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GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
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Telecom Sector Skill Council

Facilitator Guide

Sector
Telecom

Sub-Sector
Passive Infrastructure

Occupation
Customer Service/ Passive Infrastructure

Reference ID: TEL/Q4303, Version 1.0
NSQF level 4

Telecom Electrician (Advanced)

This book is sponsored by

Telecom Sector Skill Council of India

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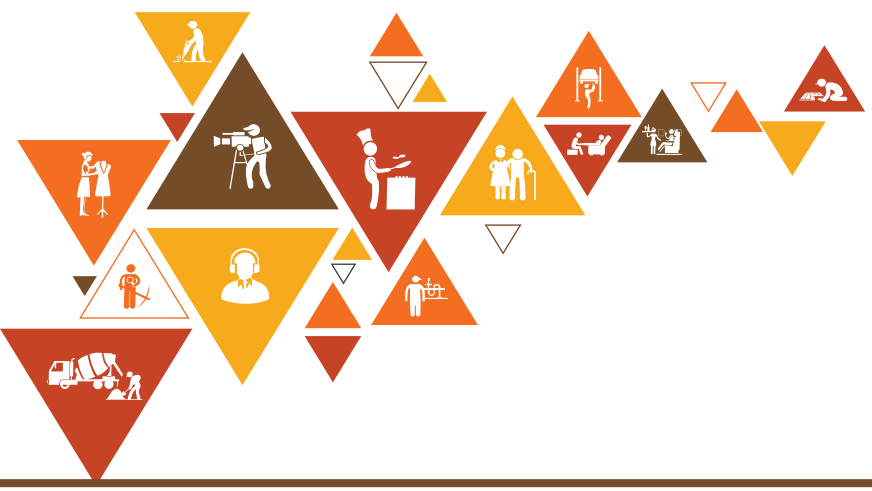


> Skill development of the new generation is a national need and is the foundation of Aatmnirbhar Bharat

Shri Narendra Modi
Prime Minister of India

Acknowledgements

The Telecom Sector Skill Council (TSSC) would like to thank all the individuals and institutions who contributed in various ways towards the preparation of this facilitator guide. The guide could not have been completed without their active contribution. Special gratitude is extended to those who collaborated during the development of the different modules in the facilitator guide. Wholehearted appreciation is also extended to all who provided peer review for these modules.

The preparation of this guide would not have been possible without the telecom industry's support. Industry feedback has been extremely beneficial since inception to conclusion, and it is with the industry's guidance that we have tried to bridge the existing skill gaps in the industry. This facilitator guide is dedicated to the aspiring youth, who desire to achieve special skills that will be a lifelong asset for their future endeavours.

About this Guide

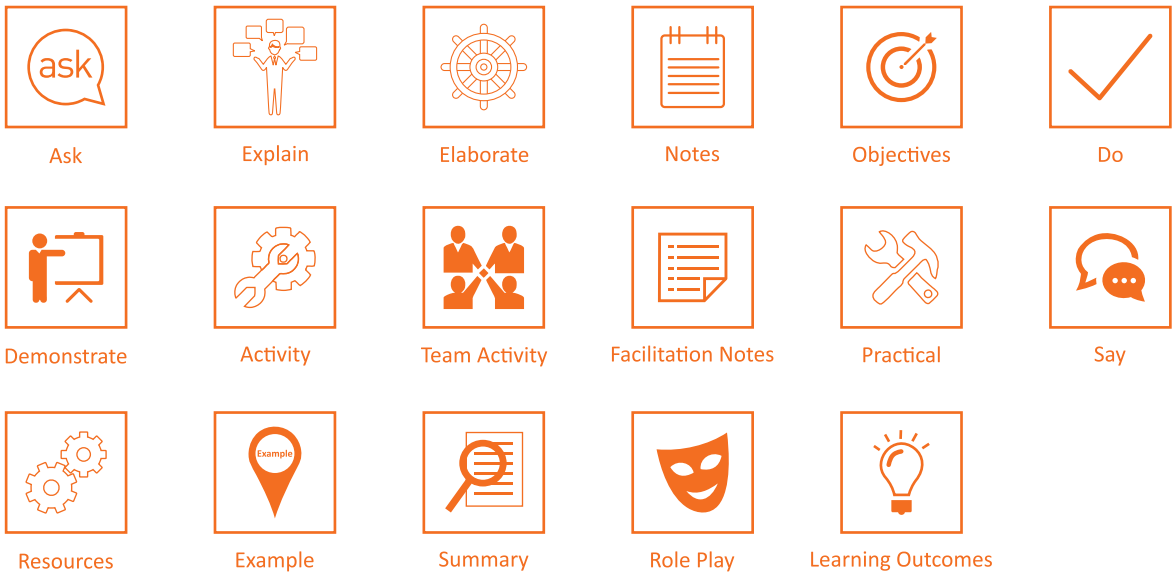
The facilitator guide (FG) for Telecom Electrician (Advanced) is primarily designed to facilitate skill development and training of people, who want to become professional Telecom Electrician (Advanced) in various stores. The facilitator guide is aligned to the Qualification Pack (QP) and the National Occupational Standards (NOS) as drafted by the Sector Skill Council (TSSC) and ratified by National Skill Development Corporation (NSDC).

It includes the following National Occupational Standards (NOSs)-

1. TEL/N4301: Install and Maintain Inverter and Battery Banks NOS
2. TEL/N4302: Design and Install One-Phase and Three-Phase Electrical Systems at cell site
3. TEL/N4303: Install, Maintain, and Troubleshoot Electrical Components
4. TEL/N4304: Upgrade electrical systems to meet capacity and power quality requirements NOS
5. TEL/N4305: Develop and implement telecom electrical standards
6. TEL/N9101: Organise Work and Resources as per Health and Safety Standards

Post this training, the participants will be able to perform tasks as professional Telecom Electrician (Advanced). We hope that this Facilitator Guide provides a sound learning support to our young friends to build a lucrative career in the Telecom Skill Sector of our country.

Symbols Used



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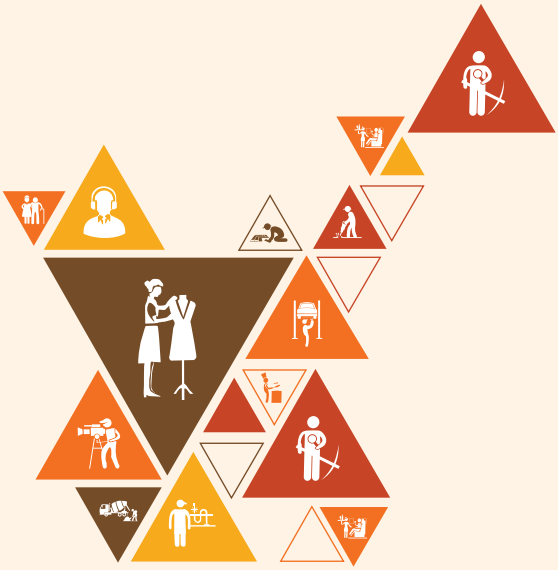
Telecom Sector Skill Council

1. Introduction to the role of a Telecom Electrician (Advanced)

Unit 1.1 - Industry Overview and Organisational Context

Unit 1.2 - Role and Responsibilities of a Telecom Electrician (Advanced)



Bridge Module

Key Learning Outcomes

By the end of this module, the participants will be able to:

1. Discuss the job role of a Telecom Electrician (Advanced).
2. Explain the scope of work for a Telecom Electrician (Advanced).

Unit 1.1: Industry Overview and Organisational Context

Unit Objectives

By the end of this unit, the participants will be able to:

1. Describe the size and scope of the Telecom industry and its sub-sectors.
2. Discuss the contribution of the Telecom Sector Skill Council to India's skill ecosystem.
3. Discuss the organisational policies on workplace ethics, managing sites, quality standards, personnel management, and public relations (PR).

Resources to be Used

Projector, Whiteboard, Markers, Handouts (telecom industry, organizational policies), Flipchart, Industry reports Videos (TSSC contributions)

Say

- Good [morning/afternoon]! I'm excited to discuss a topic today that shapes the way businesses and people interact in one of the most dynamic sectors – the telecom industry.
- In this session, we will explore the size and scope of the Telecom industry, understand the role of the Telecom Sector Skill Council, and delve into the policies that guide organizational operations within this sector.
- It's important for you to grasp these concepts, as they will not only broaden your understanding of how the telecom sector operates but also prepare you to function effectively within the industry's framework.

Ask

- Have you ever wondered how much of your daily routine depends on telecom services?
- What do you think the role of skill development is in a growing industry like telecom?
- How do you think workplace ethics and quality standards play a part in managing telecom projects or operations?

Do

- Start the session by introducing the three key topics and setting expectations for the day's learning.
- Present an overview of the Telecom industry, highlighting its sub-sectors such as mobile communication, broadband, and satellite services.
- Discuss the contribution of the Telecom Sector Skill Council to the skill development ecosystem in India.

- Explain organizational policies on workplace ethics, managing sites, and quality standards, ensuring to tie in their relevance to real-world operations.
- Encourage interaction and ask the participants to share their thoughts on the role of these topics in their daily work life.
- Allow time for participants to ask questions or share personal experiences related to the telecom industry.

Elaborate

- Describe the size and scope of the Telecom industry and its sub-sectors: Explain the vast scale of the telecom industry, including mobile communication, broadband internet, and satellite services. Highlight its role in connecting people and businesses.
- Discuss the contribution of the Telecom Sector Skill Council to India's skill ecosystem: Outline how TSSC works to bridge the skill gap by offering certifications, training, and resources for workforce development in the telecom sector.
- Discuss organizational policies on workplace ethics, managing sites, quality standards, personnel management, and public relations (PR): Emphasize the importance of ethics in telecom operations, site management practices, maintaining quality standards, personnel management approaches, and PR strategies that shape public perception of telecom organizations.

Demonstrate

Conduct a brief demonstration on how to navigate a typical telecom organization's policy document. Show participants how policies related to ethics, site management, and PR are structured and highlight key sections that they need to focus on in their role.

Activity

1. **Activity Name:** Telecom Industry Exploration
2. **Objective:** To help participants better understand the different sub-sectors of the telecom industry and the role of skill development in those sectors.
3. **Type of activity:** Group activity
4. **Resources:** Projector, whiteboard, handouts on telecom industry sub-sectors, markers.
5. **Time Duration:** 25 minutes
6. **Instructions:**
   - Divide participants into small groups (3-5 people per group).
   - Assign each group one telecom sub-sector (e.g., mobile communication, broadband, satellite services).
   - Ask each group to brainstorm and list the roles, services, and challenges associated with their assigned sub-sector.

- After 10 minutes, have each group present their findings to the class, ensuring they relate it back to the skill development efforts by the Telecom Sector Skill Council.
- Conclude by connecting each sub-sector's challenges and roles with how skill development can improve operations and workforce capability.

7. **Outcome:** Participants will have a clearer understanding of the telecom industry's size, scope, and the importance of skill development across its sub-sectors.

Notes for Facilitation

- Encourage participation by asking open-ended questions and giving ample time for responses.
- Use real-life examples wherever possible to make abstract concepts more relatable to the participants.
- When discussing the Telecom industry's sub-sectors, ensure you explain how they interconnect and contribute to the overall functioning of the sector.
- While talking about the Telecom Sector Skill Council, mention key programs and certifications that align with the roles participants might pursue.
- For organizational policies, provide clarity on how ethics, site management, and quality standards directly impact everyday tasks in telecom roles, ensuring participants understand how these policies shape their work environment.

Unit 1.2: Role and Responsibilities of a Telecom Electrician (Advanced)

Unit Objectives

By the end of this unit, the participants will be able to:

1. Discuss the role and responsibilities of a Telecom Electrician (Advanced).
2. Describe the process workflow in the organization and the role of a Telecom Electrician (Advanced).
3. Identify various employment opportunities for a Telecom Electrician (Advanced).
4. List the various daily, weekly, monthly operations/activities that take place at the site under a Telecom Electrician (Advanced).

Resources to be Used

Flipcharts, Whiteboard, Markers, Projector, Printed Handouts on Telecom Electrician Role, Workflow Diagrams, Sample Job Listings for Telecom Electrician (Advanced), Daily, Weekly, Monthly Operational Checklists for Telecom Electricians, Video Demonstration on Telecom Installation Processes, Templates for Daily/Weekly Activity Logs.

Say

- "Good morning, everyone! I'm excited to dive into today's session on the role and responsibilities of a Telecom Electrician (Advanced)."
- "By the end of this session, you'll have a clearer understanding of the Telecom Electrician's role in the industry, the workflow you'll follow, and various opportunities that exist within this field."
- "Understanding your role and how it fits into the bigger picture will help you not only excel in your daily tasks but also explore growth opportunities in this field."

Ask

- "How many of you are familiar with the daily tasks of a telecom electrician at a worksite?"
- "Can you think of any specific challenges you might face while working with telecom equipment?"
- "What types of companies or industries do you think would hire a Telecom Electrician (Advanced)?"

Do

- Begin by explaining the structure and importance of the Telecom Electrician's role in the telecom industry.
- Show a workflow diagram that illustrates the steps in a typical telecom installation project.

- Describe the key daily, weekly, and monthly activities for a Telecom Electrician (Advanced), referencing real-life examples.
- Provide information on the different types of employment opportunities available in this field.
- Discuss how the Telecom Electrician (Advanced) fits into the broader operations of the organization.
- Guide the trainees through an activity where they outline daily tasks at a telecom site.

Elaborate

- The core responsibilities, such as maintaining and installing telecom systems, troubleshooting issues, and ensuring safety and compliance with regulations.
- The steps from project initiation to completion, emphasizing the Telecom Electrician's role in each stage.
- The variety of roles available, from telecom companies to construction firms and utilities, and the potential career growth in the industry.
- The activities that occur regularly on-site, including equipment checks, installations, maintenance, and upgrades.

Demonstrate

Demonstrate a basic installation procedure of telecom cables, highlighting the steps that a Telecom Electrician (Advanced) would typically follow, including safety protocols and tools used.

Activity

1. **Activity Name:** "Day in the Life of a Telecom Electrician"
2. **Objective:** To help trainees understand the daily, weekly, and monthly tasks of a Telecom Electrician (Advanced).
3. **Type of activity:** Group
4. **Resources:** Whiteboard, Markers, Printed Handouts on Daily/Weekly/Monthly Activities, Workflow Diagrams
5. **Time Duration:** 30 minutes
6. **Instructions:**
   - Divide the trainees into small groups.
   - Provide each group with a set of daily, weekly, and monthly activities (printed handouts) and a workflow diagram.
   - Ask each group to categorize these activities into the correct timeframes (daily, weekly, monthly).
   - Once completed, ask each group to present their categorization to the rest of the class and explain their reasoning.
   - Discuss as a class, identifying any missed tasks or common challenges.
7. **Outcome:** Trainees will gain a clearer understanding of the various activities and timelines that a Telecom Electrician (Advanced) follows, and how these contribute to the overall success of telecom operations.

Notes for Facilitation

- Always engage trainees by asking questions and inviting their thoughts on each topic, ensuring that everyone is participating.
- Use real-life examples wherever possible to keep the session relatable and engaging.
- When discussing daily, weekly, and monthly tasks, ensure that trainees understand the importance of following safety procedures and maintaining equipment logs.
- Highlight how the role of a Telecom Electrician (Advanced) can differ depending on the company or project type (e.g., telecom vs. utilities).
- Encourage trainees to think about how workflow might be affected by external factors like equipment delays or emergency repairs.
- Maintain an interactive and approachable atmosphere to encourage learning.
- Keep the session focused on the practical applications of the role to ensure relevance to real-world work.

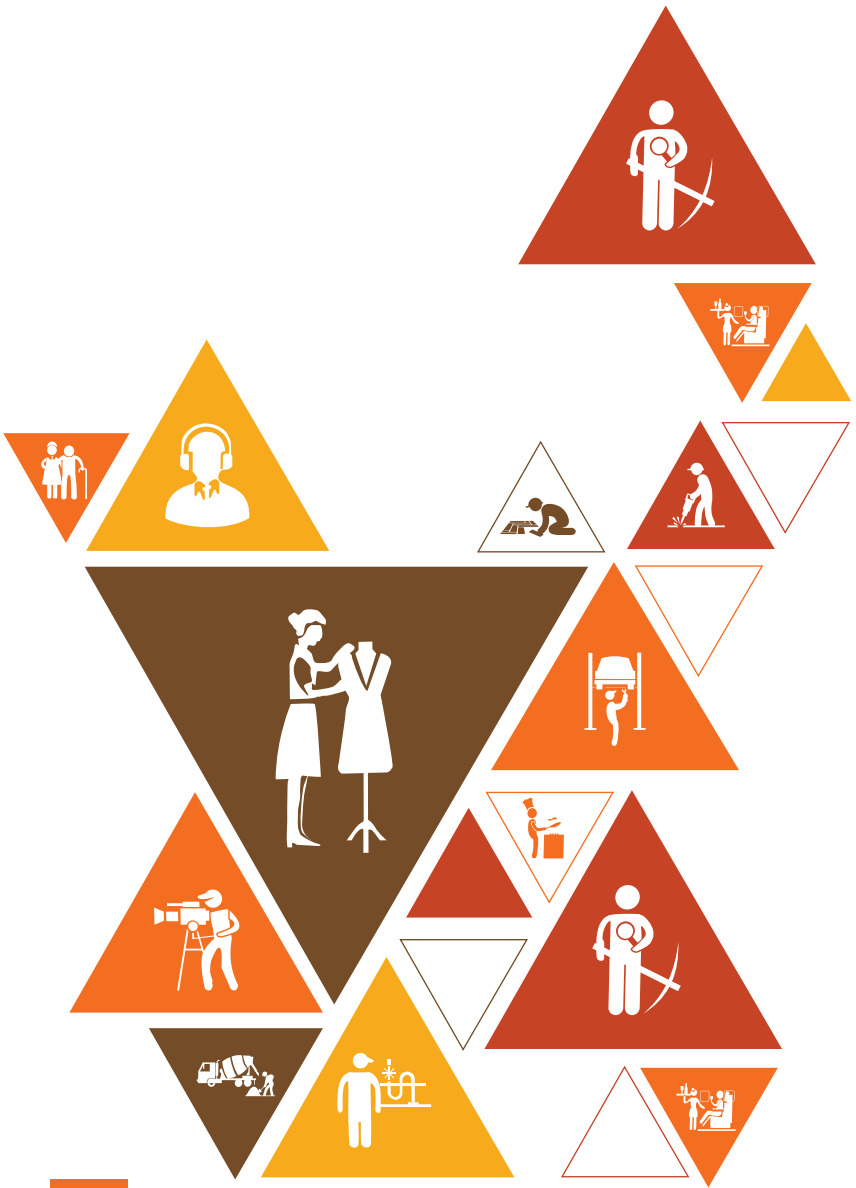
Answers to Exercises for PHB

Multiple Choice Questions:

1. b. 5.5%
2. b. National Optical Fiber Network (NOFN)
3. b. Design and maintain electrical systems for telecom sites
4. c. Testing backup power systems
5. c. Data centers

Descriptive Questions:

1. Refer: UNIT 1.1: Industry Overview and Organisational Context
   Topic: 1.1.1 Size and scope of the Telecom Industry and its Sub-Sectors
2. Refer: UNIT 1.1: Industry Overview and Organisational Context
   Topic: 1.1.2 Contribution of Telecom Sector Skill Council in India's Skill Ecosystem
3. Refer: UNIT 1.2: Role and Responsibilities of a Telecom Electrician (Advanced)
   Topic: 1.2.1 Role and Responsibilities of a Telecom Electrician (Advanced)
4. Refer: UNIT 1.2: Role and Responsibilities of a Telecom Electrician (Advanced)
   Topic: 1.2.2 Streamlining Workflow and Responsibilities of a Telecom Electrician (Advanced)
5. Refer: UNIT 1.2: Role and Responsibilities of a Telecom Electrician (Advanced)
   Topic: 1.2.2 Streamlining Workflow and Responsibilities of a Telecom Electrician (Advanced)



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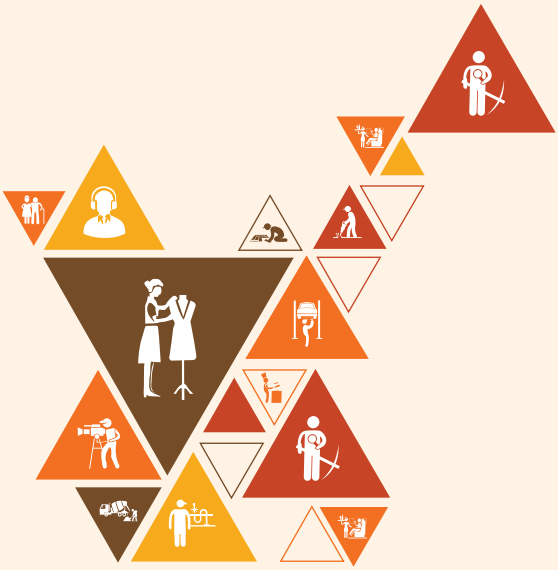
2. Inverter and Battery Bank Installation and Maintenance Practices

Unit 2.1 - Inverter Selection and Installation Process

Unit 2.2 - Battery Management and Maintenance



TEL/N4301

Key Learning Outcomes 

By the end of this module, the participants will be able to:

1. Explain the importance of choosing an inverter with an appropriate capacity for specific needs.
2. Describe the importance of adequate space around the inverter for proper airflow.
3. Demonstrate the ability to choose an inverter with the appropriate capacity for a given scenario.
4. Inspect the battery bank, inverter, and all connections for wear, damage, or corrosion.

