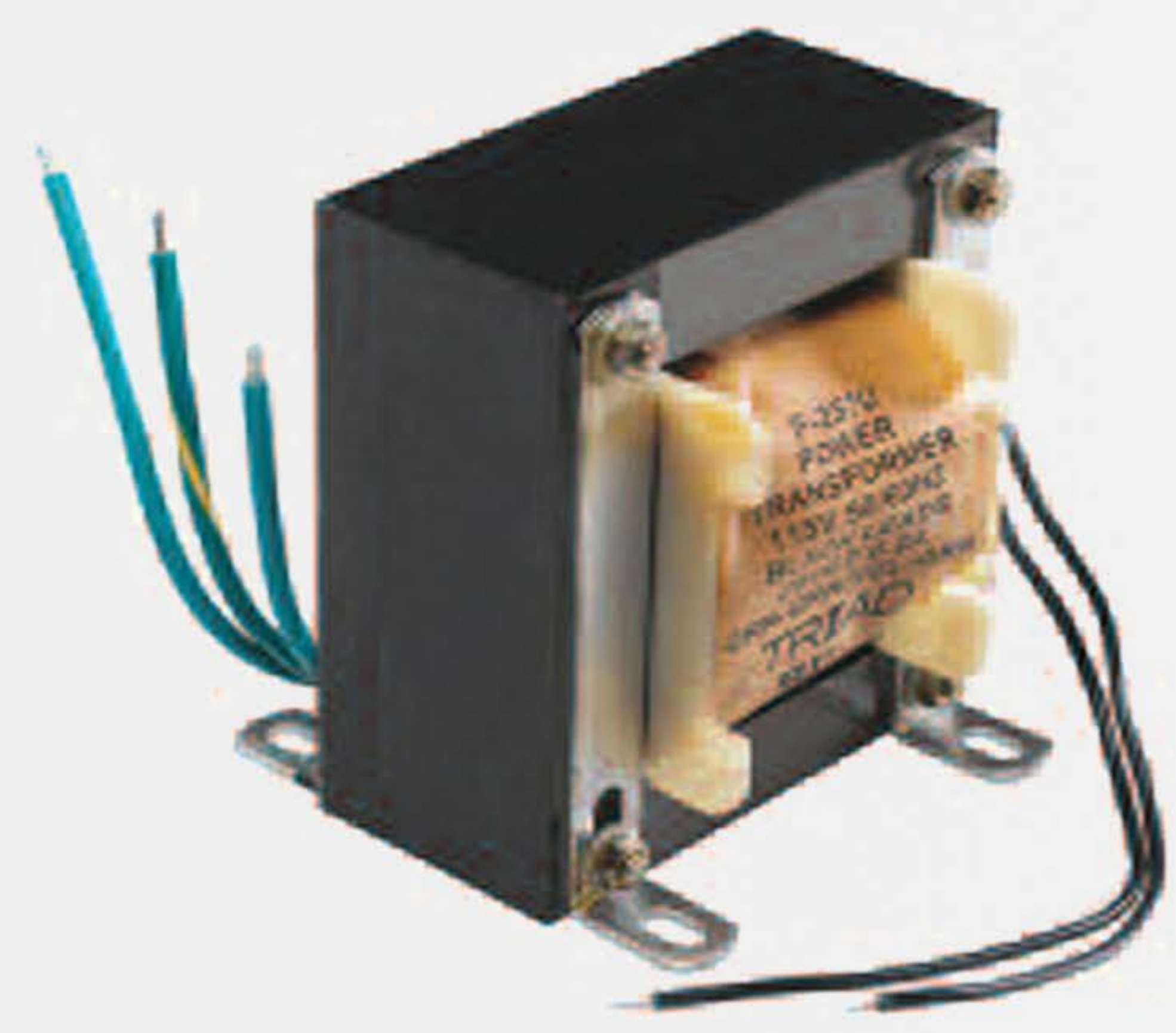
Power transformers are essential elements in the electric power systems. Understanding transformers theory of operation is a basic step for power engineers. Transformer maintenance and testing have great impacts on the reliability of power supply for customers. The course gives a thorough understanding of power transformers operation maintenance and testing. By the end of the course, participants will gain a fundamental understanding of the theory of operation, testing and maintenance of power transformers. Participants shall understand how to take the corrective action and solve problems with transformer operation. The concluding section of the course gives you the fundamental tools in performing transformer inspection, acceptance test, monitoring, maintenance and troubleshooting.

