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TRAINEE'S HANDBOOK

TRANSFORMER TESTING SUPERVISOR

QF Code: CUTM/PWR/Q6636
NSQF Level: 5
v.1

CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT, ODISHA

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CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT, ODISHA

Dr. Supriya Pattanayak
Vice Chancellor, CUTM

Foreword

This participant's handbook is a dedicated effort to provide comprehensive and relevant information to both current and prospective professionals in this field. The content has been meticulously compiled with contributions from Subject Matter Experts (SMEs) and industry leaders to ensure it is up-to-date and reliable. We extend our heartfelt thanks to all the SMEs and industry partners who have made invaluable contributions to the creation of this handbook.

I would like to express my gratitude to the SMEs and the team at Centurion University, along with our Industry Partners, for their unwavering dedication in developing this handbook in its current form.

This handbook is intended to support skill-based training in the relevant sector. We hope it will serve as a valuable resource for all stakeholders, including participants, trainers, and evaluators. Every effort has been made to ensure that this publication meets the current quality standards necessary for the successful delivery of Qualification File/NOS-based training programs. We welcome and appreciate any suggestions for future improvements to this handbook.

Acknowledgements

This participant's handbook meant for Transformer Testing Supervisor is a sincere attempt to ensure the availability of all the relevant information to the existing and prospective job holders in this job role. We have compiled the content with inputs from the relevant Subject Matter Experts (SMEs) and industry members to ensure it is the latest and authentic. We express our sincere gratitude to all the SMEs and industry members who have made invaluable contributions to the completion of this participant's handbook.

I would like to thank the SME and the team at the Centurion University along with the Industry Partners for the tireless effort in bringing the handbook in the current format.

This handbook will help deliver skill-based training in the field of Transformer Testing Supervisor. We hope that it will benefit all the stakeholders, such as Trainer & other members, Trainees, and elevators. We have made all efforts to ensure the publication meets the current quality standards for the successful delivery of Qualification File/NOS-based training programs. We welcome and appreciate any suggestions for future improvement of this handbook.

About this Guide

Participant Guide/handbook is a book designed for the Trainees to enable the training of Trainers & other members for a particular job role and to enhance the quality of executing the training program. This Facilitator guide/handbook is designed to enable the training program for the job role of "**Transformer Testing Supervisor**" in the Power Sector.

This course is aligned to Qualification Pack Reference ID: **CUTM/PWR/Q6636**.

This Qualification pack is developed by Centurion University of Technology and Management (CUTM). This course encompasses all 6 National Occupational Standards (NOS) of the Transformer Testing Supervisor Qualification Pack issued by "Centurion University of Technology and Management (CUTM)."

Each unit starts with learning objectives followed by relevant activities and corresponding training methodology. Trainee can write notes/tips after each unit, space is provided at the end of each unit

Upon successful completion of this course, the participant will be able to:

- Review customer and Supervisory requirement
- Comprehend bills of materials and updating of required logs
- Inspect for available material and understand the requirement of core and coil assembly
- Assimilate vapour phase unit, oil tank fabrication and transformer assemble
- Review Testing requirement
- Testing and quality check of assembled transformer
- Ensure organizational health, safety and security for self and others

Table of Contents

1. Introduction

Key learning outcomes

- To get introductory input for transformer manufacturing

Module objectives

- Know About Transformer
- General Operations
- Parts
- Basics of Transformer & Operation

Resources to be used

- For theory: Smart Board
- For practical: PPE Kit

Dos for the module in the training session:

- Follows Safety measures

List the activities (practical) for the execution of this module:

Sl. No.	Skill practice	Duration	Resources
1	Overview	3 Hrs	Field Visit

1.1 Introduction to Training Program

Unit Objectives:

At the end of this unit, the Trainee will be able to:

1. Explain the purpose of training.

2. Describe about National Occupation Standards and Qualification Pack in terms of job roles and responsibilities of the trade.

3. Describe the size and scope of the Transformer Industry.

4. Identify the sub-sectors of the Transformer Industry.

Description:

• Welcome and greet the Trainer & other members.

Topic Introduction-

• Give the Trainer & other members a brief overview of what will be covered in this unit

• Applications of Transformer Testing Supervisor in various project sites such as industrial/ commercial/ infrastructural projects

• Applications in Building works

Resources to be used:

Black/ white board, marker, notebook, pen, laptop along with projector, PPT, Transformer Testing Supervisor handbook.

Unit Objectives:

At the end of this unit, the Trainee will ensure that the participant will be able to:

1. Know briefly about the power sector industry in India.
2. Know the power sector and its sub-sectors.
3. Understand common occupations and job roles in the construction sector
4. Understand construction electrical works occupations, Assistant Electrician job role

1.2 Description of roles of Transformer Testing Supervisor Unit

At the end of this unit, the Trainee will be able to:

1. Understand the roles and responsibilities of the Transformer Testing Unit
2. Describe the personal attributes of a Transformer Testing Unit in the Power sector
3. Know the career progression path for a Transformer Testing Unit

Know the different Transformer Testing works that happen at a Power site i.e. installing lighting arrangements, providing electrical connections to machines and equipment etc.

Show some examples with illustrations of Transformer Testing works such as cable laying at construction sites, conduit laying through concrete structures, fixing of electrical fixtures and accessories, etc.

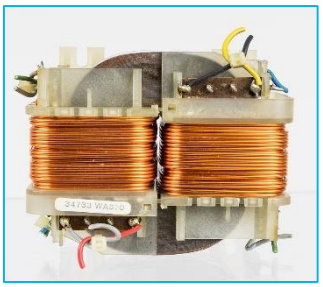
List out some electrical activities that happen often at the Transformer Testing Unit.

Roles, Responsibilities and Personal Attributes

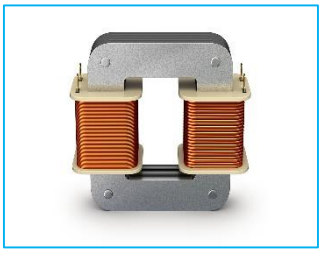
- Know the necessity of defining roles, tasks/functions, and outcomes.
- List the roles and responsibilities of a Transformer Testing Supervisor in detail.
- List the personal attributes of a Transformer Testing Supervisor in detail.
- Know the necessity of personal attributes.
- Know the main topics of the training programme.
- List down the modes of learning and practice.
- Know the duration of theoretical and practical sessions.

1.3 Basic Concepts of Transformer Testing:

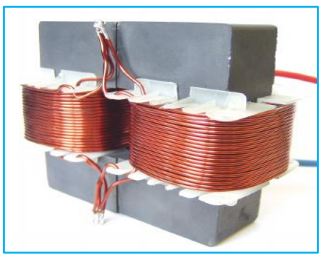
Transformer Testing involves several basic concepts that are fundamental to understanding the process of designing, Testing, and testing transformers.



Transformer: A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. It typically consists of two or more coils of wire (known as windings) that are wound around a core made of ferromagnetic material.



Core: The core of a transformer provides a path for the magnetic flux generated by the windings. It is usually made of laminated sheets of silicon steel or other magnetic materials to minimize eddy current losses and maximize magnetic efficiency.



Windings: Windings are coils of wire wound around the core of a transformer. The primary winding is connected to the input voltage source, while the secondary winding is connected to the load. The number of turns in each winding determines the voltage ratio between the input and output circuits.

Turns Ratio: The turns ratio of a transformer is the ratio of the number of turns in the primary winding to the number of turns in the secondary winding. It determines the voltage transformation ratio between the input and output circuits.

Voltage Rating: The voltage rating of a transformer indicates the maximum voltage that can be applied across its windings without exceeding its insulation capability. It is specified for both the primary and secondary windings.

Power Rating: The power rating of a transformer specifies the maximum power that it can deliver to the load without overheating. It is determined by factors such as the size of the core, the gauge of the wire, and the cooling mechanism.

Insulation: Insulation materials are used to electrically isolate the windings and core of a transformer from each other and from the transformer's enclosure. Insulation materials include varnish, paper, and synthetic resins, and they are chosen based on factors such as temperature, voltage, and environmental conditions.

Cooling: Transformers generate heat during operation, which must be dissipated to prevent overheating and damage. Cooling mechanisms include natural convection, forced air cooling, oil immersion, and liquid cooling systems.

Testing: Transformers undergo various tests during Testing to ensure their performance, reliability, and safety. These tests include insulation resistance tests, turns ratio tests, voltage withstand tests, and temperature rise tests.

Standards and Regulations: Transformer Testing must comply with industry standards and regulations to ensure product quality, safety, and reliability. These standards may include those set by organizations such as the International Electro Technical Commission (IEC) or the Institute of Electrical and Electronics Supervisors (IEEE).

Understanding these basic concepts is essential for designing, testing, and testing transformers that meet performance requirements and regulatory standards.