Unit 2.1: Inverter Selection and Installation Process

Unit Objectives

By the end of this unit, the participants will be able to:

1. Illustrate the working principle of an inverter.
2. Explain the importance of choosing an inverter with an appropriate capacity for specific needs.
3. Describe the significance of selecting compatible batteries for an inverter's output capacity.
4. Identify a suitable location for inverter installation based on environmental factors.
5. Calculate and allocate adequate space around the inverter for proper airflow.
6. Show how to ground the inverter according to local electrical codes.
7. Connect the inverter to the battery bank using provided cables while ensuring correct polarity.
8. Demonstrate safe practices to avoid short circuits, overloads, and mishandling.

Resources to be Used

Inverters of various capacities, battery banks, cables for connection, multimeters, grounding rods, proper installation tools, printed handouts on inverter installation and safety guidelines, flipcharts, a projector, and safety equipment (gloves, goggles, etc.).

Say

- "Good morning, everyone! I hope you're all doing well and ready to dive into the world of inverters."
- "Today, we are going to explore how inverters work, why selecting the right inverter and batteries is crucial, and how to safely install and ground them for optimal performance."
- "Understanding how to correctly choose, install, and maintain inverters is vital for anyone working in electrical systems or renewable energy. It ensures safety, efficiency, and longevity of the system."

Ask

- "How many of you have seen an inverter installed at home or in your workplace?"
- "What do you think might happen if an inverter is not grounded properly?"
- "Have you ever encountered a situation where the inverter didn't work as expected? What do you think caused that?"

Do

- Begin the session by introducing the importance of inverters in electrical and renewable energy systems.
- Highlight the key topics of the chapter: working principle of inverters, selection of appropriate inverter capacity, battery compatibility, and installation.

- Emphasize the importance of safety throughout the installation process.
- Walk the participants through the theory before moving to the demonstration.
- Break down the steps involved in inverter installation, grounding, and wiring while ensuring proper safety measures are taken.
- Allow time for a demonstration on how to connect the inverter to the battery bank.
- Explain how to calculate and allocate space around the inverter for proper airflow.
- Introduce and explain electrical codes related to grounding and wiring.
- Conclude the session with a summary and Q&A.

Elaborate

- How an inverter converts DC power into AC power, which is crucial for household appliances.
- How an inverter should match the electrical load to ensure efficient operation and prevent overloading.
- How battery capacity and type need to align with the inverter's output to ensure optimal performance.
- Environmental factors like temperature, ventilation, and proximity to the electrical panel when choosing a location.
- How adequate space ensures that the inverter does not overheat and operates efficiently.
- The correct grounding technique to prevent electrical hazards.
- The importance of following polarity and secure connections to avoid damage.
- The importance of safety by discussing common errors and how to avoid them.

Demonstrate

Demonstrate the correct way to connect an inverter to a battery bank, ensuring that the cables are securely attached and the polarity is correctly followed. Show how to check the voltage with a multimeter before finalizing the connection.

Activity

1. **Activity Name:** Inverter Installation Practice
2. **Objective:** To practice the installation and wiring of an inverter with proper grounding and safety measures.
3. **Type of activity:** Group
4. **Resources:** Inverter, battery bank, cables, grounding rod, multimeter, safety equipment, handouts on installation guidelines.
5. **Time Duration:** 30 minutes
6. **Instructions:**
    - Divide the participants into small groups (3-4 members per group).
    - Provide each group with an inverter, battery bank, cables, grounding rods, and a multimeter.

- Instruct them to choose an appropriate location for the inverter and calculate the space required for airflow.
- Guide them through the process of grounding the inverter and connecting it to the battery bank with proper polarity.
- Ensure each group tests the inverter's output with a multimeter to check if the system is working correctly.
- Once completed, ask the groups to present their installation and share the reasoning behind their location and space calculations.

7. **Outcome:** Participants will learn hands-on how to install and wire an inverter correctly, ensuring safety and efficiency.

Notes for Facilitation

- Keep the session interactive by asking participants questions and encouraging them to share their experiences.
- Monitor group activities closely to ensure that participants are following safety protocols and using the correct wiring techniques.
- Emphasize the importance of selecting the right inverter capacity to avoid overloading or underperformance.
- Ensure that each participant understands the grounding process and the implications of incorrect grounding.
- Highlight the significance of airflow and space allocation to avoid overheating, which can damage the inverter.

Unit 2.2: Battery Management and Maintenance

Unit Objectives

By the end of this unit, the participants will be able to:

1. Show how to connect batteries in series or parallel as per inverter voltage requirements.
2. Interpret different warning lights and alarms on an inverter.
3. Demonstrate the steps to set up and configure a battery monitoring system to track voltage, temperature, and other relevant parameters.
4. Describe how to monitor battery voltage and state of charge (SoC).
5. Show how to connect electrical loads to the inverter's output terminals and verify that the inverter is providing the desired output voltage and frequency.
6. Perform inspection of the battery bank, inverter, and all connections for wear, damage, or corrosion.
7. Show how to clean battery terminals and apply anti-corrosion grease.
8. Develop a plan for battery replacement based on the manufacturer's recommended service.

Resources to be Used

Inverter, battery bank, electrical load, battery monitoring system, voltage and current meters, anti-corrosion grease, cleaning materials (e.g., cloth, brush), warning light chart for inverters, inverter setup manual, manufacturer's service manual for battery replacement, temperature and voltage monitoring devices, inverter connection tools, safety equipment, and demonstration board.

Say

- "Good morning, everyone! I'm really excited to have you here today!"
- "In today's session, we're going to explore how to properly select and install an inverter, including understanding the setup, monitoring systems, and regular maintenance."
- "This knowledge is essential for ensuring that your inverter systems are safely installed and efficiently maintained, ultimately preventing issues like overheating, battery failure, or incorrect voltage, which can disrupt the whole electrical setup."

Ask

- "Have you ever seen an inverter used in your house or at a workplace? How do you think it works?"
- "Have you ever been alerted by a warning light or alarm on an electrical device? What do you think they mean?"
- "When you hear about battery maintenance, what comes to your mind? Do you think batteries need regular checkups?"

Do

- Introduce the topics one by one with examples and practical demonstrations.
- Connect theory to practice by using actual inverters, batteries, and tools.
- Ensure that each participant has hands-on experience setting up batteries, connecting electrical loads, and testing the output.
- Explain and demonstrate the process of interpreting warning lights and alarms.
- Walk the trainees through how to inspect and clean the inverter and battery connections.
- Guide the participants through setting up the monitoring system to track key parameters like voltage and temperature.

Elaborate

- How to arrange batteries to meet the inverter voltage requirements.
- The meaning behind different warning signals on the inverter, such as overvoltage or battery issues.
- The system to track battery parameters, ensuring optimal performance.
- The battery's state of charge and voltage levels for proper functionality.
- About connecting loads to the inverter and ensure correct output voltage and frequency.
- The importance of regular checks for damage, wear, or corrosion on the inverter, battery bank, and their connections.
- How to clean terminals and apply protective grease to prolong battery life.
- How to set a schedule for battery replacement as per the manufacturer's guidelines.

Demonstrate

- Show how to connect batteries in series and parallel, adjusting connections to meet the voltage requirements of the inverter.
- Demonstrate how to use a multimeter to monitor battery voltage and the state of charge (SoC).
- Show the process of checking the inverter output to ensure correct voltage and frequency is supplied to the load.

Activity

1. **Activity Name:** Battery and Inverter Setup
2. **Objective:** To learn how to connect batteries and configure the inverter system.
3. **Type of Activity:** Group activity
4. **Resources:** Inverter, battery bank, multimeter, connection tools, warning light chart, manufacturer's service manual.
5. **Time Duration:** 30 minutes
6. **Instructions:**
    - Divide the trainees into small groups.
    - Each group will set up a battery bank (either in series or parallel) based on given voltage requirements.

- Connect the battery bank to the inverter and perform the basic checks: output voltage and frequency.
- Monitor and interpret warning lights on the inverter.
- Perform the necessary maintenance checks such as inspecting and cleaning the connections.
- Ensure the inverter is providing the correct output voltage by using a multimeter to measure it.

7. **Outcome:** Trainees will gain hands-on experience in setting up and monitoring the inverter and battery system.

Notes for Facilitation

- Maintain a safe learning environment, ensuring all electrical equipment is handled with care.
- Provide opportunities for trainees to ask questions and engage in discussions throughout the session.
- Emphasize the importance of correctly interpreting warning lights and alarms to prevent potential system failures.
- Stress the significance of regular maintenance of battery terminals to avoid issues like corrosion and electrical failures.
- Make sure trainees understand the need to follow the manufacturer's guidelines for battery replacement to optimize system longevity.

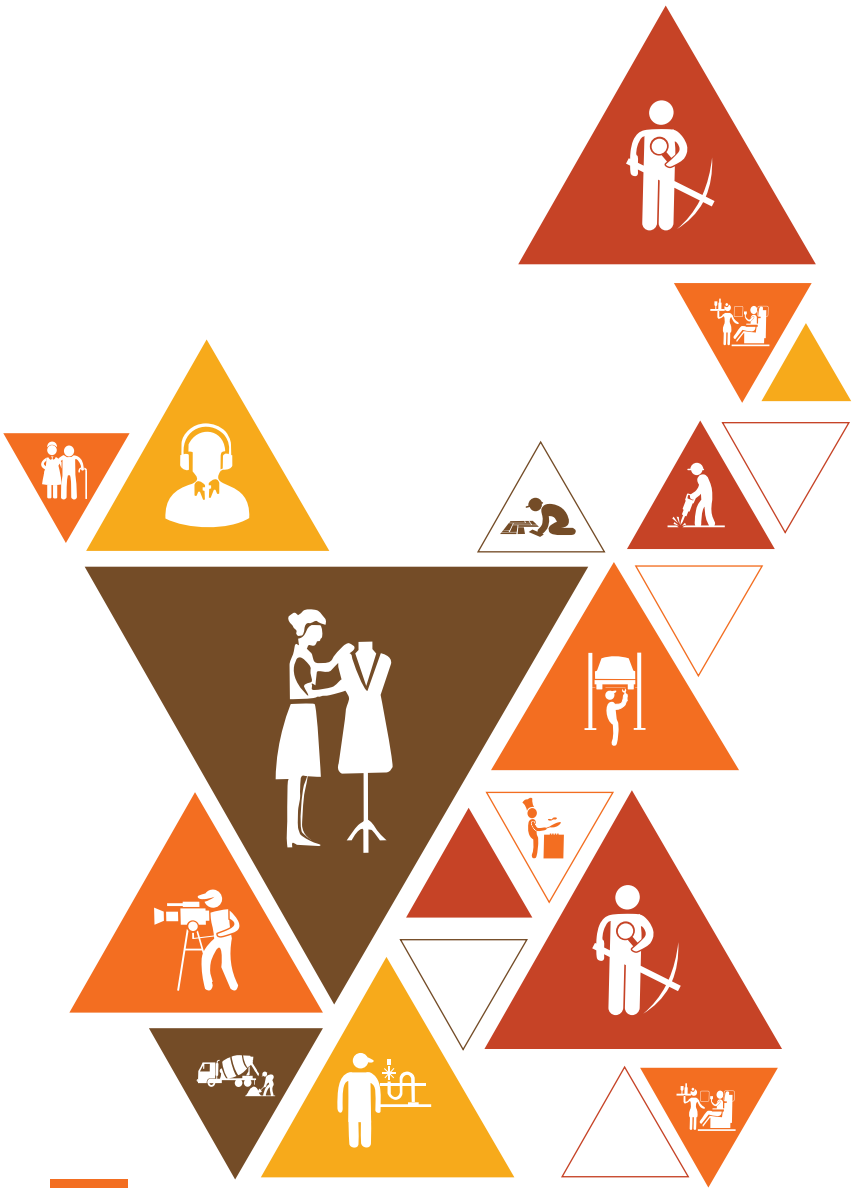
Answers to Exercises for PHB

Multiple Choice Questions:

1. c. Pure sine wave inverter
2. b. To protect equipment from electrical faults
3. b. Voltage increases, and capacity stays the same
4. b. Increases capacity
5. b. To prevent oxidation and corrosion

Descriptive Questions:

1. Refer: UNIT 2.1: Inverter Selection and Installation Process
   Topic: 2.1.1 Inverters and Their Applications in the Telecom Sector
2. Refer: UNIT 2.1: Inverter Selection and Installation Process
   Topic: 2.1.2 Working Principle of an Inverter
3. Refer: UNIT 2.1: Inverter Selection and Installation Process
   Topic: 2.1.7 Connecting the Inverter to the Battery Bank with Correct Polarity
4. Refer: UNIT 2.1: Inverter Selection and Installation Process
   Topic: 2.1.7 Connecting the Inverter to the Battery Bank with Correct Polarity
5. Refer: UNIT 2.2: Battery Management and Maintenance
   Topic: 2.2.4 Setting Up and Configuring a Battery Monitoring System



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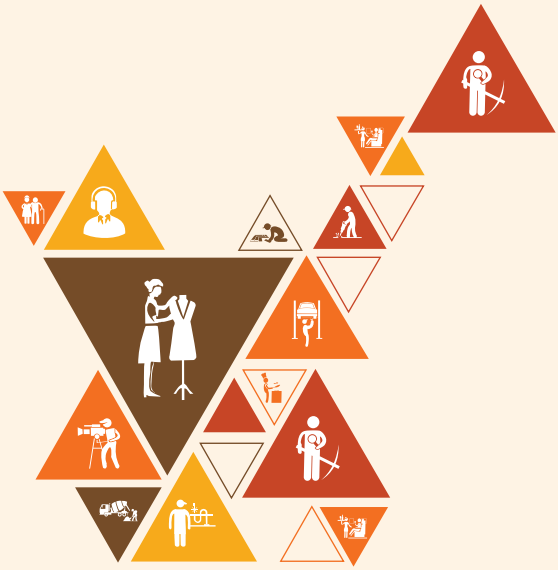
3. Electrical System Design and Installation for Telecom Cell Sites

Unit 3.1 - Electrical System Planning and Design

Unit 3.2 - Electrical System Installation and Safety



TEL/N4302

Key Learning Outcomes 

By the end of this module, the participants will be able to:

1. Describe the process of managing NOC infrastructure and incidents.
2. Demonstrate the process of tracking and analysing NOC incidents

Unit 3.1: Electrical System Planning and Design

Unit Objectives

By the end of this unit, the participants will be able to:

1. Identify the available power source and voltage levels in different telecom cell site locations.
2. Analyze equipment specifications and environmental conditions to ensure compliance with safety standards and suitability for outdoor use.
3. Calculate the total electrical load requirements for a cell site and select the appropriate voltage level for a one-phase system.
4. Design and create a grounding and bonding system that meets safety and code requirements for a given cell site.
5. Create a single-line diagram outlining the electrical system's components, adhering to industry and regional standards.
6. Choose and size circuit breakers, fuses, and protective devices to ensure safe and reliable power distribution based on equipment requirements.

Resources to be Used

whiteboard, markers, flip charts, sample electrical system diagrams, grounding system tools, voltage measuring devices, equipment specification sheets, and electrical load calculation tools.

Say

- Hello everyone, and welcome to today's session on Electrical System Planning and Design! It's great to have you here, and I'm excited to dive into this topic with you.
- In this session, we'll focus on understanding how to design and plan the electrical systems for telecom cell sites, which is crucial for ensuring safe and reliable operations.
- Understanding these concepts is vital for anyone involved in the design, installation, and maintenance of electrical systems because it ensures safety, compliance with regulations, and optimal performance of the equipment.

Ask

- Have you ever experienced an electrical issue at your workplace or home that affected the operation of equipment or devices?
- Do you think about how electricity is supplied to a telecom tower or a cell site in your daily life?
- What would happen if the power source for a telecom site failed unexpectedly?

Do

- Start by explaining the importance of electrical system planning in telecom cell sites, specifically regarding safety and operational efficiency.
- Guide participants to explore the different power sources and voltage levels available at telecom cell sites.
- Introduce the key components of a telecom site's electrical system and discuss each element in detail, such as grounding systems, electrical load calculations, and protective devices.
- Lead a discussion on industry standards and regional code requirements related to electrical systems for outdoor use.
- Use visual aids (like diagrams or sample cell site layouts) to demonstrate how these components are integrated into a complete system.
- Highlight the importance of selecting the correct voltage levels and protective devices to ensure equipment safety and prevent damage.

Elaborate

- The power sources at telecom cell site locations and how to determine appropriate voltage levels based on equipment needs and environmental conditions.
- The equipment specifications to ensure compliance with safety standards and suitability for outdoor conditions.
- The total electrical load required by the equipment and choose the correct voltage level for a one-phase system.
- A safe and code-compliant grounding and bonding system for the cell site to prevent electrical hazards.
- A single-line diagram that outlines the electrical system's components, ensuring it meets industry and regional standards.
- Appropriate circuit breakers, fuses, and other protective devices to ensure safe power distribution and protect equipment from overcurrent.

Demonstrate

Demonstrate how to create a basic single-line diagram for a telecom cell site electrical system. Start with the main power source and proceed to incorporate equipment, grounding, protective devices, and voltage levels.

Activity

1. **Activity Name:** "Designing a Telecom Cell Site Electrical System"
2. **Objective:** To help participants understand the process of designing an electrical system for a telecom cell site, including power source selection, load calculation, and grounding system design.
3. **Type of activity:** Group activity
4. **Resources:** Whiteboard, markers, sample equipment specifications, electrical load calculation sheets, grounding design templates

5. **Time Duration:** 25 minutes
6. **Instructions:**
   - Divide participants into small groups (3-4 people per group).
   - Assign each group the task of designing the electrical system for a telecom cell site, starting with selecting an appropriate power source and voltage level.
   - Ask each group to calculate the electrical load requirements and choose the suitable voltage level for a one-phase system.
   - Have them design a basic grounding system and select protective devices such as circuit breakers and fuses.
   - Finally, each group should draw a single-line diagram of their system on the whiteboard.
7. **Outcome:** Participants will gain hands-on experience in planning and designing the electrical system for a telecom cell site, including practical applications of the concepts learned.

Notes for Facilitation

- Facilitators should encourage active participation by asking open-ended questions and guiding groups as they work through the activity.
- Ensure that all groups follow the regional and industry-specific standards when designing their systems.
- While discussing grounding systems, emphasize the importance of safety to prevent electrical hazards in outdoor environments.
- When reviewing the single-line diagrams, check if all necessary components are included, such as the power source, grounding system, protective devices, and the correct voltage levels.
- During the activity, explain any challenges that might arise in real-life scenarios, like varying power sources and environmental factors.

