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Facilitator Guide



Sector
Telecom

Sub-Sector
Passive Infrastructure

Occupation
Operations and Maintenance -
Passive Infrastructure

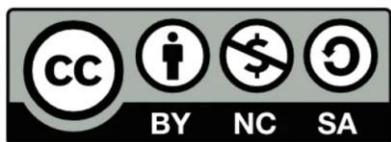
Wireless
Technician

Reference ID: TEL/Q4105, Version 4.0
NSQF level 4

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Telecom Sector Skill Council
Estel House,3rd Floor, Plot No: - 126, Sector-44
Gurgaon, Haryana 122003
Phone: 0124-2222222
Email: tssc@tsscindia.com
Website: www.tsscindia.com

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Shri Narendra Modi

Prime Minister of India

“ Skilling is building a better India.
If we have to move India towards
development then Skill Development
should be our mission. ”

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 Wireless Technician is primarily designed to facilitate skill development and training of people, who want to become professional Wireless Technicians 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/N4122–Carry out installation and wiring of wireless communication equipment
2. TEL/N4123– Configure equipment and establish wireless network connectivity
3. TEL/N4124– Diagnose and rectify wireless network faults
4. TEL/N4125– Install, test, and maintain UPS and domestic power supply
5. TEL/N9105 – Follow sustainable practices in telecom infrastructure installation
6. DGT/VSQ/N0102 - Employability Skills (60 Hours)

Post this training, the participants will be able to perform tasks as professional Technician (Wireless). 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



Ask



Explain



Elaborate



Notes



Objectives



Do



Demonstrate



Activity



Team Activity



Facilitation Notes



Practical



Say



Resources



Example



Summary



Role Play



Learning Outcomes

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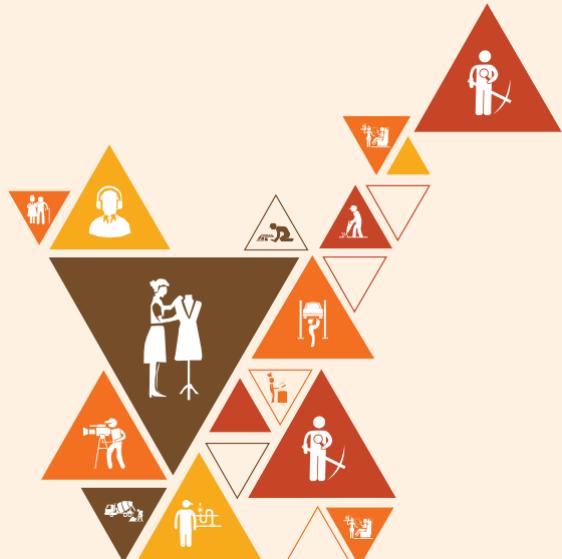
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1. Introduction to the Role of a Wireless Technician

Unit 1.1 - Introduction to Telecom Sector and Role of a Wireless Technician



(TEL/N4122)

Key Learning Outcomes



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

1. Explain the importance of Telecom Sector.
2. Discuss the roles and responsibilities of a Wireless Technician.

Unit 1.1: Introduction to Telecom Sector and Role of a Wireless Technician

Unit Objectives



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

1. Discuss the Wireless Technician's responsibilities in deploying, maintaining, and troubleshooting wireless communication equipment.
2. Describe the key components of wireless network infrastructure, including antennas, access points, and backhaul equipment.
3. Identify different wireless technologies used in broadband connectivity, such as Wi-Fi, 5GHz backhaul, and fixed wireless access (FWA).
4. Elucidate the importance of wireless network performance metrics, such as signal strength, throughput, and interference, in service quality.
5. Explain the importance of communication skills in assisting with wireless equipment configuration, troubleshooting, and resolving connectivity issues.
6. Discuss safety protocols, grounding techniques, and PPE required for wireless equipment installation and maintenance tasks, including working at heights.
7. Describe the career advancement opportunities available for a Wireless Technician in the telecommunications industry.

Resources to be Used



Participant handbook, Presentation slides, Whiteboard and markers, Handouts with key terms and concepts, Samples of electrical and electronic components used for wireless installation, Wi-Fi broadband router and related equipment, Personal Protective Equipment (PPE) such as gloves and goggles, Relevant workplace safety and environmental policies and regulations

Do



- Introduce yourself and welcome the trainees
- Start with an icebreaker activity to create a comfortable learning environment
- Explain the objectives of the session and the topics to be covered
- Use a combination of presentation slides, whiteboard illustrations, and practical demonstrations to teach the concepts
- Encourage active participation and questions from the trainees

Say



- This session aims to provide an overview of the Telecom Sector in India, specifically focusing on Wi-Fi broadband.