1.4 Outcome Questions:

- State company's code of conduct
- Discuss different types of products manufactured by the company
- State the relevance of understanding customer requirements, Supervising drawings and standards
- List tools, raw materials and consumables required for production as per the production plan/operators' instructions
- Know the application of the transformer and standards to be followed for the Testing and testing process
- Discuss assembly drawing, material grade, dimensional tolerances, and assembly process for the specific order to be executed
- Know the various elements of bills of materials
- State how to check the procurement of raw materials/tools
- List the different aspects to be checked of inspection reports to ensure quality and quantity checks
- Elucidate the importance of placing tools in different stages of the Testing process
- Define various aspects of production file, log, template, and MIS required for updating
- State protocol of reporting in case of any dispute in drawing, standards, materials, consumables, and tools
- Discuss company's hierarchy / reporting structure
- List the types of hazards, risks and threats associated at the workplace

- Discuss safety techniques for self and others
- List regulatory health and safety guidelines applicable to the Electric Vehicle workplace
- Discuss environment management system related procedures
- Elucidate procedure to store materials and tools in line with manufacturers and Cooperative Society/NGO/SHG requirements
- Discuss ways to handle and dispose of waste and debris
- Know the significance of periodic checks to keep the work area free from hazards and obstructions
- Elucidate practices of conducting mock drills/ evacuation procedures, emergency training sessions
- Discuss the importance of Employability Skills in meeting the job requirements
- Know constitutional values, civic rights, duties, citizenship, responsibility towards society etc. that are required to be followed to become a responsible citizen
- Show how to practice different environmentally sustainable practices
- Discuss 21st century skills.
- Display a positive attitude, self-motivation, problem-solving, time management skills and continuous learning mind-set in different situations
- Use appropriate basic English sentences/phrases while speaking
- Discuss the significance of reporting sexual harassment issues in time
- Discuss the significance of using financial products and services safely and securely
- Know the importance of managing expenses, income, and savings
- Know the significance of approaching the concerned authorities in time for any exploitation as per legal rights and laws
- Discuss the significance of using the internet for browsing, and accessing social media platforms, safely and securely
- Discuss the need for identifying opportunities for potential business, sources for arranging money and potential legal and financial challenges
- Differentiate between types of customers
- Know the significance of identifying customer needs and addressing them
- Discuss the significance of maintaining hygiene and dressing appropriately
- Use various sources to search and apply for jobs
- Discuss the significance of dressing up neatly and maintaining hygiene for an interview
- Discuss how to search and register for apprenticeship opportunities

2. Understand Transformer Testing Requirements, CUTM/PWR/N6639,V.1.0:

Key learning outcomes

Trainee will learn about test requirements of Distribution Transformer

Module objectives

- Know about transformer testing
- Testing Process
- Workflow

Resources to be used

- For theory: Smart Board
- For practical: PPE Kit

Dos for the module in the training session:

Follows Safety measures

List the activities (practical) for the execution of this module:

Sl. No.	Skill practice	Duration	Resources
1	Testing requirement of Transformer	30 Hrs	Hands-on in Workshop

2.1 Review customer and Supervisory requirement:

Reviewing customers and supervising requirements is a crucial step in the product development process. Here's how it's typically done:

Understand Customer Needs: Begin by thoroughly understanding the needs and expectations of the customer. This involves gathering information through market research, customer surveys, and direct communication with the customer. Identify the specific features, functions, performance criteria, and constraints that the customer desires.

Document Requirements: Document the customer requirements in a clear and concise manner. This may include creating a requirements document or a product specification sheet that outlines all the key features and functionalities requested by the customer.

Prioritize Requirements: Prioritize the customer requirements based on their importance and impact on the overall product. Some requirements may be critical and non-negotiable, while others may be nice-to-have but not essential. Use techniques like MoSCoW (Must have, Should have, Could have, won't have) to prioritize requirements effectively.

Translate to Supervising Requirements: Once customer requirements are understood, translate them into supervising requirements. Supervising requirements are more detailed and technical

specifications that guide the design and development process. They should be specific, measurable, achievable, relevant, and time-bound (SMART).

Validate Requirements: Validate the requirements with stakeholders, including customers, product managers, Supervisors, and quality assurance teams. Ensure that all parties agree on the requirements and that they accurately reflect the customer's needs and expectations.

Manage Changes: Recognize that requirements may evolve throughout the product development lifecycle. Implement a robust change management process to handle any changes to requirements effectively. This involves assessing the impact of changes, obtaining approval from stakeholders, and updating documentation accordingly.

Review for Completeness and Consistency: Conduct a thorough review of the requirements to ensure they are complete, consistent, and free from ambiguity. Verify that all requirements align with the overall product vision and goals.

Traceability: Establish traceability between customer requirements, Supervising requirements, and design specifications. This ensures that each Supervising requirement can be traced back to a specific customer need, providing clarity and accountability throughout the development process.

Document Control: Implement a document control system to manage the versioning, distribution, and access of requirement documents. This helps prevent unauthorized changes and ensures that stakeholders are working with the latest information.

Continuous Improvement: Lastly, strive for continuous improvement in the requirement review process. Solicit feedback from stakeholders, conduct post-mortem reviews after project completion, and identify lessons learned to enhance future requirement management practices.

Outcome Questions:

- State company’s code of conduct
- Discuss different types of products manufactured by the company
- State the relevance of understanding customer requirements, Supervising drawings and standards
- List tools, raw materials and consumables required for production as per the production plan/operators’ instructions
- Know the application of the transformer and standards to be followed for the Testing and testing process

Discuss assembly drawing, material grade, dimensional tolerances, and assembly process for the specific order to be executed

2.2 Comprehend bills of materials and updating of required log:

Comprehending bills of materials (BOM) and updating required logs is essential for effective inventory management and production planning. Here's a breakdown of these concepts:

Bills of Materials (BOM):

- A bill of materials is a comprehensive list of all the raw materials, components, assemblies, and sub-assemblies required to manufacture a product.
- BOMs provide detailed information about each item in the list, including part numbers, descriptions, quantities, and unit of measure.
- BOMs can be hierarchical, with multiple levels of assemblies and sub-assemblies, showing the relationship between different components.
- They serve as a blueprint for production, procurement, and inventory management, guiding the Testing process and ensuring that all necessary materials are available.

Updating Required Logs:

- Required logs, also known as inventory logs or material requisition logs, track the movement and usage of materials within a Testing facility.
- These logs are updated regularly to reflect changes in inventory levels, such as materials received, issued for production, transferred between locations, or returned to suppliers.
- Updating required logs involves recording pertinent information, including item descriptions, quantities, dates, locations, and reasons for material movements.
- Accurate and up-to-date logs are critical for inventory control, ensuring that materials are available when needed for production and preventing stock outs or overstock situations.
- Required logs may be maintained manually using paper-based forms or electronically through inventory management systems or enterprise resource planning (ERP) software.
- Regular audits and reconciliations of inventory logs help identify discrepancies, minimize errors, and improve overall inventory accuracy and accountability.

The comprehending bills of materials provides insight into the components required for production, while updating required logs ensures accurate tracking and management of inventory levels throughout the Testing process. Together, these practices facilitate efficient production planning, minimize material shortages, and optimize inventory control.

2.3 Outcome Questions:

- Know the various elements of bills of materials
- State how to check the procurement of raw material / tools
- List the different aspects to be checked of inspection reports to ensure quality and quantity

checks

- Elucidate the importance of placing tools in different stage of Testing process
- Define various aspects of production file, log, template, MIS required for updating
- State protocol of reporting in case of any dispute in drawing, standards, materials, consumables, and tools
- Discuss company's hierarchy / reporting structure

3. Perform Transformer Testing:

Key learning outcomes:

Trainee will learn about testing procedure in Distribution Transformer

Module objectives:

- Know about testing
- Quality checking Process

Resources to be used:

- For theory: Smart Board
- For practical: PPE Kit

Dos for the module in the training session:

- Follows Safety measures

List the activities (practical) for the execution of this module:

Sl. No.	Skill practice	Duration	Resources
1	Testing technique	6Hrs	Hands-on in Workshop
2	Testing & Quality checking	6 Hrs	Hands-on in Workshop

3.1 Perform transformer Testing Process:

Performing transformer Testing involves several key steps to produce high-quality transformers efficiently. The following are the test process with instruction:

1. Insulation Resistance Test
2. Dc/Winding Resistance Test
3. Turns Ratio Test
4. No Load Test
5. Load Test
6. High Voltage Test
7. Dvdf Test
8. Magnetic Balance Test
9. Vector Group Test
10. Break Down Voltage Test

3.1.1 Insulation Resistance Test:

Name of the Test: Insulation Resistant test of the Transformer

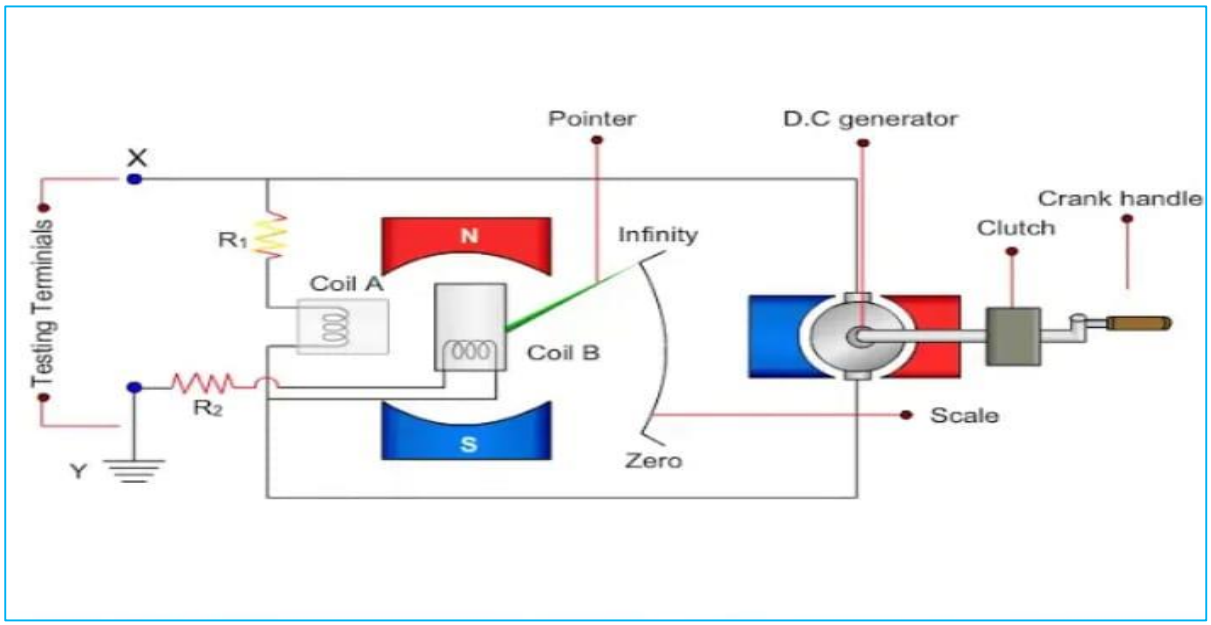
Equipment's required:

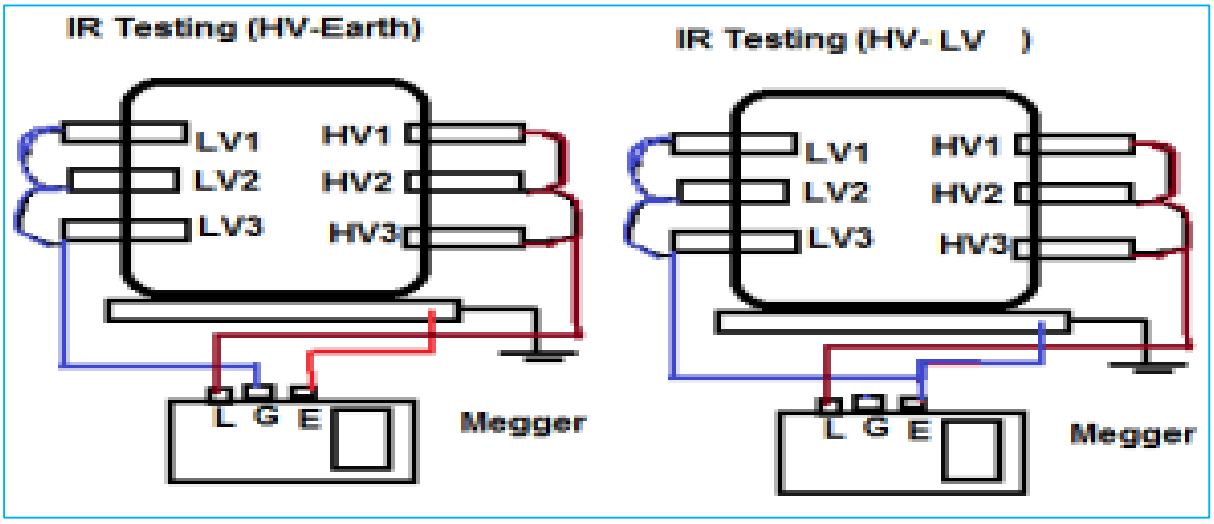
- Megger/Insulation Resistant tester
- Wires

Theory:

- The Megger test is a method of testing making use of an insulation test resistance meter that will help to verify the condition of electrical insulation.
- Always used in DC supply in the Megger test.
- Its unit always carries mega ohm (M ohm)

Circuit Diagram:





Procedure:

- First, we will disconnect all the line & neutral terminals of the transformer.
- Megger leads are connected to LV & HV bushing studs to measure insulation resistance IR value in between the LV & HV windings.

- Megger leads are connected to HV bushing studs and transformer tank earth point to measure insulation resistance IR value in between HV windings & Earth.
- Megger leads are connected to LV bushing studs & transformer tank earth point to measure insulation resistance IR value in between the LV windings & Earth.

Prescribed Value:

Max Volt Rating of Equipment	Megger Size	Min.IR Value
5 KV	2500 Volts	1000 M ohm
8 KV	2500 Volts	2000 M ohm
15 KV	2500 Volts	5000 M ohm
25 KV	5000 Volts	20000 M ohm

One Meg ohm Rule for IR Value for Equipment:

- Based upon equipment rating:
- < 1K V = 1 MΩ minimum
- >1KV = 1 MΩ /1KV

Observation:

HV-EARTH	LV-EARTH	HV-LV
2500 M ohm	1500 M ohm	2500 M ohm
2500 M ohm	2500 M ohm	FAULT

Conclusion:

From the above assumptions/values, we conclude that the first t transformer is found to be in healthy condition whereas the second transformer is in unhealthy (faulty) condition.

3.1.2 DC/Winding Resistance Test:

Name of the Test: Winding Resistance or DC Resistance of the Transformer

Equipment's required:

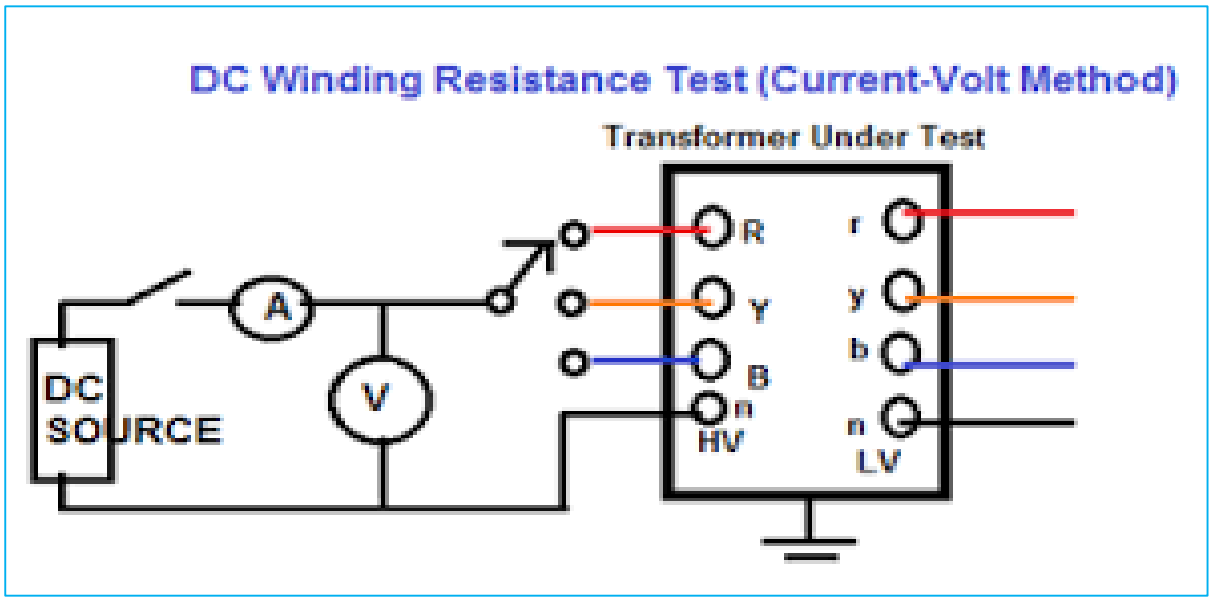
- Micro ohm meter
- Patch chords

Theory:

- Measuring the resistance of transformer windings assures that each circuit is wired properly and that all connections are tight.
- Transformer winding resistance measurements are obtained by passing a known DC current through the winding under test and measuring the voltage drop across each terminal.

- Winding resistance directly proportional to the temperature.

Circuit Diagram:



Procedure:

- Connect the equipment's as per the circuit diagram.
- Give supply to the ohm meter.
- Then short (I-, V-) & (I+, V+)
- Connect the shorted wire in different phase R-Y-B, both HV side & LV side of the transformer.
- Then measured the value.
- If LV side value vary then checked Neutral point & other point of LV side.

Prescribed Value:

HV side	**LV side**	**Neutral LV side**
11.953 ohm	25.54 m ohm	14.633 m ohm
11.952 ohm	25.64 m ohm	14.740 m ohm
11.961 ohm	25.75 m ohm	14.801 m ohm

Observation:

HV side	**LV side**	**Neutral-LV side**
RY=22.9 ohm	RY=30.7 m ohm	NY=14.7 m ohm
RB=23.2 ohm	RB=25.4 m ohm	NB=20.6 m ohm

BY=23.1 ohm	BY=32.8 m ohm	NY=15.3 m ohm

Conclusion:

We observed that the measured value of LV side or STAR connection side will vary. If it is given same value then we know that the winding connection is proper.so find the accurate fault we test in each phase with neutral in LV side of the Transformer.

3.1.3 Turns Ratio Test:

Name of the Test: Turns ratio test of the transformer.