## Training Methodology:

- 1- Presentation & Slides
- 2- Audio Visual Aids
- 3- Interactive Discussion
- 4- Participatory Exercise
- 5- Action Learning
- 6- Class Activities
- 7- Case Studies
- 8- Workshops
- 9- Simulation



# Upon completion of this course, students will be able to:

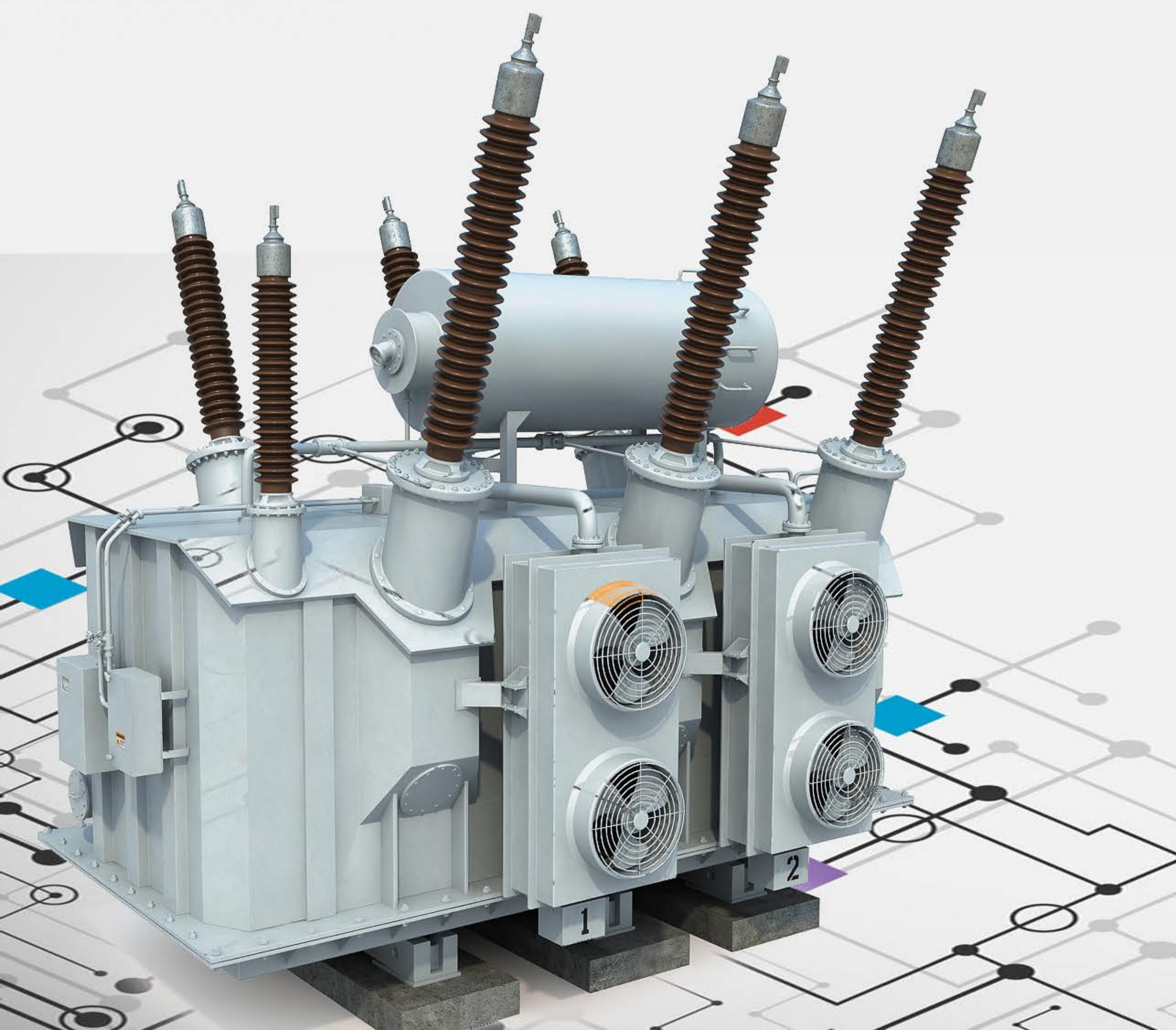


- 1- Understand theory of operation of power transformers
- 2- Identify different transformer applications.
- 3- Identify different types of transformer construction
- 4- Identify the difference between core form and shell form constructions.
- 5- Understand transformer connections and polarity
- 6- Study transformer cooling classifications
- 7- Differentiate between Dry-type, liquid-filled and gas-filled tanks
- 8- Understand oil testing and sampling
- 9- Get acquired with synthetics and other insulating fluids
- 10- Get acquired with different inspection, acceptance and pre-arrival preparations steps
- 11- Specify the internal inspection, receiving, moving and storage operations
- 12- Be able to do transformer tests
- 13- Be able to do transformer maintenance, documentation and scheduling.
- 14- Get acquired with transformer monitoring and diagnostics.