Unit 3.2: Electrical System Installation and Safety

Unit Objectives

By the end of this unit, the participants will be able to:

1. Develop a comprehensive understanding of surge protection and backup power systems to ensure uninterrupted service.
2. Install transformers, switchgear, distribution panels, and other electrical components following manufacturer guidelines and local codes.
3. Conduct continuity checks, insulation resistance tests, and functional tests on the electrical system using appropriate testing equipment.
4. Identify and correct voltage imbalances to ensure even power distribution and prevent fluctuations in a three-phase system.
5. Connect cell site equipment, including base stations, antennas, and power distribution units (PDUs), to the electrical system, ensuring proper grounding and secure connections.
6. Assess the importance of proper labelling, signage, and equipment enclosure in maintaining safety at the cell site.

Resources to be Used

Electrical components such as transformers, switchgear, distribution panels, voltage testing equipment, and backup power systems.

Say

- "Hello everyone! I'm excited to have you here today to dive into the essentials of electrical system installation and safety."
- "Our objective for today is to give you a comprehensive understanding of how to ensure the safety, continuity, and efficiency of electrical systems in critical environments like cell sites."
- "This knowledge is vital for keeping operations running smoothly and safely, ensuring that we prevent disruptions and avoid electrical hazards that can lead to costly repairs or even dangerous accidents."

Ask

- "Have you ever experienced a power outage, and what impact did it have on your daily activities?"
- "Can anyone share how important grounding is when you connect electrical systems or equipment?"
- "What safety precautions do you think are crucial when handling electrical systems at a workplace?"

Do

- Begin the session with a brief overview of the importance of electrical system installation and safety, emphasizing surge protection and backup power systems.
- Introduce the main topics, focusing on how each piece of equipment should be installed and tested.
- Walk the participants through different electrical tests, ensuring they understand the purpose and method of conducting continuity checks, insulation resistance tests, and voltage imbalances.
- Demonstrate the correct way to connect cell site equipment and discuss the importance of proper grounding.
- Discuss safety measures, including labeling, signage, and equipment enclosure, while showing how these can be implemented.
- Encourage questions and discussions throughout the session to keep participants engaged.

Elaborate

- how surge protectors and backup power systems ensure an uninterrupted power supply and protect against electrical surges.
- manufacturer guidelines and local electrical codes to properly install transformers, switchgear, and distribution panels.
- continuity checks, insulation resistance tests, and functional tests on electrical systems using the correct equipment.
- How voltage imbalances in a three-phase system to ensure balanced power distribution and prevent fluctuations.
- About connect equipment like base stations, antennas, and PDUs, ensuring proper grounding and secure connections.
- the importance of proper labelling, signage, and enclosures to maintain safety at the cell site.

Demonstrate

Demonstrate how to conduct a continuity test using a multimeter. Show the participants how to check for any breaks or faults in the circuit.

Activity

1. **Activity Name:** "Test the Connections"
2. **Objective:** To practice installing electrical components, conducting tests, and ensuring proper connections and grounding.
3. **Type of Activity:** Group activity
4. **Resources:** Transformers, switchgear, PDUs, grounding kits, testing tools (multimeter, insulation resistance tester), safety gear.
5. **Time Duration:** 30 minutes

6. **Instructions:**
   - Divide participants into small groups.
   - Assign each group the task of installing a transformer, PDUs, or switchgear as per the guidelines.
   - Once the installation is complete, each group will conduct a series of tests: continuity check, insulation resistance test, and voltage imbalance check.
   - After the tests, they should ensure that the equipment is properly grounded and secured.
   - The group will then label the equipment and ensure that all safety signage and enclosures are correctly installed.
7. **Outcome:** Participants will gain hands-on experience in electrical system installation, testing, grounding, and ensuring safety protocols are followed.

Notes for Facilitation

- Keep the atmosphere interactive and encourage participants to ask questions whenever they feel unsure about a concept.
- Provide clear, step-by-step instructions and ensure that participants are practicing in a safe environment.
- Stress the importance of following manufacturer guidelines and local codes for installation to avoid potential risks or violations.
- Emphasize the significance of conducting electrical system tests correctly to ensure safety and reliability of the system.
- Highlight the critical role of grounding and proper labelling/signage in preventing electrical hazards and ensuring ongoing safety at the site.

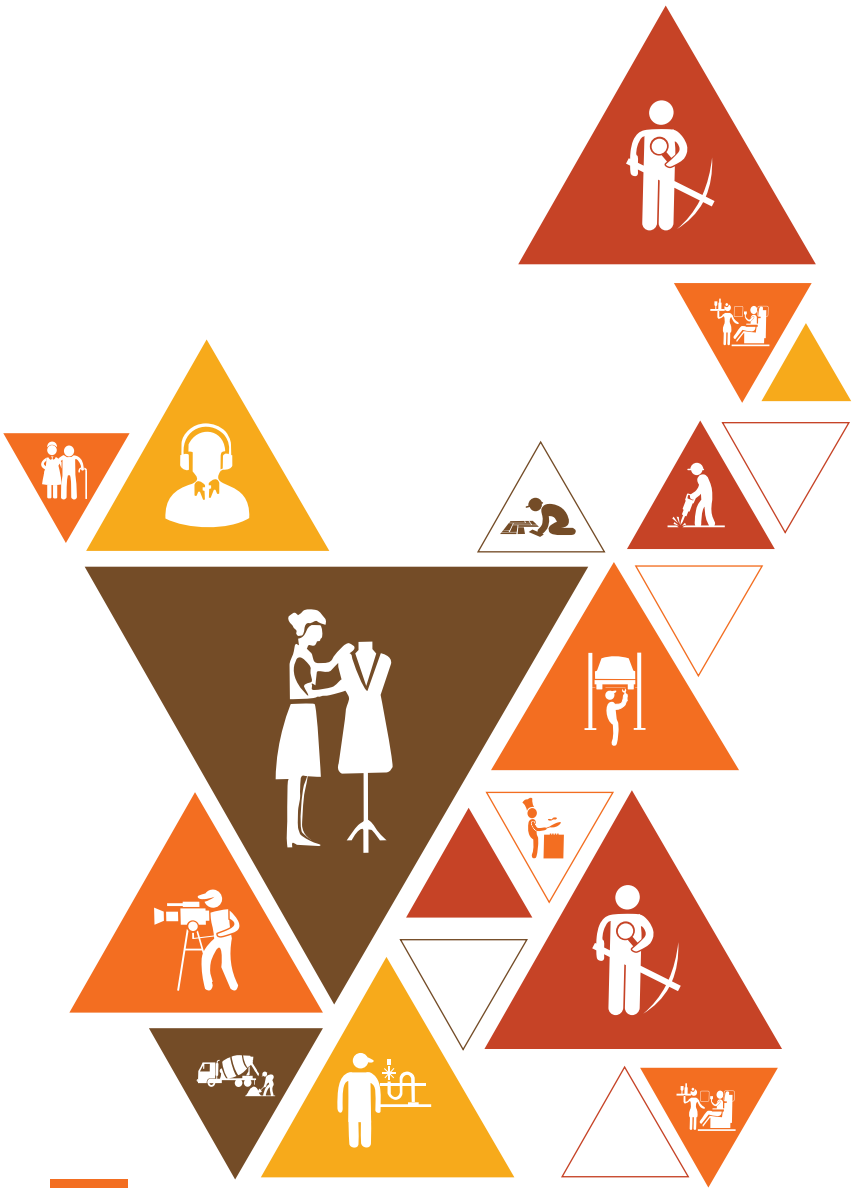
Answers to Exercises for PHB

Multiple Choice Questions:

1. b. Grid power
2. a. Generator voltage
3. a. To divert excess voltage away from equipment
4. a. Matching the UPS capacity to the equipment load
5. b. Uneven distribution of loads

Descriptive Questions:

1. Refer: UNIT 3.1: Electrical System Planning and Design
   Topic: 3.1.1 Identifying Available Power Sources and Voltage Levels at Telecom Cell Site
2. Refer: UNIT 3.1: Electrical System Planning and Design
   Topic: 3.1.2 Analyzing Equipment Specifications and Environmental Conditions
3. Refer: UNIT 3.1: Electrical System Planning and Design
   Topic: 3.1.3 Calculating Total Electrical Load Requirements and Selecting the Appropriate Voltage Level for a One-Phase System
4. Refer: UNIT 3.2: Electrical System Installation and Safety
   Topic: 3.2.2 Install Electrical Components Following Guidelines and Local Codes
5. Refer: UNIT 3.2: Electrical System Installation and Safety Topic: 3.2.5 Connecting Cell Site Equipment with Secure and Grounded Electrical Systems



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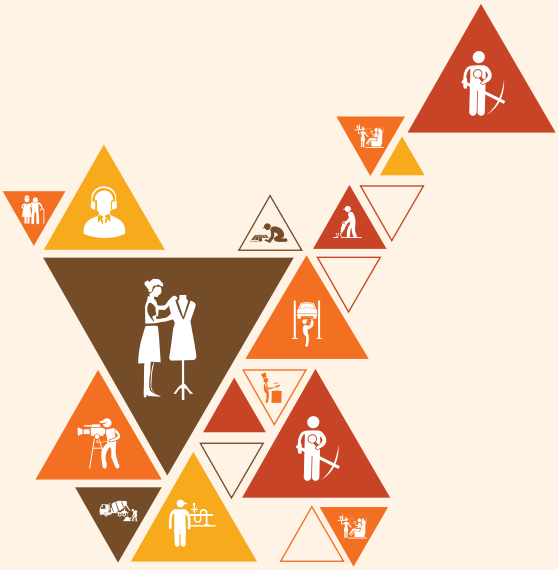
4. Electrical Components Installation, Maintenance, and Troubleshooting

Unit 4.1 - Site Preparation and Equipment Installation

Unit 4.2 - Maintenance and Troubleshooting



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Key Learning Outcomes 

By the end of this module, the participants will be able to:

1. Define and list the essential tools and equipment required for telecom equipment installation and maintenance.
2. Describe the process of conducting site surveys for generator placement.
3. Participate in a lockout/tagout exercise to safely disconnect power sources.
4. Inspect and analyze electrical components for signs of wear, damage, or corrosion.
5. Develop a reliable fuel supply system, including fuel tanks, pipes, and safety mechanisms.

Unit 4.1: Site Preparation and Equipment Installation

Unit Objectives

By the end of this unit, the participants will be able to:

1. Define and list the essential tools and equipment required for telecom equipment installation and maintenance.
2. Analyze power requirements and select an appropriate generator based on specified conditions.
3. Conduct a thorough site survey to determine generator placement and site-specific requirements.
4. Securely mount a generator to prevent vibrations and reduce noise in a controlled environment.
5. Demonstrate the process of installing power distribution equipment, backup power systems, and grounding systems in a controlled setting.
6. Show how to install surge protectors and lightning arrestors on electrical systems.
7. Practice mounting and connecting antennas and radio equipment following industry standards.
8. Connect power supplies, HVAC systems, and data cabling as per telecom requirements.
9. Set up a network operations center with proper electrical wiring and infrastructure.

Resources to be Used

Telecom installation tools, power generators (various sizes), site survey equipment, surge protectors, lightning arrestors, antennas, radio equipment, mounting brackets, data cables, power distribution equipment, backup power systems, grounding materials, HVAC systems, and network operations center setups.

Say

- "Good morning/afternoon everyone! I'm excited to dive into this session with you."
- "Today, we will learn about the essential tools, equipment, and procedures involved in telecom equipment installation, including power systems, antennas, and network setups."
- "Understanding these key elements ensures that you can effectively install and maintain telecom systems, making sure everything operates smoothly and safely in real-world environments."

Ask

- "Have you ever seen a telecom tower or antenna being installed? What do you think goes into setting it up?"
- "When you think about powering large equipment, what kind of power sources come to your mind?"
- "Do you know why it's important to secure equipment like generators or antennas? What happens if they're not properly mounted or grounded?"

Do

- Start the session by introducing the objective and importance of site preparation for telecom installations.
- Show the participants the different tools and equipment used in telecom site preparation and installation.
- Walk them through the steps of conducting a site survey to assess generator placement and power requirements.
- Demonstrate the installation of power distribution systems, backup power, grounding systems, and how to mount a generator.
- Guide the participants through the mounting and connecting of antennas, radio equipment, and the proper setup of electrical wiring for telecom.
- Engage the group by asking them to consider safety measures and why secure mounting and grounding are important.

Elaborate

- Key tools like wrenches, voltmeters, cable splicing kits, and power tools used in telecom installation and maintenance.
- How to calculate power needs and determine the right generator size for the site.
- Site-specific factors (e.g., terrain, space, power load) to choose the best generator placement.
- How to anchor and secure a generator to minimize vibrations and reduce noise.
- The procedure for connecting power systems and backup solutions to ensure consistent energy supply.
- The importance of surge protection and how to install these devices to safeguard equipment from electrical surges.
- Best practices to securely mount and connect antennas, ensuring proper alignment and functionality.
- Correct setup of all electrical, cooling, and data systems for efficient operation.
- The infrastructure setup of a network operations center, ensuring appropriate electrical and data connections.

Demonstrate

Demonstrate the process of installing a power distribution unit and a backup generator. Show how to connect the generator to the power distribution system and secure the equipment.

Activity

1. **Activity Name:** “Generator Placement and Mounting Practice”
2. **Objective:** To help participants understand how to conduct a site survey and install generators securely.
3. **Type of Activity:** Group activity
4. **Resources:** Generator, mounting tools, power cables, safety equipment, survey maps
5. **Time Duration:** 25 minutes

6. **Instructions:**
   - Divide participants into small groups.
   - Provide each group with a survey map and equipment.
   - Ask them to assess the space and identify the best placement for a generator.
   - Guide them to simulate the mounting process, ensuring they use safety tools and reduce vibrations.
   - Each group will share their reasoning for the placement and mounting decisions with the class.
7. **Outcome:** Participants will practice determining the optimal location for generator placement and the proper technique for secure mounting.

Notes for Facilitation

- Keep the session interactive, encouraging participants to ask questions and share experiences.
- Ensure all activities are conducted safely, particularly when handling equipment and tools.
- Emphasize the importance of accurate site surveys and generator sizing based on power needs.
- Focus on proper mounting techniques to prevent equipment failures due to vibrations or improper placement.
- Discuss how backup systems and surge protection are vital for the longevity of telecom equipment.

Unit 4.2: Maintenance and Troubleshooting

Unit Objectives

By the end of this unit, the participants will be able to:

1. Demonstrate the correct use of multimeters, insulation resistance testers, and cable testers.
2. Perform routine visual inspections of the generator and identify issues, such as leaks or loose connections.
3. Monitor and assess the cooling system, including coolant levels and radiator cleanliness of the generator.
4. Identify and respond to generator alarms and warnings promptly.
5. Troubleshoot fuel delivery problems, such as clogs, leaks, or contaminated fuel, in a controlled environment.
6. Ensure compliance with local permits, regulations, and safety standards for generator installation.
7. Describe the lockout/tagout procedures and their significance in ensuring safety during electrical work.

Resources to be Used

Multimeters, insulation resistance testers, cable testers, generator manuals, lockout/tagout procedure guides, fuel delivery system diagrams, radiator cleaning tools, coolant and fuel samples, generator simulator or actual generator unit, safety equipment (gloves, goggles), and inspection checklists.

Say

- Good morning/afternoon, everyone! I'm excited to be here with you today as we dive into the world of generator maintenance and troubleshooting.
- Today's session will focus on practical skills such as troubleshooting fuel delivery, using essential testing tools, performing routine checks, and understanding safety protocols.
- It's critical to understand these concepts because they ensure that your generators operate efficiently, and you can address problems before they cause major issues or safety concerns.

Ask

- Have you ever noticed a warning light or an alarm going off on a piece of machinery? What did you do about it?
- How often do you inspect or check equipment like generators or machinery in your work or home environments?
- Can anyone share an example of a time when a faulty fuel system or electrical issue caused problems in a machine or vehicle?

Do

- Begin by introducing the importance of regular maintenance and the tools used in troubleshooting.
- Explain the various types of testing equipment (multimeter, insulation resistance tester, cable tester) and their specific uses.
- Discuss the importance of understanding and following lockout/tagout procedures.
- Walk through the process of identifying common issues in generators such as leaks, loose connections, and fuel delivery problems.
- Show participants how to monitor and assess cooling systems and coolant levels, and explain why this is vital for long-term generator operation.
- Emphasize the importance of safety regulations, permits, and how they impact generator installation and operation.

Elaborate

- These tools help in measuring electrical properties and identifying faults in the wiring and insulation.
- Perform routine visual inspections of the generator: Regular inspections help in identifying issues like leaks, loose connections, or other visible wear and tear that could lead to bigger problems.
- Keeping an eye on coolant levels and radiator cleanliness ensures the generator doesn't overheat and fails unexpectedly.
- It's crucial to act quickly when an alarm or warning appears to avoid equipment damage or failure.
- Identifying issues like fuel clogs, leaks, or contamination and addressing them quickly ensures the generator runs smoothly.
- Ensure compliance with local permits, regulations, and safety standards: Understanding and adhering to regulations ensures legal compliance and safe operation during installation and maintenance.
- These procedures are essential for worker safety during electrical maintenance and repairs to prevent accidental electrical shock or other injuries.

Demonstrate

Show how to use a multimeter to test the electrical continuity of a cable or generator part. Illustrate how to read the multimeter and interpret the results correctly.

Activity

1. **Activity Name:** Generator Troubleshooting Practice
2. **Objective:** To practice troubleshooting common generator issues like cooling system failure, fuel problems, and electrical faults.
3. **Type of activity:** Group
4. **Resources:** Multimeter, insulation resistance testers, cable testers, generator unit or simulator, radiator cleaning tools, fuel system parts, coolant, inspection checklist.
5. **Time Duration:** 25 minutes

6. **Instructions:**
   - Divide the participants into groups.
   - Each group will be assigned a troubleshooting task: either a faulty electrical system, cooling issue, or fuel delivery problem.
   - Provide each group with the necessary tools to diagnose and fix the issue.
   - Ask the groups to perform inspections, test components with the right tools, and document their findings.
   - After troubleshooting, each group will present their results and solutions to the class.
7. **Outcome:** Participants will gain hands-on experience in identifying and fixing common generator issues, using diagnostic tools effectively, and working within safety protocols.

Notes for Facilitation

- Ensure all participants are actively involved in the activity and understand the steps.
- Provide feedback and support throughout the session to clarify any doubts.
- Emphasize the importance of following safety protocols, particularly when handling electrical equipment or fuel systems.
- During the troubleshooting activity, stress that correct tool usage and reading the results accurately are key to effective problem-solving.
- Remind participants about the importance of regular inspections and the early identification of issues to prevent costly repairs or downtime.