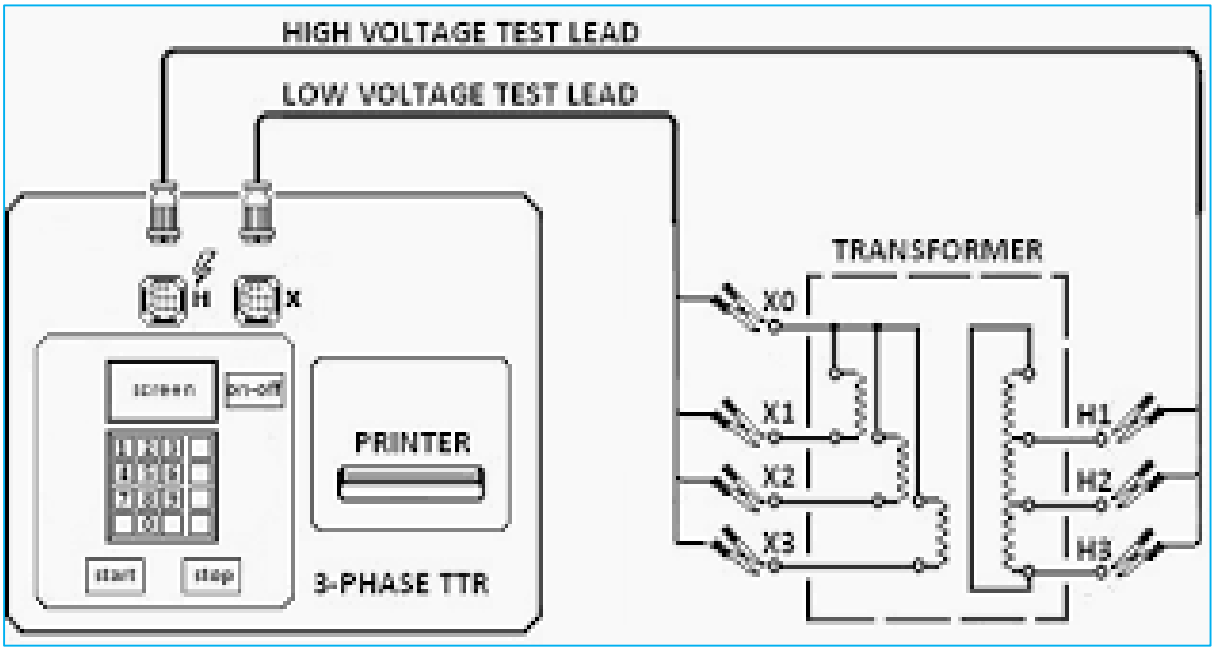
Equipment's required:

- Turns ratio tester
- patch cord

Theory:

- The transformer turns ratio is the number of turns of the primary winding divided by the no. of turns of the secondary coil.
- The transformer turns ratio provides the expected operation of the transformer and the corresponding voltage required on the secondary winding.

Circuit Diagram:



Procedure:

- Two cables (LT) X and (HT) H are connected to low voltage side with neutral and high voltage side respectively.
- Switching ON the MCB, we apply 120V to the transformer as a test voltage.

- Then we check the ratio for, AB/an, BC/bn & CA/cn – High voltage side to Low voltage side.
- Multiple factor for ratio must set to be 5 i.e.the knob of the ratio meter must be kept on the number 5.
- Then the first knob to be set on the number 8 and the second knob to be set on the number 8.after the point the third knob to be set on Zero
- Then 8.80 to be multiplied with multiple factor 5 for getting the ratio 44.

Observation:

SL NO	R PHASE	Y PHASE	B PHASE
1	40.02	44.02	43.95

Conclusion:

From the above value, we have concluded that the turns distribution is in proper ratio and also voltage.

3.1.4 No Load Test:

Name of the Test: No-load test of the transformer.

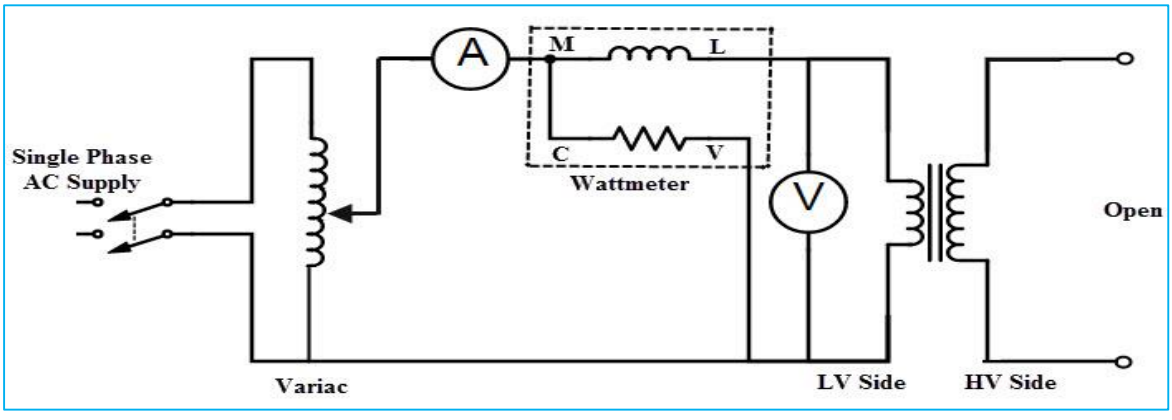
Equipment's required:

- Voltmeter
- Ammeter
- Wattmeter
- CT
- PT
- Power Analyser
- Cables
- 3 phase variac
- Auto Transformer

Theory:

- No load test or open circuit test of the transformer is performed to determine no-load loss (core loss) and no-load current *loss.*

Circuit Diagram:



Procedure:

- A wattmeter and ammeter are connected in series with LV winding to measure the open circuit power excitation current of the transformer.
- A voltmeter is connected in parallel with the voltage source to read the test voltage applied to it.
- The HV winding is kept open.
- Now with the help of variac, applied voltage gets slowly increased untill the voltmeter gives reading to the rated LV side voltage.
- In three phase supply, 433v is applied to the secondary side of the transformer to get a no load-loss within the specified limit of 200W.

Prescribed Value:

KVA	MAX VALUE
25 KVA	65
63 KVA	120
100 KVA	200

Observation:

VOLT(V)	AMP(I)	WATT(W)
Vr =251.6	Ar =1.481	Wr =34.85
Vy =253.1	Ay =1.240	Wy =72.41
Vb =246.8	Ab =1.512	Wb =220.7
V avg=250.5	A avg=1.411	W avg=109.30

Conclusion:

We therefore conclude that at no-load condition or open circuit test, the ammeter reading gives the no-load current which is very small, the voltage drop due to this current can be neglected.

3.1.5 Load Test:

Name of the Test: Load loss test of the transformer.

Equipment's required:

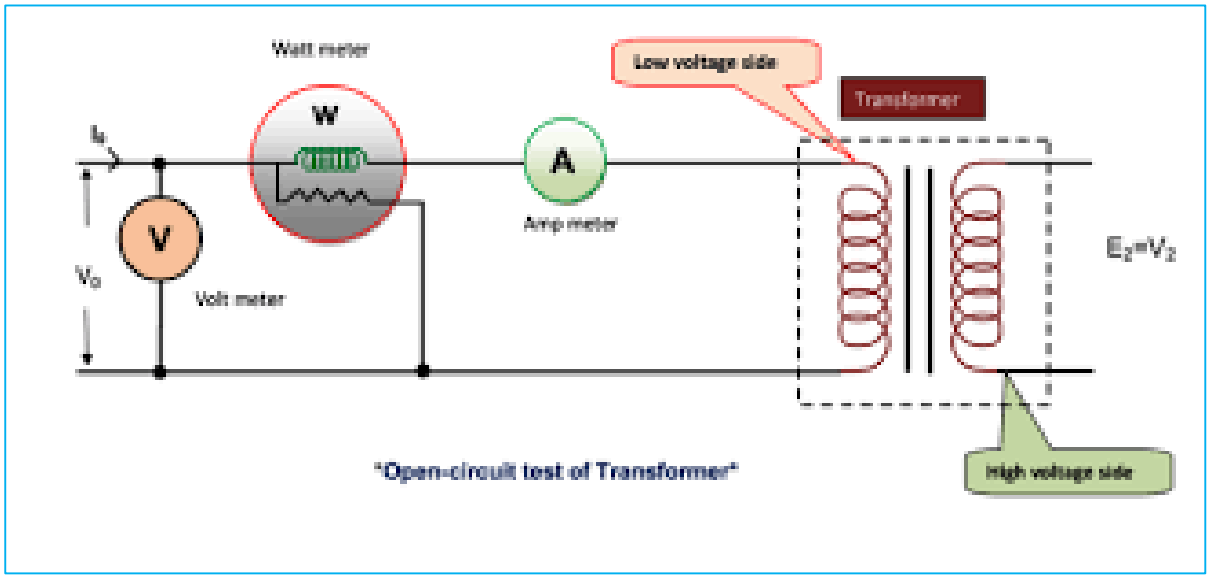
- Voltmeter
- Ammeter
- Wattmeter
- CT

- PT
- Power Analyser
- No load cables
- Three phase variac
- Autotransformer

Theory:

This test measures the power consumed by the transformer when the 433V winding is short-circuited and the rated current is passed through the 11KV winding.

Circuit Diagram:



Procedure:

- First short the LV side of the Transformer (connect to the resistive load)
- Then connect the cables in the HV side of the Transformer (applied voltage).
- Then apply the voltage through the variac till it reaches the required rated current.
- Then note down the value.
- In the three-phase supply, the rated current of 5.24 amp is applied to the primary side of the transformer for 1 min to get load loss within the specified limit i.e. 1650W.

Prescribed Value:

SL NO	KVA	50% LOAD	100% LOAD
1	16	82	224
2	25	190	635
3	63	340	1140
4	100	475	1650

Observation:

VOLT(V)	AMP(I)	WATT(W)
Vr =295.6	Ar =5.273	Wr =323.9
Vy =295.5	Ay =5.303	Wy =321.2
Vb =290.6	Ab =5.179	Wb =306.1
V =293.9	A =5.252	W =951.4

Conclusion:

We do the test to determine the series branch parameter of the equivalent circuit or transformers or to determine the winding loss of the transformers.