## who should attend?

- 1- Plant Engineers
- 2- Operations Engineers
- 3- Electrical Maintenance Engineers
- 4- Instrument and Control Engineers
- 5- Electrical Technicians
- 6- Electrical Inspectors
- 7- Electrical Maintenance Supervisors



# Course Outlines:

## DAY ONE

- 1- Power Transformers Theory
- 2- Introduction
- 3- Standards and Principle
- 4- Basic transformers action
- 5- Transformers equivalent circuit
- 6- Voltage and current distribution
- 7- Transformers impedance and representation
- 8- Tap Charge
- 9- Useful Standards
- 10- Voltage impedance and power rating
- 11- General
- 12- Voltage drop
- 13 Impedance
- 14- Voltage ratio and tapping- general
- 15- Voltage ratio with off- circuit tapings
- 16- Voltage ratio and on – load tapings
- 17- Basic insulation level (BIL)
- 18- Vector groups and neutral earthing



## DAY TWO

- 1-Power Transformers Theory
- 2-Introduction
- 3-Standards and Principles
- 4-Basic transformers action
- 5-Transformers equivalent circuit
- 6-Voltage and current distribution
- 7-Transformers impedance and representation
- 8-Tap Charge
- 9-Useful Standards
- 10-Voltage impedance and power rating
- General
- 11- Voltage drop
- 12-Impedance
- 13-Voltage ratio and tapping- general
- 14-Voltage ratio with off- circuit tapings
- 15-Voltage ratio and on – load tapings
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# DAY Three

- 1-Introduction
- 2- Types of Transformers
- 3- Transformers components and their functions
- 4- Insulating and cooling medium
- 5- Liquid
- 6-filled transformers ratings
- 7- The electrical and magnetic circuits
- 8-The construction of transformer s bushing
- 9-The function of gas relay
- 10-Transformers insulating oil
- 11-Introduction
- 12- Oil specification and properties
- 13- Oil handling and storage

- 14-Oil treatment oil unit process (Coarse Filters, Temperature, water separator, Dirt Trap, Candle filter, Electrical flow Heater)
- 15-Vokes Treatment (Description, Operation)
- 16-Transformers cooling system
- 17-Means of cooling transformers
- 18-Methods of heat exchange
- 19- Methods of circulating insulating medium
- 20- Methods of transferring heat from liquid insulation
- 21- The cooling system pumps
- 22-Different types of gauges
- 23- Oil temperature gauge
- 24- Borden type
- 25- Winding temperature gauge
- 26- Oil flow gauge



# DAY Four

- 1- Poly- phase transformer Connections
- 2-Different types of three
- 3-Phase winding connection
- 4- Connection of three- Phase
- 5- Transformers having 2 or 3 winding
- 6- Parallel operation of transformers
- 7- Testing of Transformers
- 8- Introduction
- 9-Categories of test
- 10-Winding Dc Resistance Measurement
- 11- Bridge Methods of Resistance Measurement
- 12- No-Load Test
- 13 Sustained Short Circuit Test

- 14 Calculation of Efficiency of transformers from the result of no-load test and sustained S.C test
- 15 Temperature rise (heat Run) Test
- 16 Insulation Resistance Measurements
- 17 Insulation Capacitance and its insulation power
- 18- factor Measurements
- 19- charges operation
- 20-Categories of test
- 21-Winding Dc Resistance Measurement
- 22- Bridge Methods of Resistance Measurement
- 23- No-Load Test

# DAY FIVE

- 1-Maintenance of power transformers -Breakdown
- 2-Maintenance versus preventive
- 3-Maintenance -Inspection, servicing, overhaul
- 4-Monitoring
- 5-Maintenance Management
- 6-General Guide
- 7-Lines for maintenance
- 8-Temperature supervision
- 9-cooling equipment
- 10Part wise Maintenance schedule
- 11- Maintenance spares and maintenance facilities
- 12- Inspection, repairs, overhaul
- 13- Maintenance frequency: daily, monthly, yearly
- 14- Un-Schedule Maintenance
- 15- Preventative maintenance
- 16- Maintenance of unattended transformers
- 17- Trebles with power transformers and possible causes of failure
- 18 Trouble shooting and investigation of trouble