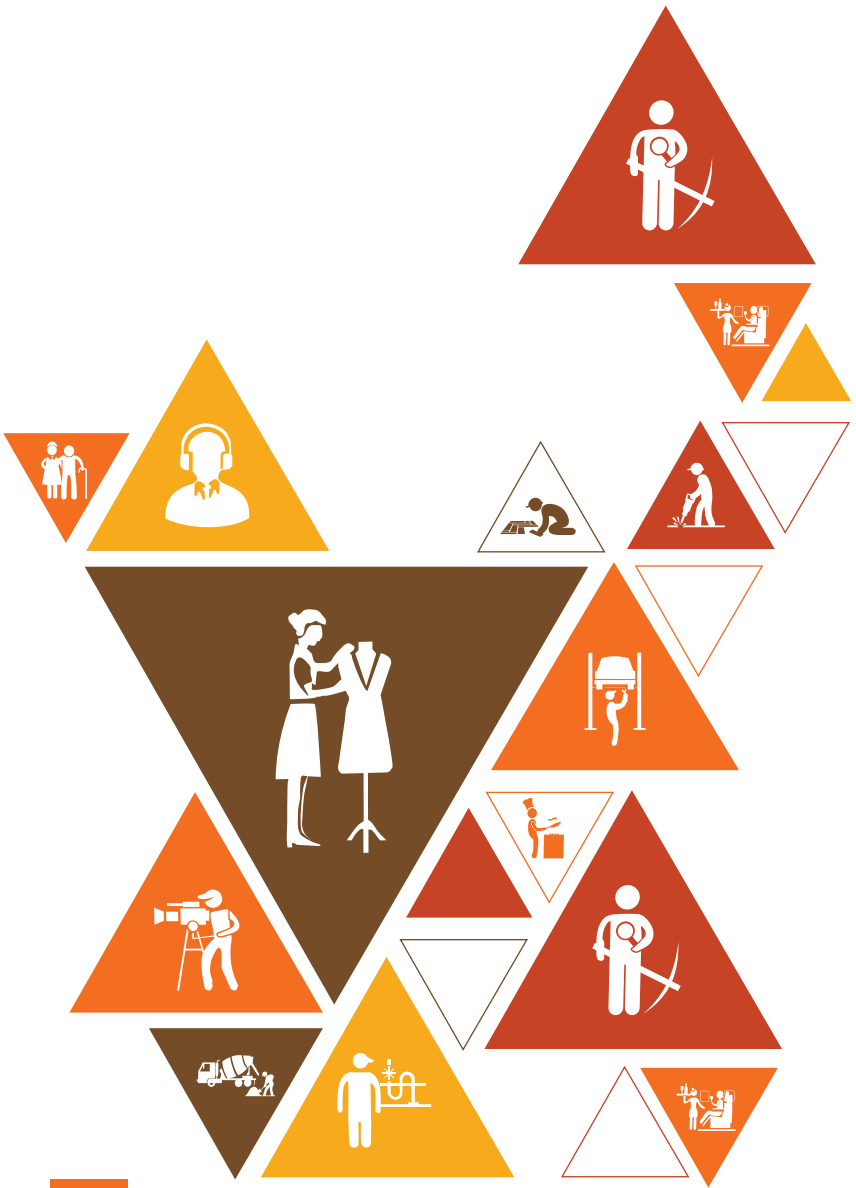
Answers to Exercises for PHB

Multiple Choice Question

1. b. Multimeter
2. c. Power requirements and future expansion
3. b. To divert excess energy during voltage surges to the ground
4. b. Inspect the multimeter for damage
5. b. Reduced performance

Descriptive Questions:

1. Refer: UNIT 4.1: Site Preparation and Equipment Installation
   Topic: 4.1.2 Analyze Power Needs and Choose the Right Generator
2. Refer: UNIT 4.1: Site Preparation and Equipment Installation
   Topic: 4.1.3 Installing a Generator at a Telecom Site
3. Refer: UNIT 4.1: Site Preparation and Equipment Installation
   Topic: 4.1.5 Installing Surge Arrestors and Lightning Arrestors
4. Refer: UNIT 4.1: Site Preparation and Equipment Installation
   Topic: 4.1.6 Mounting and Connecting Antennas and Radio Equipment Following Industry Standards
5. Refer: UNIT 4.2: Maintenance and Troubleshooting
   Topic: 4.2.2 Performing Routine Visual Inspections of a Generator



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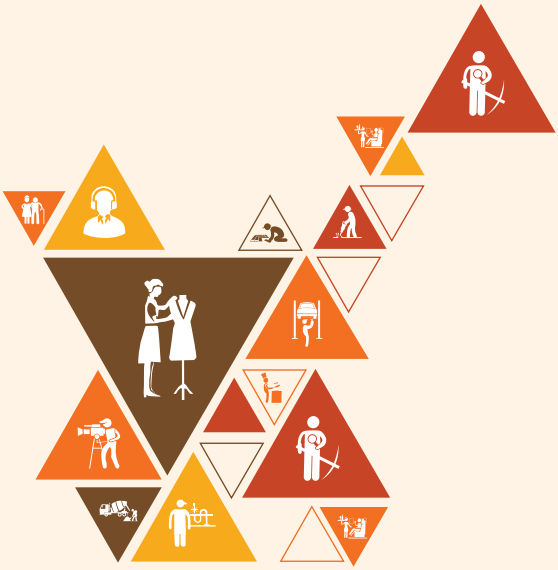
5. Capacity and Power Quality Enhancement Strategies for Electrical Systems

Unit 5.1 - Understanding and Monitoring Electrical Systems

Unit 5.2 - Maintenance, Troubleshooting, and Upgrades



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Key Learning Outcomes 

By the end of this module, the participants will be able to:

1. Recall the fundamental principles of electrical infrastructure and power requirements in telecom systems.
2. Apply electrical principles to calculate power-related parameters.
3. Develop upgrade plans for electrical distribution systems, including the selection of appropriate components and installation coordination.

Unit 5.1: Understanding and Monitoring Electrical Systems

Unit Objectives

By the end of this unit, the participants will be able to:

1. Apply electrical principles to calculate power-related parameters.
2. List common power quality issues, including voltage fluctuations, harmonics, and surges.
3. Use power quality monitoring equipment to collect data on voltage stability and harmonics.
4. Explain the importance of balancing electrical loads in a telecom environment.
5. Describe the concept of power factor correction and its significance.
6. Analyze power quality reports to identify areas for improvement in telecom equipment performance.
7. Apply knowledge of electrical diagrams and schematics to understand the wiring in telecom equipment.

Resources to be Used

Electrical circuit diagrams, power quality monitoring equipment, multimeters, oscilloscope, voltage stabilizer, telecom power supply schematics, printed power quality reports, whiteboard, markers, projector with slides on power factor correction and electrical load balancing.

Say

- Good morning, everyone! I hope you're all energized and ready to dive into today's session on electrical systems. This topic is crucial for ensuring that our telecom infrastructure runs efficiently and reliably.
- Today, we'll learn how to apply electrical principles to analyze power quality, monitor voltage stability, and improve telecom equipment performance.
- Understanding and monitoring electrical systems helps prevent power-related failures, improves efficiency, and ensures uninterrupted service in telecom operations. It also helps reduce costs and equipment damage over time.

Ask

- Have you ever noticed lights flickering at home when multiple appliances are running? What do you think causes that?
- Why do we sometimes experience sudden voltage drops or spikes when using heavy electrical equipment?
- Have you seen or heard about power-saving devices in offices or telecom facilities? What do you think they do?

Do

- Introduce the fundamental electrical concepts relevant to power monitoring, such as voltage, current, resistance, and power factor.
- Explain power quality issues and their impact on telecom operations using real-world examples.
- Demonstrate how to use power monitoring tools and interpret their readings.
- Discuss the importance of balancing electrical loads and power factor correction in telecom environments.
- Provide a walkthrough of electrical diagrams and schematics, explaining their relevance in troubleshooting telecom equipment.
- Facilitate an interactive session where participants analyze sample power quality reports and suggest improvements.

Elaborate

- Ohm's Law and power formulas to calculate power-related parameters such as voltage, current, and resistance.
- Common problems like voltage fluctuations, harmonics, surges, and their impact on equipment.
- How to operate multimeters, oscilloscopes, and power analyzers to collect and interpret data.
- Why distributing electrical loads evenly is essential for preventing equipment failures and inefficiencies.
- How improving power factor reduces energy waste and enhances system efficiency.
- Real-world data to identify areas of concern and suggest optimizations.
- Telecom power schematics to troubleshoot and optimize power distribution.

Demonstrate

Show how to measure voltage stability, detect harmonics, and assess power factor in a telecom setup.

Activity

1. **Activity Name:** Power Quality Assessment Challenge
2. **Objective:** Understand how to identify and analyze power quality issues using real data.
3. **Type of Activity:** Group
4. **Resources:** Power quality monitoring equipment, printed power quality reports, sample electrical diagrams, whiteboard, markers
5. **Time Duration:** 30 minutes
6. **Instructions:**
    - Divide participants into small groups.
    - Provide each group with a sample power quality report containing issues such as voltage fluctuations and harmonics.
    - Ask them to identify the problems in the report.

- Have each group propose solutions for improving power quality based on their analysis.
- Each group presents their findings to the class.

7. **Outcome:** Participants will develop the ability to interpret power quality reports and suggest corrective measures.

Notes for Facilitation

- Ensure that participants actively engage with the monitoring equipment and power reports to reinforce learning.
- Encourage questions and discussions to help participants relate concepts to real-life telecom applications.
- Emphasize the significance of power factor correction in reducing energy consumption and costs.
- Clarify the difference between electrical load balancing and voltage stabilization in telecom environments.
- Reinforce the importance of using proper protective equipment when working with electrical systems.
- Discuss how proactive power monitoring can prevent costly downtime in telecom operations.

Unit 5.2: Maintenance, Troubleshooting, and Upgrades

Unit Objectives

By the end of this unit, the participants will be able to:

1. Operate electrical testing instruments, such as oscilloscopes, to assess the health of electrical circuits and components.
2. Recognize and troubleshoot common electrical faults, such as short circuits and ground faults.
3. Perform detailed electrical assessments for cell sites and telecom equipment to identify potential issues and capacity constraints.
4. Assess the reliability of backup power systems and make recommendations for improvements.
5. Troubleshoot and isolate electrical problems in telecom systems to minimize downtime.
6. Identify opportunities to improve energy efficiency in the electrical systems of telecom sites.
7. Design electrical systems with scalability in mind to accommodate future growth and technology advancements.
8. Analyze load requirements to determine the need for electrical infrastructure upgrades.
9. Develop upgrade plans for electrical distribution systems, including the selection of appropriate components and installation coordination.

Resources to be Used

Multimeters, oscilloscopes, circuit diagrams, telecom site schematics, backup power system specifications, electrical load analysis tools, voltage testers, wire strippers, protective gloves, safety goggles, whiteboard, markers, projector, and training slides.

Say

- Good [morning/afternoon] everyone! I'm excited to have you all here as we dive into one of the most critical aspects of telecom operations—maintaining, troubleshooting, and upgrading electrical systems.
- Today, we're going to learn how to operate testing instruments, troubleshoot electrical faults, assess telecom power systems, and design electrical upgrades that ensure efficiency and scalability.
- Understanding these concepts will help you minimize downtime, improve energy efficiency, and enhance the reliability of telecom networks, which is crucial in ensuring uninterrupted communication services.

Ask

- Have you ever experienced a power outage at home and tried to figure out what went wrong?
- What do you think happens when a telecom tower loses power unexpectedly? How does it impact users?
- Can you recall a time when a device in your home stopped working due to an electrical issue? What did you do to fix it?

Do

- The role of electrical maintenance in telecom networks and its impact on service reliability.
- Use of electrical testing instruments like multimeters and oscilloscopes, explaining their purpose and how to interpret readings.
- The common electrical faults, such as short circuits and ground faults, using real-life examples.
- The importance of backup power systems, assessing their reliability, and identifying areas for improvement.
- Strategies for energy efficiency and the importance of designing scalable electrical systems.
- Hands-on activity where participants analyze a sample telecom site's electrical system to identify potential upgrade needs.

Elaborate

- How to use oscilloscopes and multimeters to assess the condition of electrical circuits and components.
- Common issues like short circuits, open circuits, and ground faults.
- Electrical evaluations of telecom sites to detect potential risks and capacity limitations.
- The reliability of power backups and propose improvements for uninterrupted service.
- Faults to minimize service interruptions.
- Ways to optimize power consumption at telecom sites.
- Future expansion and technology upgrades by designing flexible electrical systems.
- The necessity of infrastructure upgrades based on power demand.
- Appropriate components and coordinate installation for efficient power distribution.

Demonstrate

- Demonstration of using an oscilloscope and multimeter
- Show how to connect a multimeter to measure voltage and resistance.
- Demonstrate using an oscilloscope to visualize electrical waveforms.
- Explain how to interpret readings and diagnose potential circuit issues.

Activity

1. **Activity Name:** Electrical Load Assessment
2. **Objective:** Analyze and determine the need for electrical infrastructure upgrades.
3. **Type of Activity:** Group Activity
4. **Resources:** Sample telecom site electrical diagrams, multimeters, calculators, electrical load charts, worksheets.
5. **Time Duration:** 30 minutes

6. **Instructions:**
   - Divide participants into small groups.
   - Provide each group with a sample telecom site electrical diagram.
   - Ask them to calculate the total power load based on given data.
   - Have them identify whether the current electrical system can handle future expansion.
   - Each group will propose upgrade recommendations and present their findings.
7. **Outcome:** Participants will understand how to analyze electrical load requirements and determine when upgrades are necessary.

Notes for Facilitation

- Encourage interactive discussions by asking participants about their real-life experiences with electrical troubleshooting.
- Ensure all safety measures are followed when handling electrical testing instruments.
- Emphasize the importance of preventive maintenance in avoiding major electrical failures.
- Highlight the role of backup power systems in maintaining telecom services during outages.
- Explain how energy efficiency contributes to cost savings and sustainability in telecom operations.

Answers to Exercises for PHB

Multiple Choice Question

1. a. P = V x I
2. b. Overheating and potential equipment failure
3. b. Multimeter
4. b. To observe real-time voltage waveforms
5. a. Conducting visual inspections

Descriptive Questions:

1. Refer: UNIT 5.1: Understanding and Monitoring Electrical Systems
   Topic: 5.1.1 Applying Electrical Principles to Calculate PowerRelated Parameters
2. Refer: UNIT 5.1: Understanding and Monitoring Electrical Systems
   Topic: 5.1.2 Common Power Quality Issues in Telecom Systems
3. Refer: UNIT 5.2: Understanding and Monitoring Electrical Systems
   Topic: 5.2.1 Using Electrical Testing Instruments to Assess Circuit Health
4. Refer: UNIT 5.2: Understanding and Monitoring Electrical Systems
   Topic: 5.2.1 Using Electrical Testing Instruments to Assess Circuit Health
5. Refer: UNIT 5.2: Understanding and Monitoring Electrical Systems
   Topic: 5.2.2 Conduct Detailed Electrical Assessments for Telecom Equipment and Cell Sites

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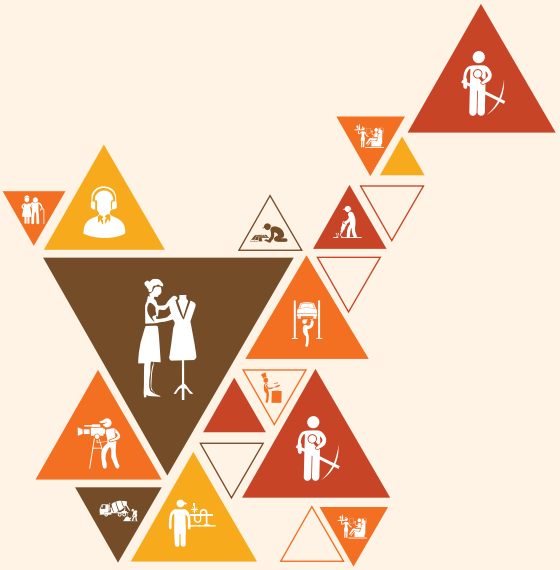
6. Establishing Electrical Standards

Unit 6.1 - Fault Detection and Protection System Design

Unit 6.2 - Testing, Commissioning, and Troubleshooting

Unit 6.3 - Network Security and Infrastructure Management



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Key Learning Outcomes 

By the end of this module, the participants will be able to:

1. Describe the types of electrical hazards and the importance of risk assessments in electrical protection.
2. Summarize the key components of an effective protection system and how they work together.
3. Apply troubleshooting skills to identify and resolve network issues promptly.
4. Implement security measures, including firewalls and access controls, to protect a simulated network infrastructure.

Unit 6.1: Fault Detection and Protection System Design

Unit Objectives

By the end of this unit, the participants will be able to:

1. Explain the significance of staying updated with electrical codes and standards for safety in protection system design.
2. Differentiate between various fault detection methods, including overcurrent, differential, ground fault protection and ways to mitigate them.
3. Define various protective devices such as circuit breakers, fuses, and relays and their application in electrical protection.
4. Explain the concept of redundancy in protection systems and its role in enhancing reliability.
5. Describe the purpose and components of an effective grounding and bonding system.
6. Describe the concept of protection zones in an electrical system and their role in safeguarding critical equipment.

Resources to be Used

Textbooks on electrical protection systems, national and international electrical codes and standards (e.g., NEC, IEC), circuit diagrams and schematics, sample protective devices like fuses, circuit breakers, and relays, simulation software for fault detection, whiteboard and markers, projector and slides, electrical protection manuals, grounding and bonding system models, videos demonstrating fault detection techniques, real-world case studies on protection system failures.

Say

- Hey everyone! I'm excited to have you all here today. Electrical protection is a crucial part of ensuring safety in electrical systems, and we'll be diving into how fault detection and protection systems work. Let's make this an interactive and insightful session!
- Today, we will explore different fault detection methods, the role of protective devices, and how grounding, redundancy, and protection zones work to safeguard electrical systems.
- Understanding fault detection and protection is essential because it helps prevent electrical hazards, reduces downtime, and protects both equipment and lives. Whether you're working in electrical maintenance, design, or safety, this knowledge is key!

Ask

- Have you ever experienced a power trip at home? What do you think caused it?
- Why do we have fuses and circuit breakers in our houses? How do they help in preventing electrical accidents?
- Have you seen large industrial power grids? How do you think they manage electrical faults without causing widespread blackouts?

Do

- Introduce the importance of electrical codes and standards and discuss how they ensure safety in protection system design.
- Explain the different fault detection methods, their applications, and ways to mitigate them.
- Demonstrate various protective devices such as fuses, circuit breakers, and relays, explaining their roles in preventing faults.
- Discuss the concept of redundancy in protection systems and how it enhances reliability.
- Describe the purpose of grounding and bonding in electrical systems and show practical examples.
- Explain the idea of protection zones in electrical systems and their importance in safeguarding equipment.

Elaborate

- Why staying updated with standards like NEC and IEC is crucial for safety and compliance.
- Overcurrent, differential, and ground fault protection, along with ways to mitigate them.
- The functions and applications of fuses, circuit breakers, and relays in electrical protection.
- How backup protection mechanisms improve system reliability.
- How grounding and bonding prevent electrical shocks and improve system safety.
- Protection zones, their importance, and how they safeguard critical equipment.

Demonstrate

Show a live demonstration of how a circuit breaker trips during an overcurrent situation. Use a controlled setup with a small breaker, a light bulb, and a variable power supply to simulate an overload.

Activity

1. **Activity Name:** Identify and Classify Protective Devices (Topics: Protective Devices, Fault Detection Methods)
2. **Objective:** To help trainees identify different protective devices and understand their function in an electrical protection system.
3. **Type of Activity:** Group Activity
4. **Resources:** Sample fuses, relays, circuit breakers, pictures or diagrams of different protective devices, a whiteboard, and markers.
5. **Time Duration:** 30 minutes

6. **Instructions**
   - Divide the trainees into small groups and provide them with a set of sample protective devices or printed images.
   - Ask each group to classify the devices into categories such as overcurrent protection, ground fault protection, and differential protection.
   - Each group must discuss and write down how each device functions and where it is used.
   - Once done, groups will present their findings, and the facilitator will clarify misconceptions and explain their applications.
7. **Outcome:** Trainees will gain hands-on experience in recognizing and classifying protective devices and understanding their roles in electrical protection.

Notes for Facilitation

- Ensure that all trainees participate actively by asking them to share real-life examples related to electrical protection.
- Keep explanations simple and practical, avoiding too much technical jargon, especially for beginners.
- Emphasize the importance of staying updated with electrical codes and standards to ensure safe designs.
- Clarify the difference between the various fault detection methods and their appropriate applications.
- Reinforce the idea that redundancy improves the reliability of protection systems, preventing system-wide failures.
- Use visual aids, such as schematics and real-life case studies, to enhance understanding of protection zones and their role in system safety.

Unit 6.2: Testing, Commissioning, and Troubleshooting

Unit Objectives

By the end of this unit, the participants will be able to:

1. Evaluate the results of protection system testing and commissioning to ensure proper operation.
2. Perform cable testing and certification to validate the functionality and compliance of installed cables.
3. Conduct a risk assessment for a specific electrical system and determine the level of protection required.
4. Show how to test and commission a protection system to validate its proper operation under both normal and fault conditions.
5. Perform a practical arc flash hazard analysis and design protective measures.

Resources to be Used

Multimeter, insulation resistance tester, high-voltage test equipment, cable certification tools, arc flash PPE, electrical schematics, protection relay manuals, sample electrical panels, risk assessment templates, hazard analysis software, whiteboard, markers, and projector.