3.1.6 High Voltage Test:

Name of the Test: High voltage test of the transformer

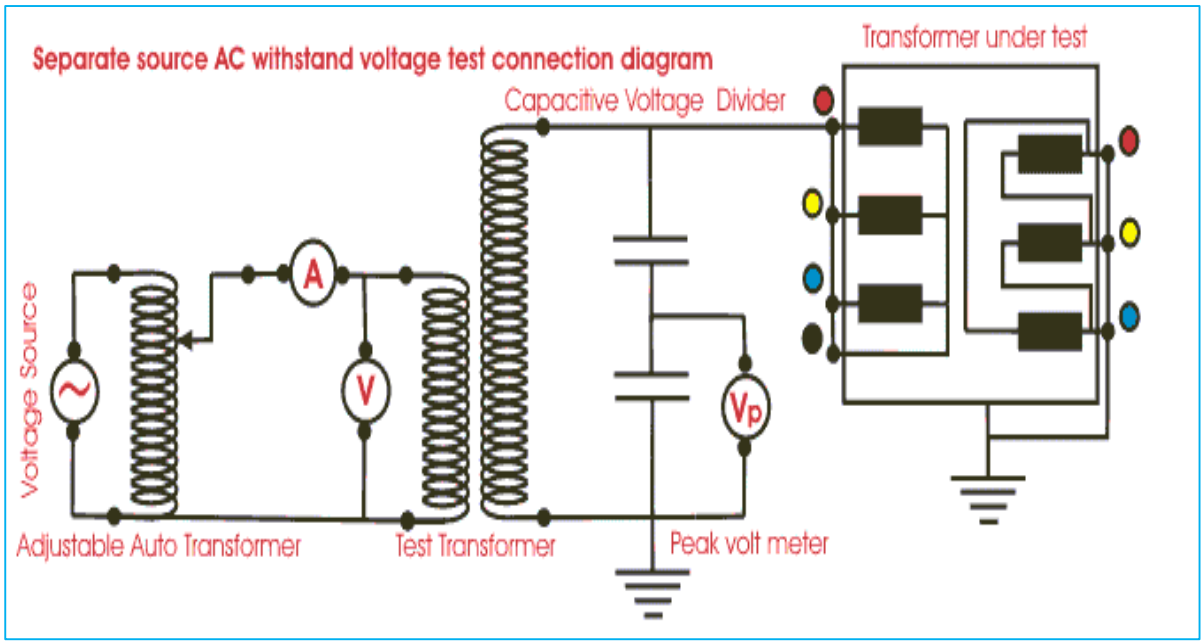
Equipment's required:

- Multimeter
- Transformer
- 3 phase variac
- Wires

Theory:

- The high voltage test is done in the transformer to check the withstanding voltage capacity and clearance of the winding and tank surface.
- It is usually done on the LT/LV side (star connected) of a transformer.

Circuit Diagram:



Procedure:

- High voltage is applied across a specimen of insulation or equipment under test by means of a high voltage transformer.
- A resistor is connected with series with the transformer to limit the short circuit current in the event of breakdown occurred in the device under test.
- In separate source over voltage test, for the three phase 11/0.433kv type transformer an amount of 28kv is applied through PT to the HT side of the transformer while the LT side is shorted and connected to the earth side of PT.

Observation:

Primary side	Applied voltage	Time	Result
HV	28 KV	1 Min	Withstood
LV	3 KV	1 Min	Withstood

Conclusion:

Finally, we observed that the transformer can withstand the high voltage (tested voltage).

3.1.7 Dvdf Test:

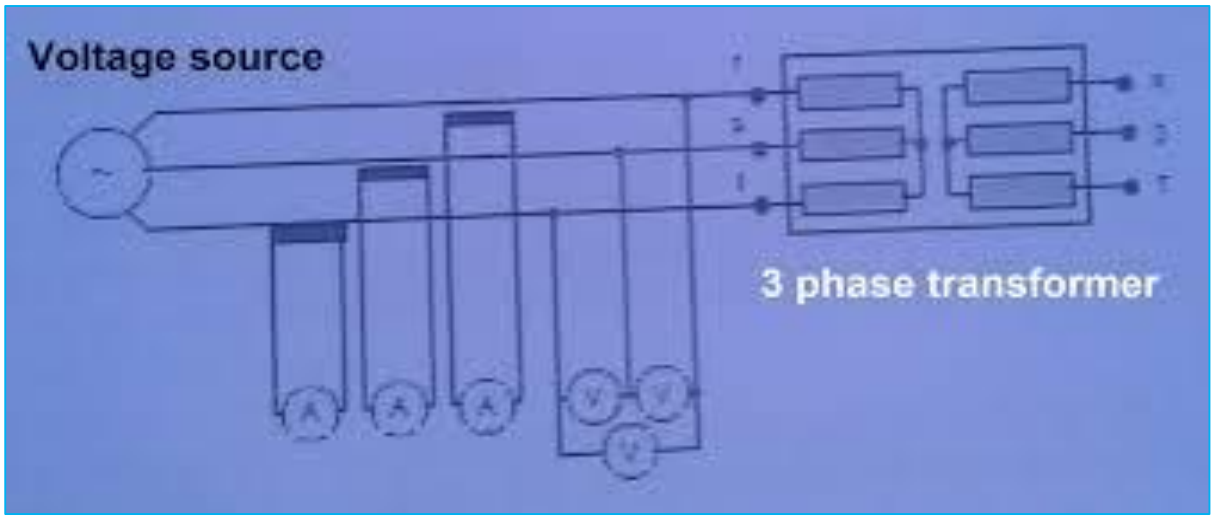
Name of the Test: DVDF Test of the transformer.

Equipment's required:

- Motor – Generator set
- DVDF panel

Theory: DVDF test is usually performed to check inter- turn insulations of the windings withstand capacity of the transformer.

Circuit Diagram:



Procedure:

- For an 11KV/433V transformer, 866 volts are applied at the 433V winding with the help of a generator for 1 minute.
- This induces 22KV on the 11KV side.
- HV winding is always kept open.
- The frequency of the 866V supply is also increased to 100HZ.

Observation:

IR – 0.4 Amp

IY – 0.3 Amp

IB – 0.3 Amp

Conclusion:

Here after completing the above DVDF for the induced overvoltage test, we got to know about the winding insulation and the voltage withstand capacity of the Transformer**.**

3.1.8 Magnetic Balance Test:

Name of the Test: Magnetic balance test of the transformer

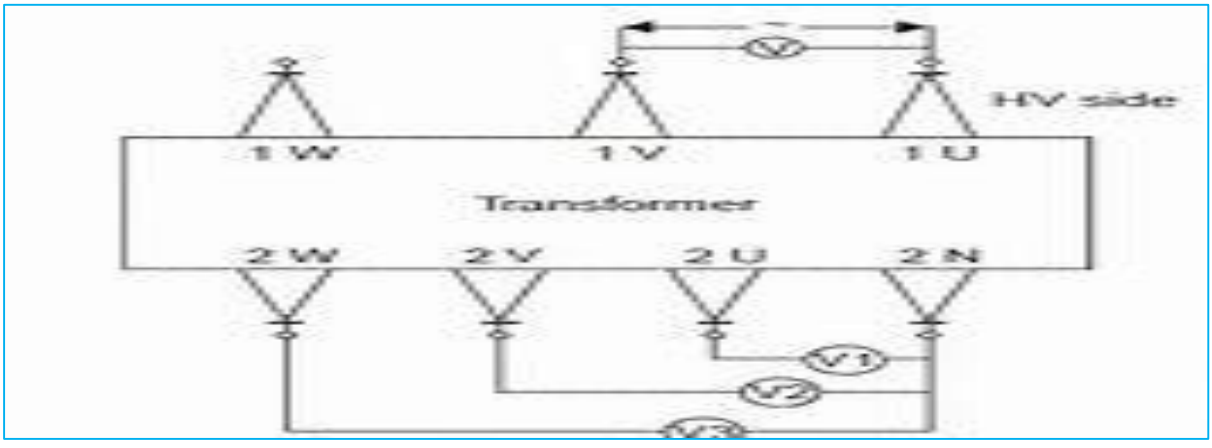
Equipment's required:

- Multimeter
- Transformer
- 3 phase variac
- Wires

Theory:

- The magnetic balance test is conducted on transformer to identify inter turn faults and magnetic imbalance.
- It is usually done on the LT/LV side (star connected) of a transformer.

Circuit Diagram:



Procedure:

- Connect the equipment's as per the circuit diagram.
- Give supply the transformer through control panel or variac.
- Here 2U, 2V, 2W & 2N are LV side point of the transformer.
- At first, we give supply in LV side in 2U & 2N then measure the value of 2V,2N &2W,2N, then alternate the supply in other side like 2V,2N &2W,2N and measure its two-opposite side.
- Because the sum of these two voltages should give the applied voltage i.e. 2UN=2VN+2WN.
- Then measure the value.

Observation:

SL NO	SUPPLY IN 2UN	SUPPLY IN 2VN	SUPPLY IN 2WN
1.	2UN=57V	2VN=60V	2WN=60V
2.	2VN=34V	2UN=26V	2UN=17V
3.	2WN=17V	2WN=26V	2VN=34V

Conclusion:

Finally, we observed that the transformer is magnetically balanced. If there is any inter-turn short circuit that may result in the sum of the two voltages not being equal to the applied voltage.

3.1.9 Vector Group Test:

Name of the Test: Vector group test of the transformer

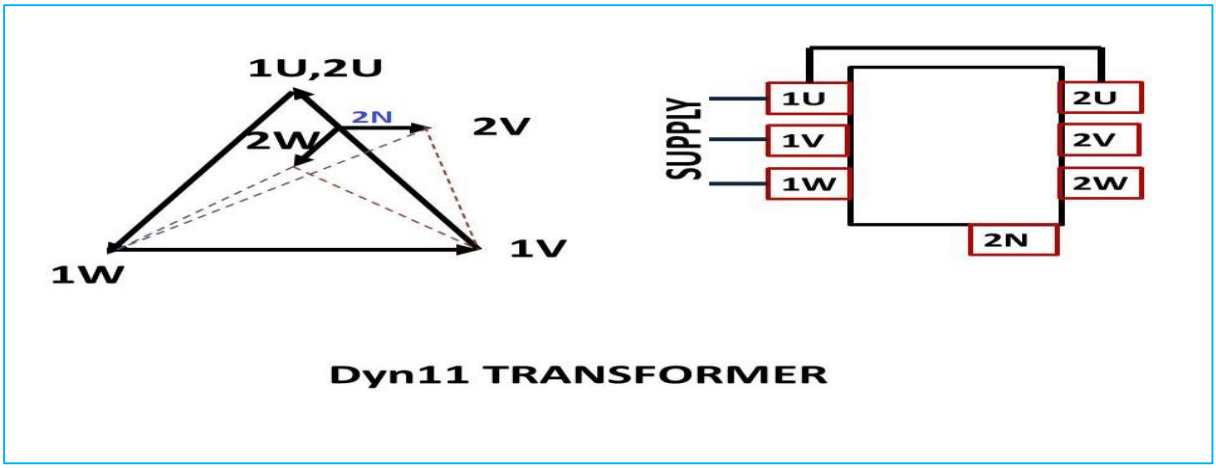
Equipment's required:

- Multimeter
- Transformer
- 3 phase variac
- Wires

Theory:

- The **vector group of the transformer** is an essential property for the successful parallel operation of transformers. Hence every electrical power transformer must undergo through **vector group test of the transformer** at factory site to ensure the customer specified vector group of the transformer.

Circuit Diagram:



Procedure:

- Connect the neutral point of the star-connected winding with the earth.
- Join 1U of HV and 2U of LV together.
- Apply 415 V, three-phase supply to HV terminals.
- Measure voltages between terminals 1V-2V, 1V-2W, 1W-2V, and 1W-2W which means voltages between each LV terminal and HV neutral.
- Also measure voltages between terminals 2V-1V, 2W-1W and 2V-1W.

Observation:

For dyn11 transformer, we will find,

1U2V=1V2W

1W2V>1W2W

1V2V	1V2W	1W2V	1W2W	1V2V=1V2W	1W2V>1W2W
137	137	141	136	137=137	141>136

Conclusion:

The vector group shows winding configuration and difference in phase angle between them.

3.1.10 Break down Voltage Test:

Name of the Test: BDV test of the transformer oil

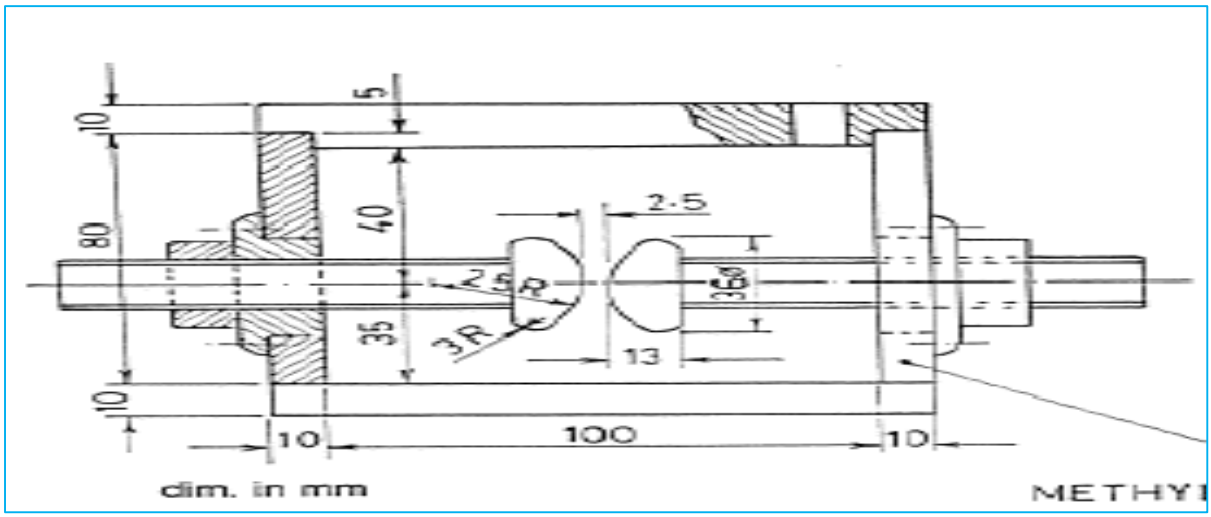
Equipment Required:

- BDV tester
- Transformer oil

Theory:

BDV test means breakdown voltage test. Dielectric strength means the maximum capacity to withstand voltage of insulating oil. This test shows the dielectric strength of transformer oil. In transformer oil has mainly two purposes, first for insulation and second as cooling.

Circuit Diagram:



Procedure:

- For the BDV test, an oil sample from a transformer was taken in a sample pot.
- The oil is kept in a pot in which one pair of electrodes is fixed with a gap of 2.5/4mm between them.
- Now slowly rising voltage is applied between the electrodes.
- Observe the voltage at which sparking starts between the electrodes, which means at which voltage dielectric strength of transformer oil between the electrodes has been broken down.

Observation:

- The test is repeated a minimum of three times and values are recorded. We got the BDV values 45kv, 50kv, and 50kv respectively BDV rating around 30Kv-40kV is considered good.

Conclusion:

BDV test is an important test for the transformer oil. It helps to detect the presence of moisture and slugs in oil. By observing the voltage value of the transformer, we can decide that, is the oil is useful for the transformer.

3.2 Testing and Quality Control:

- Perform routine tests such as turns ratio, insulation resistance, power factor, and load tests to ensure transformer performance meets specifications.
- Conduct dielectric tests, including impulse and partial discharge tests, to verify insulation integrity and withstand voltage capability.
- Inspect the transformer for visual defects, mechanical integrity, and adherence to design and testing standards.

3.3 Finishing and Packaging:

- Clean and paint the transformer tank to protect against corrosion and improve aesthetics.
- Label the transformer with essential information such as ratings, serial numbers, and safety warnings.
- Package the transformer securely for shipping, ensuring adequate protection against handling and transportation hazards.

3.4 Documentation and Certification:

- Prepare documentation including test reports, inspection records, and certification of compliance with industry standards and customer specifications.
- Provide user manuals, installation instructions, and maintenance guidelines to customers along with the transformer.

3.5 Shipping and Delivery:

- Arrange for transportation and delivery of transformers to customer sites or distribution centers.
- Monitor shipping and logistics to ensure timely delivery and minimize transit damage.
- By following these steps, transformer manufacturers can produce high-quality transformers that meet performance, reliability, and safety requirements for various applications.

3.6 Integration and Testing:

- Integrate the vapour phase unit with the transformer assembly, ensuring proper alignment and connection of components.
- Conduct functional tests and performance checks to verify the operation of the integrated system.
- Test the transformer under load conditions to assess its performance, efficiency, and reliability.

3.7 Quality Assurance and Documentation:

- Implement quality assurance measures throughout the Testing process, including inspections, audits, and compliance checks.
- Document assembly procedures, test results, and quality control measures for traceability and future reference.
- Ensure compliance with industry standards, regulations, and customer specifications.

3.8 Packaging and Shipping:

- Package the assembled transformer unit securely for transportation, taking into account factors such as size, weight, and fragility.

- Coordinate shipping logistics to ensure safe and timely delivery to customer sites or distribution centers.
- Provide documentation, including assembly instructions, operating manuals, and warranty information, with the shipped units.
- By assimilating vapor phase unit assembly, oil tank fabrication, and transformer assembly into a unified Testing process, manufacturers can streamline production, improve efficiency, and deliver high-quality transformer units that meet customer requirements and industry standards.

3.9 Inspect for available material and understand the requirement of core and coil assembly:

Inspecting for available material and understanding the requirements of core and coil assembly is crucial for effective production planning and ensuring that all necessary components are on hand for testing transformers. Here's how this process can be approached:

3.6.1 Material Inspection:

- Begin by conducting a thorough inspection of available materials in inventory, including raw materials, components, and sub-assemblies.
- Verify the quantity, quality, and condition of each material to ensure they meet the required specifications and standards for use in transformer Testing.
- Check material availability against the bill of materials (BOM) or inventory records to identify any shortages or discrepancies.
- Record the inspection findings, including material quantities, condition assessments, and any deviations from expected standards.

3.6.2 Understanding Core and Coil Assembly Requirements:

- Refer to the bill of materials (BOM) or Supervisory specifications to understand the requirements for core and coil assembly.
- Identify the specific materials needed for the core, including laminated steel sheets or cores made of other magnetic materials.
- Determine the dimensions, thickness, and other specifications for the core components based on the transformer design and performance requirements.
- Similarly, assess the requirements for coil assembly, including the type of wire, insulation materials, winding configurations, and number of turns for each winding.
- Consider any special requirements or customization needed for the core and coil assembly based on the transformer's intended application, voltage rating, and load capacity.