Say

- Good morning, everyone! I'm excited to dive into today's session because we're tackling something crucial—Testing, Commissioning, and Troubleshooting!
- By the end of this session, you'll know how to evaluate protection system performance, conduct cable testing, assess risks, and perform an arc flash analysis.
- Understanding this topic is not just about technical skills; it's about safety. Faulty systems can lead to failures, hazards, and costly downtime.

Ask

- "Have you ever experienced a sudden power outage at home? What do you think could be the reason behind it?"
- "When you charge your phone, have you ever noticed the charging cable getting hot? What do you think causes that?"
- "Why do you think electrical appliances come with safety certifications? How do they ensure reliability?"

Do

- Explain the importance of testing, commissioning, and troubleshooting in electrical systems, linking it to real-life safety and efficiency concerns.
- Use diagrams and real components to show different testing tools and how they work.

- Conduct a step-by-step walkthrough of evaluating protection system performance and risk assessment.
- Engage the trainees by having them inspect and test a sample circuit or relay setup.

Elaborate

- Interpreting test reports to confirm that protection relays and circuits function correctly.
- How installed cables meet electrical and safety standards.
- Electrical hazards and determine necessary protective measures.
- System functionality under normal and fault conditions.
- Potential arc flash risks and design protective solutions.

Demonstrate

How to test a relay using a test set, verifying its response under different fault conditions.

Activity

1. **Activity Name:** Cable Testing and Certification
2. **Objective:** To ensure trainees understand how to test cables for insulation integrity and compliance.
3. **Type of Activity:** Group
4. **Resources:** Multimeter, insulation tester, sample cables, safety gloves, test result sheets
5. **Time Duration:** 30 minutes
6. **Instructions:**
   - Divide the trainees into small groups and assign each a set of cables.
   - Provide a multimeter and insulation tester to each group.
   - Instruct them to perform continuity testing using the multimeter.
   - Guide them to measure insulation resistance using the insulation tester.
   - Have them compare their readings to standard compliance values.
   - Discuss findings as a group and highlight key takeaways.
7. **Outcome:** Trainees will gain hands-on experience in cable testing and understand compliance requirements.

Notes for Facilitation

- Encourage active participation by linking concepts to real-life scenarios.
- Ensure all safety precautions are followed while handling electrical testing equipment.
- Reinforce the importance of proper documentation of test results.
- Explain the role of software tools in risk assessment and troubleshooting.
- Discuss industry standards and how they impact protection system testing.
- Address common troubleshooting challenges and best practices to overcome them.

Unit 6.3: Network Security and Infrastructure Management

Unit Objectives

By the end of this unit, the participants will be able to:

1. Analyze the requirements of a network infrastructure and determine the appropriate networking hardware and cable routing plan.
2. Implement security measures, including firewalls and access controls, to protect a simulated network infrastructure.
3. Analyze network configurations to ensure optimal performance and security.
4. Apply troubleshooting skills to identify and resolve network issues promptly.
5. Evaluate the effectiveness of security measures in protecting the network infrastructure from cyber threats.
6. Develop and implement a comprehensive emergency response plan for electrical faults in a practical scenario.

Resources to be Used

Networking hardware such as routers, switches, and network cables, a computer lab with pre-configured simulated network environments, firewall configuration software, network monitoring tools like Wireshark, cybersecurity threat simulation software, troubleshooting toolkits, emergency response procedure documents, whiteboard and markers, projector for demonstrations, and printed handouts with network security guidelines.

Say

- Hey everyone! I'm really excited to be here today as we dive into a topic that impacts almost everything we do online—network security and infrastructure management.
- By the end of this session, you'll be able to analyze network requirements, implement security measures, troubleshoot issues, and develop emergency response plans to protect network infrastructure.
- Every device you use—whether it's your phone, laptop, or even smart home devices—relies on secure networks. Understanding how to protect these networks is essential in today's digital world.

Ask

- Have you ever lost internet access and had to restart your Wi-Fi router? What do you think happens when you do that?
- When you log into a website, how does the site verify that it's really you?
- Why do companies use firewalls and antivirus software, and have you ever had a security warning pop up on your device?

Do

- Explain the key components of a network infrastructure, including routers, switches, and cabling.
- Demonstrate how firewalls and access controls function to protect network security.
- Guide participants through basic troubleshooting steps to diagnose and fix network issues.
- Walk through an emergency response plan for handling network failures due to electrical faults.
- Encourage interactive discussions and real-world application of security measures.

Elaborate

- The essential networking hardware and develop an optimized cable routing plan.
- Firewalls, access controls, and authentication systems to protect the network.
- Existing network setups for efficiency and security vulnerabilities.
- Diagnostic tools to detect and resolve connectivity and security issues.
- Network security measures to ensure protection against cyber threats.
- Step-by-step strategy to address electrical faults and prevent network downtime.

Demonstrate

Show how to configure a firewall by setting up rules that allow or block specific types of network traffic, explaining how this protects the network from unauthorized access.

Activity

1. **Activity Name:** Secure Network Configuration Challenge (Topics: Implement Security Measures, Evaluate Network Configurations)
2. **Objective:** To understand and apply firewall configurations and access control techniques in a simulated environment.
3. **Type of Activity:** Group
4. **Resources:** Simulated network setup, firewall software, access control settings guide, network troubleshooting toolkit
5. **Time Duration:** 30 minutes
6. **Instructions:**
   - Divide participants into small groups and assign each group a simulated network setup.
   - Provide each group with a list of security vulnerabilities in their network.
   - Ask them to configure firewalls and access controls to mitigate the vulnerabilities.
   - Each group will test their security measures using a simulated cyberattack scenario.
   - Groups will present their configurations and explain the rationale behind their security choices.
7. **Outcome:** Participants will gain hands-on experience in securing a network by implementing firewalls and access controls effectively.

Notes for Facilitation

- Encourage participation by asking trainees to share personal experiences with network security issues.
- Use real-life examples to simplify technical concepts and engage learners.
- Highlight the importance of proactive security measures in preventing cyber threats.
- Explain how incorrect firewall settings can lead to network vulnerabilities or connectivity issues.
- Emphasize the significance of regular network monitoring to detect and respond to security breaches.
- Reinforce the role of emergency response planning in minimizing downtime during network failures.

Answers to Exercises for PHB

Multiple Choice Question

1. b. To ensure the safety and proper design of electrical systems
2. b. To provide a safe path for fault currents
3. b. Bonding conductor
4. b. To ensure reliability and safety of the telecom electrical system
5. a. To ensure network performance and scalability

Descriptive Questions:

1. Refer: UNIT 6.1: Fault Detection and Protection System Design
   Topic: 6.1.1 Electrical Codes and Standards for Safe Protection System Design
2. Refer: UNIT 6.1: Fault Detection and Protection System Design
   Topic: 6.1.4 Implement Redundancy in Protection Systems to Enhance Reliability
3. Refer: UNIT 6.2: Fault Detection and Protection System Design
   Topic: 6.2.3 Conducting Risk Assessment for Electrical Systems
4. Refer: UNIT 6.2: Fault Detection and Protection System Design
   Topic: 6.2.5 Arc Flash
5. Refer: UNIT 6.3: Network Security and Infrastructure Management
   Topic: 6.3.3 Network Configuration Analysis

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7. Process of Organising Work and Resources as per Health and Safety Standards

Unit 7.1 - Workplace Health & Safety

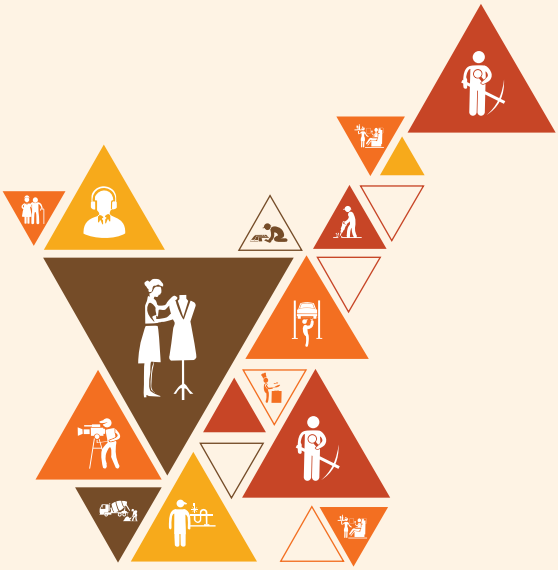
Unit 7.2 - Different types of Health Hazards

Unit 7.3 - Importance of Safe Working Practices

Unit 7.4 - Reporting Safety Hazards

Unit 7.5 - Waste Management

Unit 7.6 - Organizations' Focus on the Greening of Jobs



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Key Learning Outcomes 

By the end of this module, the trainees will be able to:

1. Explain about the work place health and safety
2. Differentiate various health hazards
3. Demonstrate various first aid techniques
4. Importance of safety at workplace
5. Understand Basic hygiene Practices and hand washing techniques
6. Explain the need for social distancing
7. Understand the reporting of hazards at workplace
8. Explain e-waste and process of disposing them
9. Explain Greening of jobs

Unit 7.1: Workplace Health & Safety

Unit Objectives

By the end of this unit, the trainees will be able to:

1. Understand about workplace health and safety
2. Explain tips to design a safe workplace
3. Explain precautions to be taken at a workplace

Resources to be Used

Presentation slides or visual aids, Examples of safe workplace designs, Visuals demonstrating precautions at a workplace.

Say

- Today, we're diving into a topic that's crucial for each one of us - Workplace Health & Safety. Let's make our workspace not just productive but also safe and secure!
- Our objective today is to understand the fundamentals of workplace health and safety. We'll explore how to design a safe workplace and discuss important precautions. This knowledge is essential for creating a work environment that prioritizes our well-being.
- Workplace safety isn't just a legal requirement; it's about our well-being. Knowing the ins and outs of creating a safe workspace ensures that we can all go home healthy and sound every day.

Ask

- Can you share an experience where workplace safety measures made a significant difference?
- What are some common challenges you've observed regarding safety in your workplace?
- Why is it important for employees to actively contribute to maintaining a safe work environ-ment?

Do

- Discuss the importance of workplace health and safety.
- Outline the session objectives.

Elaborate

Understanding Workplace Health and Safety

- Provide an overview of the concept, legal aspects, and its impact on employees and produc-tivity.

Designing a Safe Workplace and Precautions

- Share tips and best practices for designing a safe workplace.
- Discuss specific precautions that should be taken at a workplace.

Demonstrate

- Demonstrate examples of safe workplace designs and explain the reasoning behind them.

Activity

1. **Activity name:** Safety Check: Design Your Workspace
2. **Objective:** Apply knowledge of safe workplace design.
3. **Type of Activity:** Group
4. **Resources:** Templates for designing workspaces, markers, and flip charts.
5. **Time Duration:** 25 minutes
6. **Instructions:**
   - Groups design a safe workspace using provided templates, considering safety aspects dis-cussed.
7. **Outcome:** Improved understanding of practical implementation of safe workspace princi-ples.

Notes for Facilitation

- Encourage open discussions and questions.
- Emphasize that safety is everyone's responsibility.
- Highlight the role of each individual in maintaining a safe workplace.
- Emphasize the psychological impact of a safe environment on employee well-being and produc-tivity.
- Encourage a proactive approach towards safety, such as reporting hazards and suggesting im-provements.

Unit 7.2: Different types of Health Hazards

Unit Objectives

By the end of this unit, the trainees will be able to:

1. Understand the health hazards
2. Demonstrate First Aid Techniques

Resources to be Used

Presentation slides or visual aids, First aid kits for demonstration purposes, Handouts on com-mon health hazards.

Say

- Today's session is crucial as we delve into 'Different Types of Health Hazards' and learn practi-cal first aid techniques. Let's ensure we are equipped with the knowledge to keep ourselves and our colleagues safe.
- Our goal today is twofold: Firstly, to understand various health hazards that can affect us in our daily lives. Secondly, we'll go beyond awareness and dive into practical first aid techniques. This knowledge can be a lifesaver in emergencies.
- In our unpredictable lives, accidents and health emergencies can happen anytime. Knowing how to identify health hazards and administer basic first aid can make a significant difference, potentially saving lives.

Ask

- Can you share an instance where knowing first aid made a difference in handling a health emergency?
- What are some common health hazards you think people might encounter in their daily lives?
- How can awareness of health hazards contribute to a safer environment at home or work?

Do

- Briefly introduce the importance of understanding health hazards.
- Outline the session objectives.

Elaborate

Understanding Health Hazards

- Discuss various health hazards such as physical, chemical, biological, ergonomic, and psy-chosocial.
- Explain how these hazards can manifest in different settings.

First Aid Techniques

- Cover basic first aid techniques, including CPR, wound care, and responding to common health emergencies.

Demonstrate

- Demonstration common health hazards using visuals or case studies, Discuss preventive measures.

Activity

1. **Activity name:** First Aid Workshop
2. **Objective:** Apply first aid techniques.
3. **Type of Activity:** Group
4. **Resources:** First aid kits, mannequins for CPR practice, bandages, and other first aid sup-plies.
5. **Time Duration:** 30 minutes
6. **Instructions:**
   - Groups practice basic first aid techniques learned during the session.
7. **Outcome:** Enhanced confidence and practical application of first aid skills.

Notes for Facilitation

- Encourage active participation and questions.
- Maintain a supportive and open learning environment.
- Emphasize the importance of remaining calm and focused during health emergencies.
- Reinforce that first aid is not a substitute for professional medical care but can significantly im-prove outcomes before help arrives.
- Encourage participants to share personal experiences related to health hazards and first aid, fostering a collaborative learning environment.

Unit 7.3: Importance of Safe Working Practices

Unit Objectives

By the end of this unit, the trainees will be able to:

1. Explain Basic Hygiene Practices
2. Understand the importance of Social Distancing
3. Demonstrate the safe working practices

Resources to be Used

Presentation slides or visual aids, Handouts on basic hygiene practices and social distancing, Personal protective equipment (PPE) for demonstration purposes.

Say

- Today, we're diving into the 'Importance of Safe Working Practices.' It's not just about rules; it's about creating a healthy and secure work environment for all of us.
- Our aim today is to understand and appreciate the importance of basic hygiene practices, the significance of social distancing, and how to practically implement safe working practices. Let's ensure our workplaces are not just productive but also safe spaces for everyone.
- Safe working practices are the cornerstone of a healthy workplace. By understanding and im-plementing them, we contribute to our own well-being and the well-being of our colleagues. It's about fostering a culture of safety and respect.

Ask

- Can you share an example of how safe working practices have made a positive impact on your work environment?
- In what ways have you seen basic hygiene practices being emphasized in your workplace?
- How do you think social distancing contributes to a safer workplace, especially in the current context?

Do

- Briefly introduce the importance of safe working practices.
- Outline the session objectives.

Elaborate

Basic Hygiene Practices

- Discuss the significance of personal hygiene, handwashing, and maintaining a clean work-space.

Importance of Social Distancing

- Explain the concept of social distancing and its relevance in preventing the spread of infec-tions.
- Relate it to the current context and public health guidelines.

Safe Working Practices Demonstration

- Demonstrate the correct way to wear and dispose of PPE.
- Illustrate proper techniques for maintaining social distance in various workplace scenarios.

Demonstrate

Conduct a practical demonstration of implementing safe working practices in a simulated workplace scenario.

Activity

1. **Activity name:** Safety Drill (30 minutes)
2. **Objective:** Apply safe working practices.
3. **Type of Activity:** Group
4. **Resources:** PPE, visual aids, workplace layout.
5. **Time Duration:** 30 minutes
6. **Instructions:**
   - Groups perform a safety drill, incorporating basic hygiene practices and social distancing.
7. **Outcome:** Improved understanding and practical application of safe working practices.

Notes for Facilitation

- Encourage open discussions on experiences and concerns related to safety.
- Foster a non-judgmental environment to promote learning.
- Emphasize that safe working practices are everyone's responsibility.
- Stress the importance of adapting these practices to the specific context of the workplace.
- Encourage participants to share personal anecdotes about the positive impact of safe working practices in their lives.

Unit 7.4: Reporting Safety Hazards

Unit Objectives

By the end of this unit, the trainees will be able to:

1. Discuss the process of reporting in case of emergency (safety hazards)
2. Understand methods of reporting hazards

Resources to be Used

Presentation slides or visual aids, Examples of emergency contact information, Handouts on reporting procedures.

Say

- Today, we're delving into the critical topic of 'Reporting Safety Hazards.' It's not just about knowing the procedures but understanding why reporting is crucial for our collective well-being.
- Our goal today is to discuss the process of reporting safety hazards, especially in emergencies. We'll understand the methods and explore why our proactive reporting is vital for maintaining a safe working environment.
- Safety is everyone's responsibility. By the end of today's session, you'll be equipped with the knowledge needed to effectively report safety hazards, ensuring a prompt and appropriate re-sponse to emergencies.

Ask

- Can you share a situation from your own experience where reporting a safety hazard led to a positive outcome?
- How often do you review emergency contact information at your workplace?
- What challenges do you think individuals might face when it comes to reporting safety hazards?

Do

- Introduce the importance of reporting safety hazards.
- Outline the session objectives.

Elaborate

Process of Reporting in Emergencies

- Discuss the step-by-step process of reporting safety hazards during emergencies.

Methods of Reporting Hazards

- Explore different methods of reporting, including direct communication, use of emergency hotlines, and digital reporting systems.

Importance of Timely Reporting

- Emphasize the impact of timely reporting on preventing accidents and minimizing damage.

Demonstrate

- Simulate an emergency scenario and guide participants through the process of reporting. Demonstrate the use of various reporting methods.

Activity

1. **Activity name:** Reporting Drills
2. **Objective:** Practice reporting safety hazards.
3. **Type of Activity:** Group
4. **Resources:** Emergency contact information, reporting forms.
5. **Time Duration:** 30 minutes
6. **Instructions:**
   - Groups participate in reporting drills based on different emergency scenarios.
7. **Outcome:** Improved understanding and confidence in reporting procedures.

Notes for Facilitation

- Encourage a proactive attitude toward reporting safety hazards.
- Foster a non-punitive reporting culture to ensure open communication.
- Emphasize the importance of reporting even minor safety concerns.
- Stress the role of confidentiality in reporting to encourage openness.
- Discuss any specific reporting protocols or systems in place in the participants' workplaces.

Unit 7.5: Waste Management

Unit Objectives

By the end of this unit, the trainees will be able to:

1. Understand what is e-waste
2. Understand the concept of waste management
3. Explain the process of recycling of e-waste

Resources to be Used

Visual aids or slides on e-waste, Samples of e-waste products, Information on local waste man-agement facilities, Recycling bins or containers.

Say

- Today, we're diving into a crucial topic – 'Waste Management.' It's not just about cleaning up; it's about understanding what we discard and how it impacts the environment.
- Our objective today is to explore the world of waste management, with a special focus on e-waste. By the end, you'll understand what e-waste is, the concept of waste management, and the recycling process, contributing to a cleaner, greener planet.
- The way we manage waste, especially electronic waste, has a direct impact on our environ-ment. Understanding this process empowers us to make informed choices and actively partici-pate in creating a sustainable future.

Ask

- Can you name some electronic devices you've discarded recently, and what did you do with them?
- Have you ever thought about what happens to your old gadgets once you throw them away?
- Do you currently practice any recycling habits at home or in your workplace?

Do

- Introduce the concept of waste management and its importance.
- Outline the session's objectives.

Elaborate

Understanding E-Waste

- Define e-waste and discuss common electronic products contributing to it.

Concept of Waste Management

- Explain the overall concept of waste management, including the 3 R's (Reduce, Reuse, Re-cycle).

Recycling Process of E-Waste

- Detail the process of recycling e-waste and the environmental benefits.

Demonstrate

Demonstrate the disassembly of a simple electronic device to highlight recyclable compo-nents. Discuss the importance of responsible disposal.

Activity

1. **Activity name:** E-Waste Sorting
2. **Objective:** Sort various e-waste items into categories (recyclable, non-recyclable).
3. **Type of Activity:** Group
4. **Resources:** Samples of e-waste, recycling bins.
5. **Time Duration:** 30 minutes
6. **Instructions:**
   - Groups sort provided e-waste items, discussing reasons for their choices.
7. **Outcome:** Improved understanding of e-waste categories and recycling possibilities.

Notes for Facilitation

- Encourage participants to share personal experiences or challenges related to waste manage-ment.
- Emphasize the importance of individual responsibility in waste reduction.
- Provide information on local e-waste recycling facilities or programs.
- Discuss the impact of improper e-waste disposal on the environment.
- Encourage participants to share any sustainable waste management practices they are aware of.

Unit 7.6: Organizations' Focus on the Greening of Jobs

Unit Objectives

By the end of this unit, the trainees will be able to:

1. Understand the concept of ESG
2. Explain the different factors of ESG

Resources to be Used

Visual aids or slides on e-waste, Samples of e-waste products, Information on local waste man-agement facilities, Recycling bins or containers.

Say

- Today, we're diving into a crucial topic – 'Waste Management.' It's not just about cleaning up; it's about understanding what we discard and how it impacts the environment.
- Our objective today is to explore the world of waste management, with a special focus on e-waste. By the end, you'll understand what e-waste is, the concept of waste management, and the recycling process, contributing to a cleaner, greener planet.
- The way we manage waste, especially electronic waste, has a direct impact on our environ-ment. Understanding this process empowers us to make informed choices and actively partici-pate in creating a sustainable future.

Ask

- Can you name some electronic devices you've discarded recently, and what did you do with them?
- Have you ever thought about what happens to your old gadgets once you throw them away?
- Do you currently practice any recycling habits at home or in your workplace?

Do

- Introduce the concept of waste management and its importance.
- Outline the session's objectives.

Elaborate

Understanding E-Waste

- Define e-waste and discuss common electronic products contributing to it.

Concept of Waste Management

- Explain the overall concept of waste management, including the 3 R's (Reduce, Reuse, Re-cycle).

Recycling Process of E-Waste

- Detail the process of recycling e-waste and the environmental benefits.

Demonstrate

Demonstrate the disassembly of a simple electronic device to highlight recyclable compo-nents. Discuss the importance of responsible disposal.

Activity

1. **Activity name:** E-Waste Sorting
2. **Objective:** Sort various e-waste items into categories (recyclable, non-recyclable).
3. **Type of Activity:** Group
4. **Resources:** Samples of e-waste, recycling bins.
5. **Time Duration:** 30 minutes
6. **Instructions:**
   - Groups sort provided e-waste items, discussing reasons for their choices.
7. **Outcome:** Improved understanding of e-waste categories and recycling possibilities.

Notes for Facilitation

- Encourage participants to share personal experiences or challenges related to waste manage-ment.
- Emphasize the importance of individual responsibility in waste reduction.
- Provide information on local e-waste recycling facilities or programs.
- Discuss the impact of improper e-waste disposal on the environment.
- Encourage participants to share any sustainable waste management practices they are aware of.

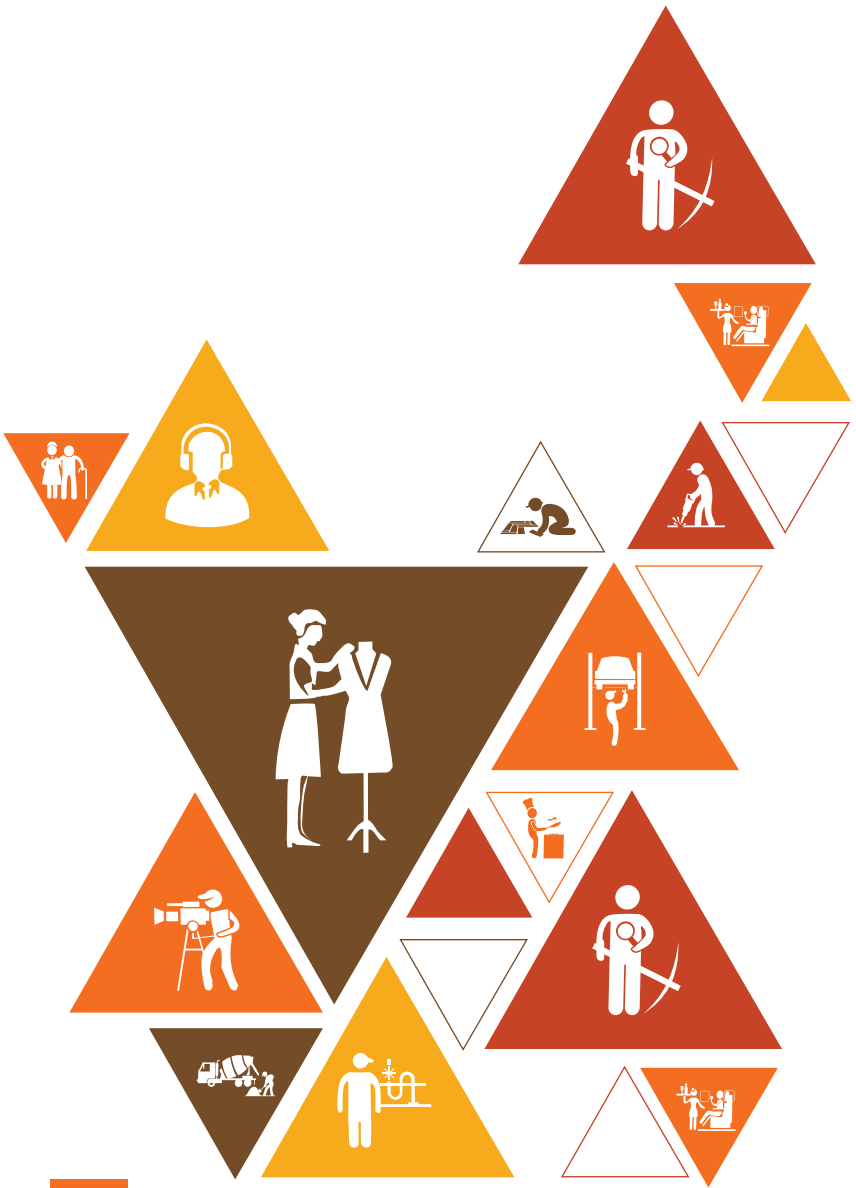
Answers to Exercises for PHB

Multiple Choice Questions

1. a. First Aid
2. a. Cold
3. a. Antiseptic
4. a. Chemical hazards
5. a. Cardio Pulmonary Resuscitation

Answer the following:

1. Refer - UNIT 5.1 Hazards and Accidents in the Store and Safe Practices
   Topic – Importance of Health and Safety
2. Refer - UNIT 5.1 Hazards and Accidents in the Store and Safe Practices
   Topic – Effects of Poor Maintenance
3. Refer - UNIT 5.1 Hazards and Accidents in the Store and Safe Practices
   Topic – Importance of Health and Safety
4. Refer - UNIT 5.2 Safety Practices
   Topic – Securing Customer Records
5. Refer - UNIT 5.2 Safety Practices
   Topic – Securing Customer Records



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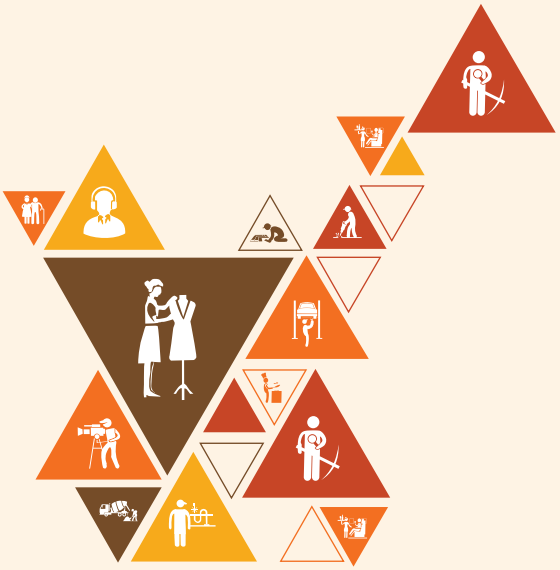
8. Employability Skills



DGT/VSQ/N0102

Scan the QR codes or click on the link for the e-books

https://www.skillindiadigital.gov.in/content/list

Employability Skills

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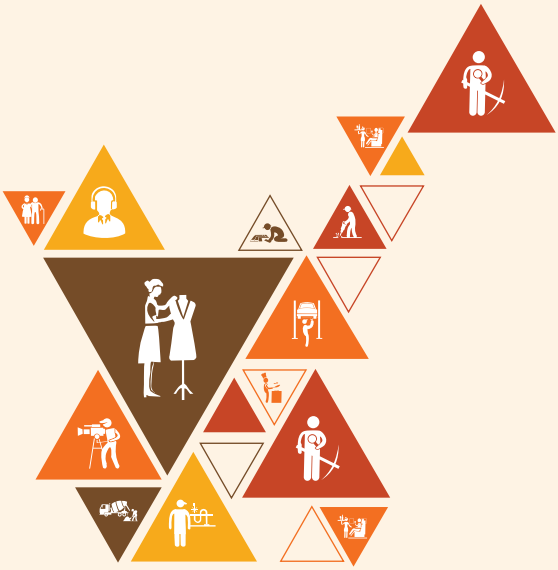
9. Annexures

Annexure I: Training Delivery Plan

Annexure II: Assessment Criteria

Annexure III: List of QR Codes Used in PHB



Annexure I

Training Delivery Plan

Training Delivery Plan			
Program Name:	Telecom Electrician (Advanced)		
Qualification Pack Name & Ref. ID	Telecom Electrician (Advanced), TEL/Q4303, V2.0		
Version No.	2.0	**Version Update Date**	Not Applicable
Pre-requisites to Training (if any)	Not Applicable		
Training Outcomes	**By the end of this program, the participants will be able to:** 1. Describe the process of designing and installing electrical infrastructure, including grounding and bonding systems, transformers, switchgear, and power distribution units, while adhering to industry standards and safety codes. 2. Analyze power quality issues, calculate power-related parameters, and use monitoring equipment to ensure stable power distribution. 3. Install an inverter system by choosing the appropriate capacity, selecting compatible batteries, and following safety precautions, ensuring a reliable power supply. 4. Monitor and maintain batteries, inverters, and generators, including cleaning terminals, applying anticorrosion grease, and setting up battery monitoring systems for optimal performance.		

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
1	**Introduction to the role of a Telecom Electrician (Basic)**	**Overview of the Telecom Industry and the Role of a Telecom Electrician (Basic)**	• Describe the size and scope of the Telecom industry and its subsectors. • Discuss the role and responsibilities of a Telecom Electrician (Basic).	Bridge Module	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films	8 Theory (5:00) Practical (3:00)
		Employment Opportunities and Workplace Ethics for a Telecom Electrician	• Identify various employment opportunities for a Telecom Electrician (Basic). • Discuss the organisational policies on workplace ethics, managing sites, quality standards, personnel management and public relations (PR).				8 Theory (5:00) Practical (3:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Roles and Responsibilities of a Telecom Electrician (Basic) in Organizational Workflow	• Describe the process workflow in the organization and the role of a Telecom Electrician (Basic). • List the various daily, weekly, monthly operations/activities that take place at the site under a Telecom Electrician (Basic).				8 Theory (5:00) Practical (3:00)
		Role and Responsibilities of a Telecom Electrician (Basic)	• Role play based on case studies, outlining the scope, responsibilities, and challenges of a Telecom Electrician (Basic). • Analyse the requirements for the course and prepare for the prerequisites of the course.				6 Theory (5:00) Practical (1:00)
2	**Inverter and Battery Bank Installation and Maintenance Practices**	**Selection and Installation of Inverters and Batteries**	• Choose an inverter with the appropriate capacity for the need. • Select compatible batteries that can handle the inverter's output capacity. • Install the inverter in a well-ventilated, dry, and secure location, away from direct sunlight and extreme temperatures. • Ensure there is adequate space around the inverter for proper airflow and heat dissipation. • Connect the batteries in series or parallel, depending on the inverter's voltage requirements.	TEL/N4301 PC1, PC2, PC4, PC5, PC6, PC7, PC8	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films, Inverter, Compatible batteries, Safety signage and PPE, measuring tape, markers, screws, brackets, Battery bank, Inverter cables, Grounding tools and materials,	8 Theory (3:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			• Connect the inverter to the battery bank using the provided cables, ensuring correct polarity. • Ground the inverter according to local electrical codes.			Multimeter, Electronic Load Simulator, Inspection mirror, Flashlight, Magnifying glass, Screwdrivers, Pliers, Wrenches, Wire brush, Dielectric grease, Circuit breaker, Fuses	
		Safety and Operational Verification	• Turn off the main power supply to ensure safety while working on the installation. • Power on the inverter and check for any warning lights or alarms. • Verify that the inverter is providing the desired output voltage and frequency. • Connect electrical loads to the inverter's output terminals. • Connect a charging source such as solar panels or a grid charger to keep the batteries charged. • Inspect the battery bank, inverter, and all connections for signs of wear, damage, or corrosion. • Tighten loose connections and replace damaged cables or connectors.	TEL/N4301 PC3, PC9, PC10, PC11, PC12, PC13, PC14			8 Theory (3:00) Practical (5:00)
		Battery Maintenance and Performance Optimization	• Monitor battery voltage and state of charge regularly. • Clean the battery terminals and apply anti-corrosion grease to prevent corrosion. • Check the water level in flooded lead-acid batteries and top up with distilled water as needed.	TEL/N4301 PC15, PC16, PC17, PC18, PC19, PC26, PC27			8 Theory (3:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			• Check the cooling fans and clean or replace them if necessary. • Check for software updates from the manufacturer and install them as recommended. • Use a battery monitoring system to keep track of voltage, temperature, and other relevant parameters. • Plan for battery replacement based on the manufacturer's recommended service.				
		Safe Handling and Risk Management of Batteries	• Ensure the correct type of battery is used. • Insert the batteries with the correct polarity (+ and -) according to the markings. • Inspect batteries for any physical damage or leakage. • Avoid deep discharges if possible, as they can shorten battery life. • Perform an equalization charge periodically. • Avoid short circuits, overloads, and mishandling that could lead to accidents. • Proper disposal or recycling of old batteries is essential. • Understand risk assessment and hazard identification in the workplace.	TEL/N4301 PC20, PC21, PC22, PC24, PC25, PC28 KU12, KU15, KU16, KU17			6 Theory (1:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			• Follow safe work practices in telecom electrical maintenance and installations. • Adhere to electrical isolation and Lockout-Tagout (LOTO) procedures.				
3	**Electrical System Design and Installation for Telecom Cell Sites**	**Fundamentals of Electrical Circuits**	• Understand basic electrical principles, including voltage, current, resistance, and power. • Apply Ohm's Law (V = IR) to electrical circuits. • Identify the available power source and voltage level. • Calculate the total electrical load (in watts or VA) that the cell site will require. • Ensure that all wiring connections are tight and free from defects. • Conduct electrical tests to verify voltage levels, grounding, and circuit continuity. • Use appropriate testing equipment, such as multimeters and ground resistance testers.	TEL/N4302 PC1, PC2, PC12, PC13, PC14, PC15 KU1, KU2, KU3	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films, Inverter, Compatible batteries, Safety signage and PPE, measuring tape, markers, screws, brackets, Battery bank, Inverter cables, Grounding tools and materials, Multimeter, Electronic Load Simulator, Inspection mirror, Flashlight, Magnifying glass, Screwdrivers, Pliers, Wrenches, Wire brush, Dielectric grease, Circuit breaker, Fuses	8 Theory (3:00) Practical (5:00)
		Electrical System Design and Safety	• Select the appropriate voltage level for the one-phase system. • Design the grounding and bonding system to meet safety and code requirements. • Ensure proper grounding of the electrical system to prevent electrical hazards. • Follow best practices for cable management, routing, and labeling.	TEL/N4302 PC3, PC4, PC7, PC8, PC16, PC17, PC19 KU6, KU9, KU11			8 Theory (3:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			• Implement safety measures, such as installing safety labels and signage, to protect personnel. • Ensure that all electrical equipment is properly enclosed and secured to prevent unauthorized access. • Specify the required voltage and frequency for the three-phase system based on equipment specifications.				
		Electrical Installation and Equipment Compliance	• Consult with local authorities and utility providers to obtain the necessary permits and approvals. • Ensure that all equipment is compliant with safety standards and suitable for harsh environmental conditions. • Install surge protection devices and backup power systems if needed to ensure uninterrupted service. • Connect the cell site equipment, including base stations, antennas, and power distribution units (PDUs), to the electrical system. • Verify that the connections are secure and properly grounded. • Conduct comprehensive testing of the electrical system, including continuity checks and insulation resistance tests.	TEL/N4302 PC5, PC6, PC9, PC10, PC11, PC29 KU4, KU5, KU10, KU12			8 Theory (3:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Three-Phase Power Distribution and Optimization	• Determine the total electrical load requirements of the cell site, including power needs of radios, antennas, and HVAC. • Create a single-line diagram outlining electrical components such as transformers, switchgear, and distribution panels. • Select an appropriate transformer to step up or down voltage levels. • Choose and size circuit breakers, fuses, and protective devices for safe power distribution. • Install circuit breakers, fuses, surge protectors, and other protection devices. • Verify that the three phases are balanced to ensure even power distribution and prevent voltage fluctuations.	TEL/N4302 PC18, PC20, PC21, PC22, PC28, PC30 KU7, KU8, KU13			6 Theory (1:00) Practical (5:00)
4	**Module 4 Components Installation, Maintenance, and Troubleshooting**	**Fundamentals of Electrical Principles**	• Understand electrical principles, including voltage, current, resistance, and power. • Learn how electrical circuits function and their role in telecom systems.	TEL/N4303 KU1, KU2	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films, Multimeters, Insulation Resistance Testers, Cable Testers, Lockout/ Tagout Kits, Surge Protectors, Lightning Arrestors,	8 Theory (2:00) Practical (6:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Tools and Equipment for Telecom Installations	• Gather essential tools such as multimeters, insulation resistance testers, cable testers, crimping tools, and soldering equipment. • Use diagnostic tools like oscilloscopes and network analysers for troubleshooting.	TEL/N4303 PC17		Power Distribution Equipment, Backup Power Systems, Grounding Systems, Antennas and Radio Equipment, Generators, Measuring Tape, Screwdrivers, Bolts and Nuts, Mounting Brackets, Pipes (Fuel Lines), Fuel Pumps, Safety Valves, Digital Multimeter, Infrared Thermometer, Flashlights, Fuel Flow Meter	8 Theory (2:00) Practical (6:00)
		Power Systems and Backup Solutions	• Install power distribution equipment, backup power systems (batteries, generators), and grounding systems. • Connect power supplies and ensure redundancy in telecom power systems. • Conduct site surveys to determine generator placement and fuel source.	TEL/N4303 PC4, PC7, PC21 KU8, KU10			8 Theory (2:00) Practical (6:00)
		Telecom Equipment Installation and Network Setup	• Mount and connect antennas, radio equipment, network switches, routers, and servers. • Set up a network operations center with proper electrical wiring and network infrastructure. • Install server racks, power distribution units (PDUs), and backup systems.	TEL/N4303 PC5, PC8, PC9 KU4			7 Theory (1:00) Practical (6:00)
		Electrical Safety and Preventive Maintenance	• Follow installation guidelines provided by telecom manufacturers. • Disconnect power sources and follow lockout/tagout procedures before working. • Inspect electrical components for wear, damage, or corrosion and ensure compliance with safety regulations.	TEL/N4303 PC2, PC3, PC11 KU15			7 Theory (1:00) Practical (6:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Cooling Systems and Air Conditioning in Telecom	• Install air conditioning units with proper ventilation and electrical connections. • Monitor and adjust temperature settings for optimal telecom operations. • Inspect and repair mechanical components such as compressors and fans.	TEL/N4303 PC40, PC42, PC48, PC50 KU12, KU13, KU14, KU18			7 Theory (1:00) Practical (6:00)
		Surge Protection, Environmental Considerations, and System Optimization	• Install surge protectors and lightning arrestors to protect telecom infrastructure. • Consider environmental factors like humidity, altitude, and temperature when selecting HVAC and power solutions. • Use diagnostic tools to identify and isolate faults in telecom power and network systems. • Perform scheduled maintenance, including battery replacements and system testing. • Ensure compliance with telecom-specific protocols for generator and HVAC operations.	TEL/N4303 PC6, PC16, PC19, PC20, PC35 KU6, KU7, KU9 KU11, KU16, KU17			5 Theory (1:00) Practical (4:00)
5	**Capacity and Power Quality Enhancement Strategies for Electrical Systems**	**Electrical Infrastructure and Power Requirements**	• Understand the existing electrical infrastructure, power requirements, and power quality issues. • Determine the specific power requirements of the site, considering the number of telecom equipment racks, air conditioning units, lighting, and any other electrical loads. • Assess the capacity of the existing electrical distribution system to handle the increased load.	TEL/N4304 PC1, PC2, PC6 KU3, KU9, KU10	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films, Multimeters, Oscilloscopes, Power quality monitoring equipment, Surge protectors, Lightning arrestors,	8 Theory (2:00) Practical (6:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Power Quality Analysis and Monitoring	• Conduct power quality analysis to identify and address issues such as voltage fluctuations, harmonics, voltage sags, and surges. • Use power quality monitoring equipment to collect data. • Continuously monitor power quality and equipment performance to proactively address issues.	TEL/N4304 PC3, PC4, PC16 KU2, KU13		Voltage stabilizers, Regulators	8 Theory (2:00) Practical (6:00)
		Load Balancing and Power Distribution Optimization	• Balance the electrical loads to ensure even distribution of power among phases to prevent overloading and voltage imbalances. • Implement voltage regulation equipment to maintain stable voltage levels within the desired range, especially in areas with frequent voltage fluctuations. • Develop upgrade plans that include selecting appropriate electrical components and coordinating new equipment installation.	TEL/N4304 PC5, PC14, PC30 KU10, KU11			8 Theory (1:00) Practical (7:00)
		Electrical Upgrades and System Expansion	• Upgrade the electrical distribution system. • Replace or upgrade transformers, circuit breakers, switchgear, and distribution panels. • Add additional electrical circuits and outlets to accommodate new equipment.	TEL/N4304 PC7, PC8, PC9 KU1, KU10, KU11			8 Theory (1:00) Practical (7:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Backup Power and Surge Protection	• Install backup power solutions such as uninterruptible power supplies (UPS) or backup generators to ensure uninterrupted operation. • Install surge protection devices to safeguard sensitive telecom equipment from voltage spikes and surges. • Assess the reliability of backup power systems and make necessary upgrades.	TEL/N4304 PC10, PC11, PC35 KU5, KU14			7 Theory (1:00) Practical (6:00)
		Electrical Safety and Compliance	• Ensure proper grounding and bonding of electrical equipment to mitigate the risk of electrical faults and improve safety. • Ensure that all electrical upgrades and installations comply with local electrical codes, industry standards, and safety regulations. • Install surge protectors and lightning arrestors to safeguard telecom systems from transient voltage spikes and lightning strikes.	TEL/N4304 PC13, PC17, PC33 KU6, KU15			7 Theory (1:00) Practical (6:00)
		Troubleshooting and Maintenance of Electrical Systems	• Recognize common electrical faults, such as short circuits, open circuits, and ground faults, through systematic testing and analysis. • Effectively troubleshoot and isolate electrical problems in telecom systems to minimize downtime.	TEL/N4304 PC23, PC24, PC26 KU8, KU12, KU16			7 Theory (1:00) Practical (6:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			• Implement corrective actions to address electrical issues, including repairing or replacing faulty components and conducting preventive maintenance.				
		Energy Efficiency and Future Scalability	• Identify opportunities to improve energy efficiency, such as optimizing cooling systems and implementing energy-saving technologies like LED lighting. • Design electrical systems with scalability in mind to accommodate future growth and technology advancements. • Develop and adhere to a schedule for routine electrical maintenance tasks.	TEL/N4304 PC36, PC37, PC38 KU7			7 Theory (1:00) Practical (6:00)
6	**Establishing Electrical Standards**	**Electrical Hazard Identification and Risk Assessment**	• Identify potential electrical hazards and conduct thorough risk assessments to determine the level of protection required. • Stay up-to-date with relevant electrical codes and standards (e.g., NEC, IEC) to ensure compliance and safety in the design and implementation of protection systems. • Evaluate the specific needs of the network infrastructure, including bandwidth, scalability, and connectivity requirements, to determine the scope of the installation project.	TEL/N4305 PC1, PC2, PC4 KU4	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films, Multimeter, Insulation Resistance Tester, Cable Tester, Surge Protectors, Protective Relays, Circuit Breakers, Fuses, Firewalls, Access Controls	8 Theory (3:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			• Risk assessments to identify potential electrical hazards and determine the appropriate level of protection required.				
		Protection Device Selection and Configuration	• Choose the right protective devices, such as circuit breakers, fuses, relays, and surge protectors, based on the specific needs of the electrical system and its components. • Configure protection settings, including current and voltage levels, time delays, and coordination with upstream and downstream devices to ensure proper fault isolation. • Incorporate redundancy in protection systems to enhance reliability and minimize downtime in case of a fault or failure. • Perform arc flash hazard analysis to assess the potential energy release in the event of a fault and design protective measures accordingly. • Configure protective relays to detect abnormal conditions and trip circuit breakers or initiate other protective actions when necessary.	TEL/N4305 PC3, PC5, PC6, PC8, PC9			8 Theory (3:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Network Infrastructure and Cable Installation	• Create a detailed network topology design, including the placement of routers, switches, access points, and cable routes, to ensure optimal performance and reliability. • Choose the appropriate networking hardware, including routers, switches, access points, and cables, based on the network design and budget constraints. • Develop a cable routing plan that considers factors such as cable length, signal integrity, cable type (e.g., Ethernet, fiber optic), and cable management. • Install and terminate network cables, connectors, and jacks, following industry standards and best practices for cable management and labeling. • Conduct testing and certification of installed cables to verify proper functionality, signal quality, and compliance with performance standards (e.g., Ethernet cable testing).	TEL/N4305 PC19, PC20, PC21, PC23, PC24			8 Theory (3:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Fault Detection, Monitoring, and Maintenance	• Implement various fault detection methods, including overcurrent, differential, and ground fault protection, as appropriate to the system. • Incorporate remote monitoring and control capabilities to assess system health, receive alarms, and remotely operate protective devices. • Maintain accurate documentation of protection schemes, settings, and equipment layouts, and ensure clear labeling of protective devices and zones. • Develop and implement a regular maintenance plan, including periodic testing and inspection of protective devices to ensure ongoing reliability. • Ensure that all protection systems comply with local, national, and international regulations and standards.	TEL/N4305 PC10, PC11, PC12, PC13, PC14, PC16			6 Theory (1:00) Practical (5:00)
7	**Process of organizing work and resources as per health and safety standards**	**Workspace Maintenance and Personal Safety**	• Keep workspace clean and tidy • Perform individual role and responsibilities as per the job role while taking accountability for the work • Record/document tasks completed as per the requirements within specific timelines • Implement schedules to ensure timely completion of tasks	TEL/N9101 PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8, PC9, PC10, PC11, PC12, PC13 KU9, KU10, KU11, KU12, KU16	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Relevant stationery,	8 Theory (3:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			• Identify the cause of a problem related to own work and validate it • Analyse problems accurately and communicate different possible solutions to the problem • Comply with organisation's current health, safety, security policies and procedures • Check for water spills in and around the work space and escalate these to the appropriate authority • Report any identified breaches in health, safety, and security policies and procedures to the designated person • Use safety materials such as goggles, gloves, ear plugs, caps, ESD pins, covers, shoes, etc. • Avoid damage of components due to negligence in ESD procedures or any other loss due to safety negligence • Identify hazards such as illness, accidents, fires or any other natural calamity safely, as per organisation's emergency procedures, within the limits of individual's authority • Participate regularly in fire drills or other safety related workshops organised by the company			First Aid Kit and Equipment used in Medical Emergencies	