- Cross-reference the BOM with available materials to determine if all required components for core and coil assembly are present or if additional procurement is necessary.

3.6.3 Procurement Planning:

- Based on the inspection results and understanding of core and coil assembly requirements, develop a procurement plan to acquire any missing or insufficient materials.
- Prioritize procurement activities based on criticality, lead times, and availability of alternative sources.
- Coordinate with suppliers to place orders for required materials, ensuring timely delivery and adherence to quality standards.
- Monitor procurement progress closely and adjust the production schedule as needed to accommodate material availability and lead times.
- By systematically inspecting available materials and understanding core and coil assembly requirements, manufacturers can ensure that they have the necessary components on hand to proceed with transformer testing efficiently and effectively. This approach helps minimize production delays, optimize inventory management, and maintain product quality and reliability.

3.10 Outcome Questions:

- Recall the quantity required for each stage per transform design
- Discuss the reporting structure to report concern in case of any quality/quantity discrepancy
- List various aspects of core, i.e., size, material, grain orientation before cutting core shape per design
- Know core stacking as required with appropriate quantity
- List various aspects of coil, i.e., size, material, number of coils
- State the importance of keeping positive pressure and stake horizontal/vertical winding mandrels in winding room
- Know various aspects of conductor to be vet, i.e., conductor is copper magnetic wire or continuously transposed conductor, pre-wrapped with thermally upgraded paper or nomex
- Know the significance of coil windings and its process
- Discuss clamping process and use of LTC/DTC
- Know the relevance of drying of core and coil assembly using a vapour phase cycle method
- State required oven temperature and time for curing
- Discuss monitoring of power factor & water extraction
- List the tank requirements and study tank assembly drawing

- State the relevance of making grit-blasted cleaning the tank before priming and painting
- Elucidate final hydraulic clamping after vapour phase unit is re-packed
- State significance of LTC connections
- Know department documentation policy
- Know different assembly process used for transformer assembly

Classroom Aids:

Training kit (Trainee guide, Presentations), Whiteboard, Marker, Projector, Laptop, Presentation, Participant Handbook, etc.

Tools, Equipment and Other Requirements

Core, bolt guides, coil, winding mandrels, conductor, samples of thermally upgraded paper or nomex, high strength wire or epoxy bonded CTC, stress ring, epoxy resin, clamps, leads, busbars, etc.

4. Transformer testing requirement:

Key learning outcomes:

Trainee will learn about test requirements of Distribution Transformer

Module objectives:

- Know about transformer testing
- Testing Process
- Workflow

Resources to be used:

- For theory: Smart Board
- For practical: PPE Kit

Dos for the module in the training session:

- Follows Safety measures

List the activities (practical) for the execution of this module:

Sl. No.	Skill practice	Duration	Resources
1	Testing requirement of Transformer	30 Hrs	Hands-on in Workshop

4.1 Review Transformer testing requirement:

Reviewing transformer testing requirements is essential to ensure the quality, reliability, and safety of transformers before they are deployed in various applications.

4.1.1 Understanding Standards and Specifications:

Begin by understanding the relevant standards and specifications that govern transformer testing. These may include international standards such as IEC (International Electrotechnical Commission) standards, national standards, industry standards, and customer specifications.

4.1.2 Reviewing Test Methods:

Review the test methods specified in the standards and specifications to identify the types of tests required for transformer evaluation. These may include routine tests, type tests, special tests, and field tests.

4.1.3 Identifying Testing Parameters:

- Identify the key parameters to be tested during transformer testing, such as voltage ratio, winding resistance, insulation resistance, impedance, losses, temperature rise, and dielectric strength.
- Determine the test conditions, including test voltages, frequencies, durations, and tolerances specified in the standards or specifications.

4.1.4 Documentation Review:

- Review the documentation provided by the manufacturer, including test plans, test procedures, and test reports, to ensure compliance with testing requirements.
- Verify that the test setup, instrumentation, and measurement techniques meet the specified standards and are calibrated and traceable to national or international standards.

4.1.5 Performing Tests:

- Conduct transformer tests according to the specified procedures and test methods. This may involve testing transformers at different stages of production, including incoming inspection, in-process testing, and final acceptance testing.
- Use appropriate test equipment, instruments, and tools to perform the tests accurately and reliably.

4.1.6 Data Analysis and Interpretation:

- Analyze the test results to verify that the transformer meets the specified performance criteria and acceptance criteria.
- Interpret the test data to identify any deviations, anomalies, or failures that may indicate quality issues or non-compliance with standards.

4.1.7 Reporting and Documentation:

- Prepare test reports documenting the test procedures, test results, observations, and conclusions.
- Ensure that the test reports are accurate, complete, and compliant with relevant standards and specifications.
- Retain the test reports for record-keeping and traceability purposes.

4.1.8 Quality Assurance and Continuous Improvement:

- Implement quality assurance measures to ensure that transformer testing is conducted consistently and effectively.
- Continuously monitor and review testing processes, procedures, and results to identify opportunities for improvement and optimization.

4.2 Outcome Questions:

- Describe the fundamental purpose and operation of transformers in electrical systems.
- Know the methods and equipment used in conducting these tests.
- Know the methods and equipment used in conducting these tests.
- Demonstrate the ability to plan and execute transformer tests, considering factors like test objectives, test procedures, and equipment selection.
- Analyse test data to assess the condition of transformers and identify any abnormalities

or faults.

- Interpret test results to make informed decisions about the condition of a transformer, including whether it needs maintenance, repair, or replacement.
- List the process documentation, inspection and testing standards and procedures
- Know the importance of health, hygiene, safety and quality standards and the impact of non-compliance of standards on consumers, employees, and the business

Classroom Aids:

Computer, Projection Equipment, PowerPoint Presentation and software, Facilitator's Guide, Participant's Handbook.

Tools, Equipment and Other Requirements:

Bolt/lugs, testing equipment and tools, silica gel, sample records, etc.

5. Testing and quality check of assembled transformer, CUTM/ PWR/N6636, V.1.0:

Key learning outcomes:

Trainee will learn about Testing & Quality Checking in Distribution Transformer

Module objectives:

- Know about Quality
- Quality checking Process

Resources to be used:

- For theory: Smart Board
- For practical: PPE Kit

Dos for the module in the training session:

Follows Safety measures

List the activities (practical) for the execution of this module:

Sl. No.	Skill practice	Duration	Resources
1	Quality control technique	6Hrs	Hands-on in Workshop
2	Testing & Quality	6 Hrs	Hands-on in Workshop

5.1 Testing and quality check of assembled transformer:

Testing and quality checks of assembled transformers are critical to ensuring that they meet performance standards, safety regulations, and customer requirements. Here's an overview of the typical testing and quality check procedures:

5.1.1 Visual Inspection:

Conduct a visual inspection of the assembled transformer to check for any visible defects, damage, or irregularities in components, connections, and insulation.

5.1.2 Insulation Resistance Test:

Perform an insulation resistance test to measure the resistance between windings and between windings and ground. This test ensures that the insulation system is intact and capable of withstanding normal operating voltages.

5.1.3 Turns Ratio Test:

Conduct a turns ratio test to verify the accuracy of the transformer's voltage ratio. This test ensures that the transformer will provide the correct output voltage under load conditions.

5.1.4 Winding Resistance Test:

Measure the resistance of each winding to ensure that it falls within specified limits. Deviations in winding resistance can indicate Testing defects or damage to the winding insulation.

5.1.5 Induced Voltage Test:

Apply a high-voltage AC or impulse voltage to the windings to test their ability to withstand transient voltage spikes and surges.

5.1.6 Short-Circuit Test:

Perform a short-circuit test to evaluate the transformer's impedance and losses under short-circuit conditions. This test helps determine the transformer's impedance voltage, which affects its voltage regulation and fault current capability.

5.1.7 Load Loss and No-Load Loss Test:

Measure the transformer's load loss and no-load loss to determine its efficiency and energy consumption under different load conditions.

5.1.8 Dielectric Strength Test:

Apply a high-voltage AC or DC voltage to the transformer windings to test their dielectric strength and ability to withstand high voltages without breakdown.

5.1.9 Temperature Rise Test:

Monitor the temperature rise of the transformer windings and oil during operation to ensure that they do not exceed specified limits. Excessive temperature rise can indicate insulation degradation or inadequate cooling.

5.1.10 Insulating Oil Testing:

Perform tests on the insulating oil, including dielectric strength, acidity, and moisture content, to ensure that it meets specified quality standards and will provide adequate insulation and cooling properties.

5.1.11 Functional Tests:

Conduct functional tests to verify the transformer's operation under normal operating conditions, including energizing and de-energizing sequences, tap changer operation (if applicable), and protection relay testing.

5.1.12 Quality Documentation:

Prepare detailed test reports documenting the test procedures, test results, observations, and conclusions. Ensure that the test reports are accurate, complete, and compliant with relevant standards and specifications.

5.2 Outcome Questions:

- Know various testing methods to be followed as per design and application
- Know the process of show routine test, loss measurement and temperature rise test, dielectric test
- Discuss the relevance of checking damage, flash, and hair crack

- State ways to identify faults by visually inspecting general appearance, leakage of oil, and physical condition
- Discuss to check silica gel breather for the oil level in oil cap on specific parameters
- State the relevance of maintaining records of transformer basic information
- List the process documentation, inspection and testing standards and procedures
- Know the importance of health, hygiene, safety and quality standards and impact of non-compliance of standards on consumers, employees, and the business

Classroom Aids:

Computer, Projection Equipment, PowerPoint Presentation and software, Facilitator's Guide, Participant's Handbook

Tools, Equipment and Other Requirements:

Bolt/lugs, testing equipment and tools, silica gel, sample records, etc.