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Health and Hygiene Manage-ment	• Report any hazard outside the individual's authority to the relevant person in line with organisational procedures and warn others who may be affected • Maintain appropriate posture while sitting/ standing for long hours • Handle heavy and hazardous materials with care, while maintaining appropriate posture • Sanitize workstation and equipment regularly • Clean hands with soap, alcohol-based sanitizer regularly • Avoid contact with anyone suffering from communicable diseases and take necessary precautions • Take safety precautions while travelling e.g. maintain 1m distance from others, sanitize hands regularly, wear masks, etc. • Report hygiene and sanitation issues to appropriate authority • Follow recommended personal hygiene and sanitation practices, for example, washing/ sanitizing hands, covering face with a bent elbow while coughing/sneezing, using PPE, etc.	TEL/N9101 PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC22 KU14, KU15, KU16			8 Theory (3:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Resource and Energy Conservation	• Optimize usage of material including water in various tasks/ activities/processes • Use resources such as water, electricity and others responsibly • Carry out routine cleaning of tools, machine and equipment • Optimize use of electricity/energy in various tasks/ activities/processes • Perform periodic checks of the functioning of the equipment/machine and rectify wherever required • Report malfunctioning and lapses in maintenance of equipment • Use electrical equipment and appliances properly	TEL/N9101 PC23, PC24, PC25, PC26, PC27, PC28, PC29 KU17, KU18			8 Theory (3:00) Practical (5:00)
		Waste Management and Safety	• Identify recyclable, non-recyclable and hazardous waste • Deposit recyclable and reusable material at identified location • Dispose non-recyclable and hazardous waste as per recommended processes • Waste management and methods of waste disposal • Common sources of pollution and ways to minimize it.	TEL/N9101 PC30, PC31, PC32 KU19, KU20, KU21, KU22			6 Theory (1:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
Total Duration							Theory: 90:00 Practical: 180:00
Employability Skills (DGT/VSQ/N0102) **(https://www.skillindiadigital.gov.in/content/list)**							60:00
OJT							120:00
Total Duration							PR + TH + OJT + ES= 450 : 00

Annexure II

Assessment Criteria

CRITERIA FOR ASSESSMENT OF TRAINEES

Assessment Criteria for Telecom Electrician (Advanced)	
Job Role	**Telecom Electrician (Advanced)**
Qualification Pack	**TEL/Q4303, V2.0**
Sector Skill Council	**Telecom Sector Skill Council**

S. No.	Guidelines for Assessment
1	The assessment for the theory part will be based on knowledge bank of questions approved by the SSC.
2	Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/ option NOS/ Set of NOS.
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre (as per assessment criteria below).
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training centre based on this criterion.
5	To pass the Qualifications File, every trainee should score a minimum of 50% of aggregate marks.
6	In case of unsuccessful completion, the trainee may seek reassessment on the Qualification File.

Assessment Outcomes	Assessment Criteria for Outcomes	Marks Allocation		
		Theory	Practical	Viva
TEL/N4301: Install and Maintain Inverter and Battery Banks	Inverter and Battery Banks	25	30	6
	PC1. choose an inverter with the appropriate capacity for need	1	1	-
	PC2. select compatible batteries that can handle the inverter's output capacity	2	3	1
	PC3. turn off the main power supply to ensure safety while working on the installation	1	1	-
	PC4. install the inverter in a well-ventilated, dry, and secure location, away from direct sunlight and extreme temperatures	1	2	-
	PC5. ensure there is adequate space around the inverter for proper airflow and heat dissipation	2	1	-
	PC6. connect the batteries in series or parallel, depending on your inverter's voltage requirements	3	1	-
	PC7. connect the inverter to the battery bank using the provided cables, ensuring correct polarity	1	3	-
	PC8. ground the inverter according to local electrical codes	1	3	-
	PC9. power on the inverter and check for any warning lights or alarms	1	4	1
	PC10. verify that the inverter is providing the desired output voltage and frequency	1	1	1

	PC11. connect electrical loads to the inverter's output terminals	2	1	-
	PC12. connect a charging source such as solar panels or a grid charger to keep the batteries charged	1	1	-
	PC13. inspect the battery bank, inverter, and all connections for signs of wear, damage, or corrosion	1	1	1
	PC14. tighten loose connections and replace damaged cables or connectors	1	1	-
	PC15. monitor battery voltage and state of charge regularly	1	1	-
	PC16. clean the battery terminals and apply anti- corrosion grease to prevent corrosion	1	1	1
	PC17. check the water level in flooded lead-acid batteries and top up with distilled water as needed	2	1	-
	PC18. check the cooling fans and clean or replace them if necessary	1	1	1
	PC19. check for software updates from the manufacturer and install them as recommended	1	2	-
	Battery Technology	15	20	4
	PC20. make sure the correct type of battery is been used	1	2	-
	PC21. insert the batteries with the correct polarity (+ and -) according to the markings	3	3	-
	PC22. inspect batteries for any physical damage or leakage	2	1	1
	PC23. clean battery terminals and cable connections to prevent corrosion	1	3	1
	PC24. avoid deep discharges if possible, as they can shorten battery life	3	1	-
	PC25. perform an equalization charge periodically	1	3	1
	PC26. use a battery monitoring system to keep track of voltage, temperature, and other relevant parameters	1	3	-
	PC27. plan for battery replacement based on the manufacturer's recommended service	1	2	-
	PC28. avoid short circuits, overloads, and mishandling that could lead to accidents	2	2	1
	NOS Total	**40**	**50**	**10**
TEL/N4302: Design and Install One-Phase and Three-Phase Electrical Systems at cell site	One-Phase Electrical Systems	24	30	7
	PC1. identify the available power source and voltage level	1	2	-
	PC2. calculate the total electrical load (in watts or VA) that the cell site will require	1	3	-
	PC3. select the appropriate voltage level for the one-phase system, typically 120/240V in residential areas or 208/120V in commercial areas	2	1	1
	PC4. design the grounding and bonding system to meet safety and code requirements	1	1	1
	PC5. consult with local authorities and utility providers to obtain the necessary permits and approvals for the electrical installation	2	1	1
	PC6. ensure that all equipment is compliant with safety standards and suitable for outdoor or harsh environmental conditions	1	2	-
	PC7. ensure proper grounding of the electrical system to prevent electrical hazards	3	2	1
	PC8. follow best practices for cable management, routing, and labelling	1	1	-
	PC9. install surge protection devices and backup power systems if needed to ensure uninterrupted service	1	1	-

	PC10. connect the cell site equipment, including base stations, antennas, and power distribution units (PDUs), to the electrical system	1	3	1
	PC11. verify that the connections are secure and properly grounded	2	1	-
	PC12. test the equipment to ensure it functions correctly	1	1	-
	PC13. conduct electrical tests to verify voltage levels, grounding, and circuit continuity	2	4	1
	PC14. use appropriate testing equipment, such as multimeters and ground resistance testers	2	2	-
	PC15. ensure that all wiring connections are tight and free from defects	1	1	-
	PC16. implement safety measures, such as installing safety labels and signage, to protect personnel working at the cell site	1	1	1
	PC17. ensure that all electrical equipment is properly enclosed and secured to prevent unauthorized access	1	3	-
	Three-Phase Electrical Systems	16	20	3
	PC18. total electrical load requirements of the cell site, including the power needs of the radios, antennas, HVAC	1	1	-
	PC19. specify the required voltage and frequency for the three-phase system based on the equipment's specifications and regional standards	1	1	-
	PC20. create a single-line diagram that outlines the electrical system's components, including transformers, switchgear, distribution panels, and loads	2	3	-
	PC21. select an appropriate transformer to step up or down voltage levels as needed and to provide isolation and safety	1	1	-
	PC22. choose and size circuit breakers, fuses, and protective devices to ensure safe and reliable power distribution	1	1	1
	PC23. design distribution panels and subpanels to distribute power to various loads, ensuring balanced phases and redundancy if necessary	1	1	-
	PC24. install transformers, switchgear, distribution panels, and other electrical components following manufacturer guidelines and local codes	1	1	-
	PC25. run and terminate electrical cables and conductors according to the single-line diagram and applicable standards	2	1	-
	PC26. establish grounding systems for both safety and equipment protection	1	3	1
	PC27. make secure and properly torqued electrical connections, and label all cables and conductors for easy identification	1	4	-
	PC28. install circuit breakers, fuses, surge protectors, and other protection devices as specified in the design	1	1	1
	PC29. conduct comprehensive testing of the electrical system, including continuity checks, insulation resistance tests, and functional tests	1	1	-
	PC30. verify that the three phases are balanced to ensure even power distribution and prevent voltage fluctuations	2	1	-
	NOS Total	**40**	**50**	**10**
TEL/N4303: Install, Maintain, and Troubleshoot Electrical Components	Electrical Components in Telecom Systems	15	20	4
	PC1. gather the required tools and equipment, including multimeters, insulation resistance testers, cable testers, crimping tools, and soldering equipment	-	1	-
	PC2. follow the installation guidelines provided by the telecom equipment manufacturer	1	1	-

	PC3. disconnect power sources and lockout/tagout procedures before starting any work	1	1	-
	PC4. Install power distribution equipment, backup power systems (e.g., batteries, generators), and grounding systems	1	1	1
	PC5. mount and connect antennas and radio equipment	1	1	-
	PC6. install surge protectors and lightning arrestors	1	1	-
	PC7. connect power supplies, HVAC systems, and data cabling	1	1	-
	PC8. set up the network operations center with proper electrical wiring and network infrastructure	1	1	-
	PC9. install server racks, power distribution units (PDUs), and backup power systems	1	1	1
	PC10. connect network switches, routers, and servers	1	1	1
	PC11. inspect electrical components for signs of wear, damage, or corrosion	1	1	-
	PC12. monitor backup power systems and replace batteries as needed	1	1	-
	PC13. keep electrical components clean and free of dust, which can lead to overheating and malfunctions	-	1	-
	PC14. use compressed air or specialized cleaning tools to remove dust and debris	-	1	-
	PC15. schedule to replace or refurbish components before they fail	-	1	-
	PC16. test backup power systems regularly to ensure they function during power outages	-	1	1
	PC17. use diagnostic tools like multimeters, oscilloscopes, and network analyzers to identify issues	1	1	-
	PC18. disconnect or isolate components to narrow down the source of the problem	1	1	-
	PC19. repair or replace faulty electrical components, such as power supplies, circuit breakers, or damaged wiring	1	1	-
	PC20. thoroughly test the system to ensure the issue is resolved	1	1	-
	Generators	15	19	3
	PC21. conduct a thorough site survey to determine the generator's placement, size requirements, fuel source, and environmental considerations	-	1	-
	PC22. choose an appropriate generator based on power requirements, backup duration, and site- specific conditions (e.g., altitude, temperature, humidity)	1	2	-
	PC23. ensure compliance with local permits, regulations, and safety standards for generator installation	1	1	-
	PC24. construct a stable concrete foundation for the generator	1	2	-
	PC25. securely mount the generator to prevent vibrations and reduce noise	1	1	1
	PC26. establish a reliable fuel supply system, including fuel tanks, pipes, and safety mechanisms	1	1	-
	PC27. connect the generator to the telecom system's electrical panel, ensuring proper grounding and wiring	1	1	-
	PC28. conduct initial start-up and load testing to ensure the generator operates correctly and can handle the anticipated load	1	1	-

	PC29. perform routine visual inspections of the generator, checking for leaks, loose connections, and signs of wear or damage	1	1	-
	PC30. regularly change engine oil, fuel filters, and air filters according to the manufacturer's recommendations	1	1	-
	PC31. monitor the cooling system, including coolant levels and radiator cleanliness	1	1	1
	PC32. check and maintain the generator's batteries, including cleaning terminals and ensuring they are fully charged	1	1	-
	PC33. monitor fuel levels, condition, and quality regularly	1	1	-
	PC34. clean fuel tanks and replace fuel filters as needed	1	1	-
	PC35. periodically test the generator under load conditions to ensure it can handle the telecom system's power demands	1	1	-
	PC36. use diagnostic tools and software provided by the generator manufacturer to identify issues	-	-	1
	PC37. monitor the generator's alarm system for any alerts or warnings and address them promptly	-	1	-
	PC38. troubleshoot fuel delivery problems, such as clogs, leaks, or contaminated fuel	1	-	-
	Air Conditioners	10	11	3
	PC39. ensure that the installation location complies with safety and environmental regulations	1	-	-
	PC40. select an air conditioner unit that meets the cooling capacity and efficiency requirements of the site	1	1	-
	PC41. install the air conditioner unit securely on a level surface to prevent vibrations and damage	1	1	-
	PC42. ensure proper ventilation and clearance for airflow around the unit	1	1	-
	PC43. connect the air conditioner to a stable power source with the correct voltage and amperage	1	1	1
	PC44. check for refrigerant leaks during installation	1	1	-
	PC45. clean or replace air filters regularly to maintain airflow and efficiency	1	-	-
	PC46. clean the evaporator and condenser coils to remove dirt and debris, which can reduce efficiency	1	1	-
	PC47. lubricate moving parts, such as fan motors and bearings, as per the manufacturer's recommendations	1	1	1
	PC48. monitor and adjust the temperature settings to maintain the desired operating conditions	1	1	1
	PC49. regularly inspect electrical components for signs of overheating or damage	-	1	-
	PC50. check the power supply and wiring for faults or loose connections	-	1	-
	PC51. inspect and repair any mechanical components, like fans or compressors, that are not functioning correctly	-	1	-
	NOS Total	**40**	**50**	**10**
TEL/N4304: Upgrade electrical systems to meet capacity and power quality requirements	Electrical Distribution Systems and Power Quality	15	20	3
	PC1. understand the existing electrical infrastructure, power requirements, and power quality issues	1	2	-