6. Ensure organizational health, safety, and security, CUTM/ PWR/N7805, V.1.0:

Key learning outcomes:

Trainee will learn about safety & safety procedure

Module objectives:

- Know about safety
- Risk Analysis
- HIRA

Resources to be used:

- For theory: Smart Board
- For practical: PPE Kit

Dos for the module in the training session:

Follows Safety measures

List the activities (practical) for the execution of this module:

Sl. No.	Skill practice	Duration	Resources
1	Fire fighting	6Hrs	Hands-on in Workshop
2	Electrical shock treatment	6Hrs	Hands-on in Workshop

6.1 Ensure organizational health, safety, and security:

Ensuring organizational health, safety, and security is essential for maintaining a safe and productive work environment, protecting employees and assets, and mitigating risks. Here are some key steps to achieve this:

6.1.1 Develop and Implement Policies and Procedures:

- Establish comprehensive health, safety, and security policies and procedures that address various aspects of workplace safety and security.
- Ensure that these policies and procedures comply with relevant regulations, industry standards, and best practices.

6.1.2 Risk Assessment and Management:

- Conduct regular risk assessments to identify potential hazards, threats, and vulnerabilities in the workplace.
- Develop risk management plans to mitigate identified risks and implement appropriate control measures to prevent accidents, injuries, and security breaches.

6.1.3 Employee Training and Awareness:

- Provide comprehensive training to employees on health, safety, and security protocols, procedures, and emergency response plans.

- Promote awareness among employees about potential hazards, safe work practices, and security protocols through regular training sessions, communication channels, and signage.

6.1.4 Safe Work Environment:

- Maintain a clean, organized, and clutter-free work environment to minimize tripping hazards, slip-and-fall accidents, and other workplace injuries.
- Ensure that equipment, machinery, and tools are properly maintained, inspected, and operated according to manufacturer specifications and safety guidelines.

6.1.5 Emergency Preparedness and Response:

- Develop and implement emergency preparedness and response plans to effectively respond to workplace accidents, medical emergencies, natural disasters, and security incidents.
- Conduct regular drills and simulations to test the effectiveness of emergency procedures and familiarize employees with evacuation routes, assembly points, and emergency contacts.

6.1.6 Security Measures:

- Implement physical security measures such as access controls, surveillance systems, and perimeter fencing to protect against unauthorized access, theft, vandalism, and other security threats.
- Monitor and control access to sensitive areas, equipment, and information through the use of keycards, biometric systems, and visitor management protocols.

6.1.7 Health and Wellness Programs:

- Promote employee health and wellness through initiatives such as health screenings, wellness workshops, ergonomic assessments, and fitness programs.
- Provide access to resources and support services for employees dealing with physical or mental health issues.

6.1.8 Continuous Improvement:

- Regularly review and evaluate health, safety, and security practices to identify areas for improvement and implement corrective actions.
- Encourage feedback from employees, stakeholders, and external auditors to identify gaps, address concerns, and enhance organizational health, safety, and security.
- By prioritizing health, safety, and security initiatives and fostering a culture of safety and vigilance, organizations can create a secure and supportive work environment that promotes employee well-being, productivity, and organizational resilience.

6.2 Outcome Questions:

- List the types of hazards, risks and threats associated at the workplace

- Discuss safety techniques for self and others
- List regulatory health and safety guidelines applicable to the Electric Vehicle workplace
- Discuss environment management system related procedures
- Elucidate procedure to store materials and tools in line with manufacturers and Cooperative Society/NGO/SHG requirements
- Discuss ways to handle and dispose waste and debris
- Know the significance of periodic check to keep work area free from hazards and obstructions
- Elucidate practices of conducting mock drills/ evacuation procedures, emergency training sessions

Classroom Aids:

Computer, Projection Equipment, PowerPoint Presentation and software, Facilitator's Guide, Participant's Handbook

Tools, Equipment and Other Requirements

Materials and tools and equipment used at work

7. Employability Skills, DGT/VSQ/N0101, V.1.0:

Key learning outcomes:

Trainee will learn about soft skill & analytical skill

Module objectives:

- Know about soft skill
- Analytical skill

Resources to be used:

- For theory: Smart Board
- For practical: Spoken English

Dos for the module in the training session:

Follows Safety measures

List the activities (practical) for the execution of this module:

Sl. No.	Skill practice	Duration	Resources
1	Soft skill	6Hrs	Hands-on in Workshop
2	Analytical skill	6 Hrs	Hands-on in Workshop

7.1 Employability Skills:

Employability skills, also known as soft skills or transferable skills, are essential attributes that enable individuals to succeed in the workplace and adapt to changing job requirements. These skills complement technical or hard skills and are valued by employers across various industries. Here are some key employability skills:

7.1.1 Communication Skills:

Effective communication skills involve the ability to articulate ideas clearly, listen actively, and convey information in a concise and coherent manner. This includes written communication, verbal communication, and non-verbal communication.

7.1.2 Teamwork and Collaboration:

Teamwork skills involve the ability to work effectively with others, contribute to group projects, and collaborate towards common goals. This includes being able to share ideas, resolve conflicts, and support team members.

7.1.3 Problem-Solving and Critical Thinking:

Problem-solving skills involve the ability to analyze complex situations, identify problems, and develop creative solutions. Critical thinking skills enable individuals to evaluate information, think logically, and make informed decisions.

7.1.4 Adaptability and Flexibility:

Adaptability skills involve the ability to adapt to new situations, environments, and challenges. This includes being open to change, willing to learn new skills, and adjusting quickly to unexpected circumstances.

7.1.5 Time Management and Organization:

Time management skills involve the ability to prioritize tasks, manage deadlines, and allocate resources efficiently. Organization skills enable individuals to maintain order, structure, and clarity in their work processes.

7.1.6 Leadership and Initiative:

Leadership skills involve the ability to inspire and motivate others, delegate tasks, and take initiative to drive projects forward. This includes demonstrating confidence, decisiveness, and integrity in leadership roles.

7.1.7 Interpersonal Skills:

Interpersonal skills involve the ability to build and maintain positive relationships with colleagues, clients, and stakeholders. This includes empathy, diplomacy, and cultural sensitivity in interactions with others.

7.1.8 Resilience and Stress Management:

Resilience skills involve the ability to bounce back from setbacks, cope with adversity, and maintain a positive attitude in challenging situations. Stress management skills enable individuals to manage stress effectively and maintain overall well-being.

7.1.9 Digital Literacy:

Digital literacy skills involve the ability to use digital tools, software, and technology effectively in the workplace. This includes proficiency in basic computer skills, internet research, and utilizing productivity software.

7.1.10 Professionalism and Work Ethic:

Professionalism involves demonstrating integrity, accountability, and ethical behavior in all aspects of work. Work ethic involves being reliable, punctual, and committed to delivering high-quality work. Developing and honing these employability skills can significantly enhance an individual's career prospects and contribute to their success in the workplace. Employers often value these skills as much as, if not more than, technical expertise when evaluating job candidates and promoting employee growth and development.

7.2 Outcome Questions:

- Discuss the importance of Employability Skills in meeting the job requirements
- Know constitutional values, civic rights, duties, citizenship, responsibility towards society etc. that are required to be followed to become a responsible citizen

- Show how to practice different environmentally sustainable practices
- Discuss 21st century skills.
- Display positive attitude, self -motivation, problem solving, time management skills and continuous learning mind-set in different situations
- Use appropriate basic English sentences/phrases while speaking
- Discuss the significance of reporting sexual harassment issues in time
- Discuss the significance of using financial products and services safely and securely
- Know the importance of managing expenses, income, and savings
- Know the significance of approaching the concerned authorities in time for any exploitation as per legal rights and laws
- Discuss the significance of using internet for browsing, accessing social media platforms, safely and securely
- Discuss the need for identifying opportunities for potential business, sources for arranging money and potential legal and financial challenges
- Differentiate between types of customers
- Know the significance of identifying customer needs and addressing them
- Discuss the significance of maintaining hygiene and dressing appropriately
- Use various sources to search and apply for jobs
- Discuss the significance of dressing up neatly and maintaining hygiene for an interview
- Discuss how to search and register for apprenticeship opportunities

Classroom Aids:

Computer, Projection Equipment, PowerPoint Presentation and software, Facilitator's Guide, Participant's Handbook

Tools, Equipment and Other Requirements

Computer (PC) with latest configurations – and Internet connection with standard operating system and standard word processor and worksheet software (Licensed) (all software should either be latest version or one/two version below), UPS, Scanner cum Printer, Computer Tables, Computer Chairs, LCD Projector, White Board 1200mm x 900mm

Note/ Feedback:

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Ramchandrapur
P.O. – Jatni, Bhubaneswar
Dist.- Khurda, Odisha,
India, PIN– 752050

Balangir Campus
Behind BSNL Office
IDCO land, Rajib Nagar
Dist.- Balangir, Odisha
India, PIN-767001

Rayagada Campus
IDCO Industrial Area
Pitamahal, Rayagada
Dist.-Rayagada, Odisha
India, PIN-765001

Balasore Campus
Gopalpur,
P.O.-Balasore
Dist.-Balasore, Odisha
India, PIN-756044

Chatrapur Campus
Ramchandrapur,
Kaliabali Chhak,
P.O-Chatrapur, Dist.-Ganjam
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