	PC2. determine the specific power requirements of the site, considering the number of telecom equipment racks, air conditioning units, lighting, and any other electrical loads	1	1	-
	PC3. conduct power quality analysis to identify and address issues such as voltage fluctuations, harmonics, voltage sags, and surges	1	2	-
	PC4. use power quality monitoring equipment to collect data	1	1	-
	PC5. balance the electrical loads to ensure even distribution of power among phases to prevent overloading and voltage imbalances	1	1	1
	PC6. assess the capacity of the existing electrical distribution system to handle the increased load	1	1	-
	PC7. upgrade the electrical distribution system	-	1	-
	PC8. replacing or upgrading transformers, circuit breakers, switchgear, and distribution panels	-	1	-
	PC9. adding additional electrical circuits and outlets to accommodate new equipment	-	1	-
	PC10. install backup power solutions such as uninterruptible power supplies (UPS) or backup generators to ensure uninterrupted operation during power outages or fluctuations	1	1	-
	PC11. install surge protection devices to safeguard sensitive telecom equipment from voltage spikes and surges	1	1	-
	PC12. implement power factor correction equipment to improve power factor and reduce reactive power charges	1	1	1
	PC13. ensure proper grounding and bonding of electrical equipment to mitigate the risk of electrical faults and improve safety	1	1	-
	PC14. implement voltage regulation equipment to maintain stable voltage levels within the desired range, especially in areas with frequent voltage fluctuations	1	1	-
	PC15. establish a regular maintenance schedule to inspect and maintain electrical distribution equipment	1	1	1
	PC16. continuously monitor power quality and equipment performance to proactively address issues	1	1	-
	PC17. ensure that all electrical upgrades and installations comply with local electrical codes, industry standards, and safety regulations	1	1	-
	PC18. consider redundant power sources and distribution paths to enhance system reliability and minimize downtime	1	1	-
	Electrical Testing and Troubleshooting	10	20	3
	PC19. develop a strong foundation in electrical principles, including voltage, current, resistance, and power calculations	1	3	-
	PC20. read and interpret electrical diagrams and schematics to understand the wiring and connections in cell sites, BTS, NOS, and related equipment	1	2	-
	PC21. operate a wide range of electrical testing instruments, such as multimeters, oscilloscopes, clamp meters, and power analyzers	1	2	-
	PC22. accurately measure voltage and current levels to assess the health of electrical circuits and components	2	2	1
	PC23. recognize common electrical faults, such as short circuits, open circuits, and ground faults, through systematic testing and analysis	1	2	1
	PC24. effectively troubleshoot and isolate electrical problems in telecom systems to minimize downtime	1	1	-

	PC25. assess power quality parameters, including voltage stability, harmonics, and transient voltage surges, using appropriate monitoring and testing equipment	1	3	-
	PC26. implement corrective actions to address electrical issues, including repairing or replacing faulty components and conducting preventive maintenance	1	3	1
	PC27. generate comprehensive power quality reports to identify areas for improvement and optimize the performance of cell site, BTS, and NOS equipment	1	2	-
	Electrical Maintenance and Upgrade	15	10	4
	PC28. perform detailed electrical and power quality assessments for cell sites, BTS, NOS, and other sectors to identify potential issues, capacity constraints, and areas for improvement	1	1	-
	PC29. analyze the current and future load requirements of the telecom systems to determine if existing electrical infrastructure is sufficient or if upgrades are needed	1	-	-
	PC30. develop upgrade plans that include selecting appropriate electrical components (circuit breakers, transformers, wiring, etc.) and coordinating the installation of new equipment to meet increased power demands	1	1	-
	PC31. utilize power quality monitoring tools and equipment to assess voltage levels, harmonics, frequency variations, and other electrical parameters affecting the stability of the power supply	1	1	1
	PC32. identify and rectify voltage fluctuations and sags that can disrupt the operation of telecom equipment by installing voltage stabilizers or regulators	1	1	1
	PC33. install surge protectors and lightning arrestors to safeguard telecom systems from transient voltage spikes and lightning strikes	1	1	-
	PC34. continuously monitor and maintain proper grounding systems to minimize the risk of electrical faults and ensure personnel safety	1	1	-
	PC35. assess the reliability of backup power systems (e.g., generators, uninterruptible power supplies) and make necessary upgrades to ensure seamless operation during power outages	2	1	-
	PC36. identify opportunities to improve energy efficiency, such as optimizing cooling systems, and implementing energy-saving technologies like LED lighting	2	1	1
	PC37. design electrical systems with scalability in mind to accommodate future growth and technology advancements	2	1	1
	PC38. develop and adhere to a schedule for routine electrical maintenance tasks, including cleaning, tightening connections, and lubricating moving parts	2	1	-
	NOS Total	**40**	**50**	**10**
TEL/N4305: Develop and implement telecom electrical standards	Electrical Protection Systems	20	25	4
	PC1. identify potential electrical hazards and conducting thorough risk assessments to determine the level of protection required	1	2	-
	PC2. stay up-to-date with relevant electrical codes and standards (e.g., NEC, IEC) to ensure compliance and safety in the design and implementation of protection systems	1	2	1
	PC3. choose the right protective devices, such as circuit breakers, fuses, relays, and surge protectors, based on the specific needs of the electrical system and its components	2	1	1

	PC4. configure protection settings, including current and voltage levels, time delays, and coordination with upstream and downstream devices to ensure proper fault isolation	1	1	-
	PC5. establish effective grounding and bonding systems to reduce the risk of electrical faults and to protect against electrical shock hazards	1	2	-
	PC6. incorporate redundancy in protection systems to enhance reliability and minimize downtime in case of a fault or failure	1	1	-
	PC7. divide the electrical system into protection zones and design protective devices and schemes for each zone, considering critical equipment and personnel safety	1	2	-
	PC8. perform arc flash hazard analysis to assess the potential energy release in the event of a fault and design protective measures accordingly	1	1	-
	PC9. configure protective relays to detect abnormal conditions and trip circuit breakers or initiate other protective actions when necessary	2	2	-
	PC10. implement various fault detection methods, including overcurrent, differential, and ground fault protection, as appropriate to the system	1	1	1
	PC11. incorporate remote monitoring and control capabilities to assess system health, receive alarms, and remotely operate protective devices	1	2	-
	PC12. maintain accurate documentation of protection schemes, settings, and equipment layouts, and ensure clear labeling of protective devices and zones	2	2	-
	PC13. thoroughly test and commission protection systems to validate their proper operation under normal and fault conditions	1	2	-
	PC14. develop and implement a regular maintenance plan, including periodic testing and inspection of protective devices to ensure ongoing reliability	1	1	1
	PC15. continuously assess and improve protection systems based on evolving technology, system changes, and lessons learned from past incidents	1	1	-
	PC16. ensure that all protection systems comply with local, national, and international regulations and standards	1	1	-
	PC17. establish comprehensive emergency response plans to address electrical faults and coordinate actions to minimize downtime and safety risks	1	1	-
	Network Infrastructure and Cable Installation	20	25	6
	PC18. evaluate the specific needs of the network infrastructure, including bandwidth, scalability, and connectivity requirements, to determine the scope of the installation project	2	3	1
	PC19. create a detailed network topology design, including the placement of routers, switches, access points, and cable routes, to ensure optimal performance and reliability	1	1	1
	PC20. choose the appropriate networking hardware, including routers, switches, access points, and cables, based on the network design and budget constraints	2	2	-
	PC21. develop a cable routing plan that considers factors such as cable length, signal integrity, cable type (e.g., Ethernet, fiber optic), and cable management	2	2	-
	PC22. prepare the installation site by ensuring adequate power supply, environmental controls, and physical security measures	2	3	1

	PC23. install and terminate network cables, connectors, and jacks, following industry standards and best practices for cable management and labelling	2	1	1
	PC24. conduct testing and certification of installed cables to verify proper functionality, signal quality, and compliance with performance standards (e.g., Ethernet cable testing)	2	1	-
	PC25. configure network devices, such as routers and switches, to optimize network performance and security based on the design specifications	2	2	1
	PC26. implement security measures, including firewalls, intrusion detection systems, and access controls, to protect the network infrastructure from cyber threats	1	2	-
	PC27. maintain comprehensive documentation of the network installation, including cable maps, device configurations, and test results, for future reference and troubleshooting	1	2	1
	PC28. ensure that the network installation complies with relevant industry standards, codes, and regulations, including data privacy and security regulations	1	2	-
	PC29. develop troubleshooting skills to identify and resolve network issues promptly, minimizing downtime and disruptions	1	2	-
	PC30. develop contingency plans and procedures to respond to network emergencies, such as equipment failures or security breaches	1	2	-
	NOS Total	**40**	**50**	**10**
TEL/N9101: Organize Work and Resources as per Health and Safety Standards	PC1. keep workspace clean and tidy	-	1	-
	PC2. perform individual role and responsibilities as per the job role while taking accountability for the work	1	1	1
	PC3. record/document tasks completed as per the requirements within specific timelines	-	1	1
	PC4. implement schedules to ensure timely completion of tasks	-	2	-
	PC5. identify the cause of a problem related to own work and validate it	2	2	-
	PC6. analyse problems accurately and communicate different possible solutions to the problem	1	2	-
	PC7. comply with organisation's current health, safety, security policies and procedures	1	1	-
	PC8. check for water spills in and around the work space and escalate these to the appropriate authority	1	2	1
	PC9. report any identified breaches in health, safety, and security policies and procedures to the designated person	1	2	1
	PC10. use safety materials such as goggles, gloves, ear plugs, caps, ESD pins, covers, shoes, etc.	1	2	1
	PC11. avoid damage of components due to negligence in ESD procedures or any other loss due to safety negligence	2	3	1
	PC12. identify hazards such as illness, accidents, fires or any other natural calamity safely, as per organisation's emergency procedures, within the limits of individual's authority	2	1	-
	PC13. participate regularly in fire drills or other safety related workshops organised by the company	1	3	-
	PC14. report any hazard outside the individual's authority to the relevant person in line with organisational procedures and warn others who may be affected	1	3	-

	PC15. maintain appropriate posture while sitting/standing for long hours	1	1	-
	PC16. handle heavy and hazardous materials with care, while maintaining appropriate posture	1	1	-
	PC17. sanitize workstation and equipment regularly	1	2	-
	PC18. clean hands with soap, alcohol-based sanitizer regularly	-	1	-
	PC19. avoid contact with anyone suffering from communicable diseases and take necessary precautions	-	1	-
	PC20. take safety precautions while travelling e.g. maintain 1m distance from others, sanitize hands regularly, wear masks, etc.	1	2	-
	PC21. report hygiene and sanitation issues to appropriate authority	1	1	-
	PC22. follow recommended personal hygiene and sanitation practices, for example, washing/sanitizing hands, covering face with a bent elbow while coughing/sneezing, using PPE, etc.	1	1	-
	PC23. optimize usage of material including water in various tasks/ activities/processes	1	2	-
	PC24. use resources such as water, electricity and others responsibly	1	2	1
	PC25. carry out routine cleaning of tools, machine and equipment	1	2	-
	PC26. optimize use of electricity/energy in various tasks/activities/ processes	1	3	1
	PC27. perform periodic checks of the functioning of the equipment/ machine and rectify wherever required	1	3	1
	PC28. report malfunctioning and lapses in maintenance of equipment	1	2	-
	PC29. use electrical equipment and appliances properly	1	2	-
	PC30. identify recyclable, non-recyclable and hazardous waste	1	2	1
	PC31. deposit recyclable and reusable material at identified location	1	3	-
	PC32. dispose non-recyclable and hazardous waste as per recommended processes	1	3	-
	NOS Total	**30**	**60**	**10**
DGT/VSQ/ N0102: Employ-ability Skills (60 Hours)	Introduction to Employability Skills	1	1	-
	PC1. identify employability skills required for jobs in various industries	-	-	-
	PC2. identify and explore learning and employability portals	-	-	-
	Constitutional values – Citizenship	1	1	-
	PC3. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.	-	-	-
	PC4. follow environmentally sustainable practices	-	-	-
	Becoming a Professional in the 21st Century	2	4	-
	PC5. recognize the significance of 21st Century Skills for employment	-	-	-
	PC6. practice the 21st Century Skills such as Self- Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life	-	-	-
	Basic English Skills	2	3	-

	PC7. use basic English for everyday conversation in different contexts, in person and over the telephone	-	-	-
	PC8. read and understand routine information, notes, instructions, mails, letters etc. written in English	-	-	-
	PC9. write short messages, notes, letters, e-mails etc. in English	-	-	-
	Career Development & Goal Setting	1	2	-
	PC10. understand the difference between job and career	-	-	-
	PC11. prepare a career development plan with short- and long-term goals, based on aptitude	-	-	-
	Communication Skills	2	2	-
	PC12. follow verbal and non-verbal communication etiquette and active listening techniques in various settings	-	-	-
	PC13. work collaboratively with others in a team	-	-	-
	Diversity & Inclusion	1	2	-
	PC14. communicate and behave appropriately with all genders and PwD	-	-	-
	PC15. escalate any issues related to sexual harassment at workplace according to POSH Act	-	-	-
	Financial and Legal Literacy	2	3	-
	PC16. select financial institutions, products and services as per requirement	-	-	-
	PC17. carry out offline and online financial transactions, safely and securely	-	-	-
	PC18. identify common components of salary and compute income, expenses, taxes, investments etc	-	-	-
	PC19. identify relevant rights and laws and use legal aids to fight against legal exploitation	-	-	-
	Essential Digital Skills	3	4	-
	PC20. operate digital devices and carry out basic internet operations securely and safely	-	-	-
	PC21. use e- mail and social media platforms and virtual collaboration tools to work effectively	-	-	-
	PC22. use basic features of word processor, spreadsheets, and presentations	-	-	-
	Entrepreneurship	2	3	-
	PC23. identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research	-	-	-
	PC24. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion	-	-	-
	PC25. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity	-	-	-
	Customer Service	1	2	-
	PC26. identify different types of customers	-	-	-
	PC27. identify and respond to customer requests and needs in a professional manner.	-	-	-

	PC28. follow appropriate hygiene and grooming standards	-	-	-
	Getting ready for apprenticeship & Jobs	2	3	-
	PC29. create a professional Curriculum vitae (Résumé)	-	-	-
	PC30. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively	-	-	-
	PC31. apply to identified job openings using offline/online methods as per requirement	-	-	-
	PC32. answer questions politely, with clarity and confidence, during recruitment and selection	-	-	-
	PC33. identify apprenticeship opportunities and register for it as per guidelines and requirements	-	-	-
	NOS Total	**20**	**30**	**-**

Annexure III

List of QR Codes Used in PHB

Module No.	Unit No.	Topic Name	Page No. in PHB	Link for QR Code (s)	QR code (s)
Module 1: Introduction to the role of a Telecom Electrician (Advanced)	Unit 1.1: Industry Overview and Organisational Context	1.1.1 Size and scope of the Telecom Industry and its Sub-Sectors	17	https://youtu.be/PirV-lZn9yI	Telecommunication-Sector of India
	Unit 1.2: Role and Responsibilities of a Telecom Electrician (Advanced)	1.2.1 Role and Responsibilities of a Telecom Electrician (Advanced)	17	https://youtu.be/2S1j4LMSqcc	Overlapping roles of telecom tower technician and telecom electrician
Module 2: Inverter and Battery Bank Installation and Maintenance Practices	Unit 2.1 Inverter Selection and Installation Process	2.1.1 Inverters and Their Applications in the Telecom Sector	55	https://youtu.be/9CXy57D6IuA	Inverters used in telecom
	Unit 2.2: Battery Management and Maintenance	2.2.3 State of Charge (SoC)	55	https://youtu.be/7DTzShuF-N6M	Concept of State of Charge (SoC) and battery management

Module No.	Unit No.	Topic Name	Page No. in PHB	Link for QR Code (s)	QR code (s)
Module 3: Electrical System Design and Installation for Telecom Cell Sites	Unit 3.1: Electrical System Planning and Design	3.1.5 Creating a Single-Line Diagram for Telecom Cell Site Electrical Systems	88	https://youtu.be/98lOYpl4Wt0	Concept of SLD
	Unit 3.2: Electrical System Installation and Safety	3.2.1 Surge Protection and Backup Power Systems	88	https://youtu.be/4YWYpyJZCJk	Concept of Surge Protection and Backup Power Systems
Module 4: Electrical Components Installation, Maintenance, and Troubleshooting	Unit 4.1: Site Preparation and Equipment Installation	4.1.1 Essential Tools and Equipment for Telecom Equipment Installation and Maintenance	128	https://youtu.be/-WyyrKbU-ruA	Telecom installation base-station materials
	Unit 4.2: Maintenance and Troubleshooting	4.2.2 Performing Routine Visual Inspections of a Generator	128	https://youtu.be/JCv_uR4FqHM	Preventive maintenance of a fuel generator
Module 5: Capacity and Power Quality Enhancement Strategies for Electrical Systems	Unit 5.1: Understanding and Monitoring Electrical Systems	5.1.1 Applying Electrical Principles to Calculate Power-Related Parameters	161	https://youtu.be/61aDe5Y-14wg	Basic electrical concepts

Module No.	Unit No.	Topic Name	Page No. in PHB	Link for QR Code (s)	QR code (s)
	Unit 5.2: Maintenance, Trouble-shooting, and Upgrades	5.2.5 Opportunities to Improve Energy Efficiency in Telecom Site Electrical Systems	161	https://youtu.be/RvUCaax2b-KY	Energy Efficiency in Telecom Site Electrical Systems
Module 6: Establishing Electrical Standards	Unit 6.1: Fault Detection and Protection System Design	6.1.1 Electrical Codes and Standards for Safe Protection System Design	201	https://youtu.be/4h_w267kQv8	Electrical codes and standards
	Unit 6.2: Testing, Commissioning, and Trouble-shooting	6.2.2 Cable Testing	201	https://youtu.be/J-3dzlGANEE	Concepts of telecom cable testing
	Unit 6.3: Network Security and Infrastructure Management	6.3.6 Create and Execute an Emergency Response Plan for Electrical Faults	201	https://youtu.be/AaA6zqLadrY	Concept of emergency response plan
7. Communication and Interpersonal Skills	UNIT 7.2: Different Types of Health Hazards	7.1.2 First Aid Techniques	232	youtu.be/GrxevjEvk_s	First Aid at Work Place

Module No.	Unit No.	Topic Name	Page No. in PHB	Link for QR Code (s)	QR code (s)
	UNIT 7.3: Importance of Safe Working Practices	7.3.1 Basic Hygiene Practices	232	https://youtu.be/IsgLivAD-2FE	How to properly wash your hands
	UNIT 7.3: Importance of Safe Working Practices	7.3.3 Safe Workplace Practices	232	https://youtu.be/qzdLm-L4Er9E	How to give CPR to an Adult, a Child or an infant
	UNIT 7.5: time Management	7.5.6 Escalation Matrix	232	youtu.be/ccAZ9nCZSLc	Escalation Matrix PowerPoint Presentation Slides

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