- We will discuss the growth and prospects of the industry, the role and responsibilities of a wireless technician, the key components used for wireless installation, and the technologies involved in Wi-Fi broadband.
- Additionally, we will cover the importance of workplace safety, health, and environmental policies and regulations.

Ask

- Have you ever used Wi-Fi?
- What do you think are some of the challenges faced by the Telecom Sector in India?
- Why do you think having workplace safety policies and regulations in place is important?

Elaborate

- The Telecom Sector has seen tremendous growth in India over the past decade, with the introduction of 4G networks and the increasing demand for high-speed internet. This has led to the emergence of new players and the expansion of existing ones.
- Wi-Fi broadband is a key segment of the Telecom Sector, offering high-speed internet access to homes and businesses. The scope and future of the industry are promising, with the government's push towards a Digital India and the increasing adoption of smart devices.
- Wireless technicians play a crucial role in the Telecom Sector, responsible for installing, maintaining, and repairing wireless equipment. They need to have a strong understanding of electrical and electronic components and safety protocols.
- The components used for wireless installation include antennas, cables, connectors, amplifiers, and transmitters. These need to be carefully selected and installed to ensure optimal performance.
- The technologies used in Wi-Fi broadband include Wireless Access Points (WAPs), routers, modems, and Ethernet switches. These enable wireless connectivity and data transfer between devices.
- Workplace safety, health, and environmental policies and regulations are essential to ensure employees' well-being and the environment's protection. These include guidelines for handling hazardous materials, using Personal Protective Equipment (PPE), and maintaining safe working conditions.

Team Activity

1. **Activity name:** Two Truths and a Lie (Icebreaker)
2. **Type:** Group activity
3. **Objective of the activity:** To help participants introduce themselves to each other in a fun and interactive way and build a positive rapport within the group.
4. **Resources:** None
5. **Time Duration:** 20-30 minutes
6. **Instructions:**
 - Ask each participant to introduce themselves to the group by stating their name and three statements about themselves.
 - Explain to the group that two statements are true and one false.
 - Ask the participants to take turns sharing their statements with the group in any order they choose.
 - After each participant shares their statements, ask the group to guess which statement is the lie.
 - Once the group has made their guess, the participant should reveal the lie and the two true statements.
 - Continue the activity until each participant has shared their statements.

7. **Outcome:** The participants will have the opportunity to get to know each other in a fun and interactive way, which will help to create a positive and welcoming environment for the session. Additionally, the activity will help to build trust and rapport between the participants, which is important for effective group learning and collaboration.

Activity



1. **Activity Name:** See and Identify
2. **Type:** Individual activity
3. **Objective of the activity:** To familiarise the participants with the various electrical and electronic components used for wireless installations.
4. **Resources:** A table with different electrical and electronic components used for wireless installations, such as cables, connectors, antennas, power supply, and handouts with names and images of the components for reference.
5. **Time Duration:** 30 minutes
6. **Instructions:**
 - Start by introducing the participants to the different electrical and electronic components used for wireless installations.
 - Place all the components on a table and give each participant a handout.
 - Ask the participants to observe the components and identify each one using the handouts as a reference.
 - The participants can ask the trainer or their peers for assistance if needed.
 - Once all the participants have identified the components, ask them to share their answers with the group.
 - Clarify any doubts or questions the participants may have about the components.
 - Emphasise the importance of each component and how they contribute to the overall functionality of a wireless installation.
7. **Outcome:** Participants will be able to identify different electrical and electronic components used for wireless installations and understand their significance in the installation process. This activity will provide a foundation for understanding the technical aspects of wireless installations and prepare them for further learning.

Notes for Facilitation



- Keep the session interactive and engaging.
- Encourage questions and discussions from the participants.
- Use multimedia tools to deliver the content effectively.
- Provide hands-on experience wherever possible.
- Emphasise the importance of safety guidelines and regulations in the workplace.

Answers to Exercises for PHB

Multiple Choice Questions:

1. d. All of the above
2. d. All of the above
3. b. Used for internet connectivity in commercial and public spaces
4. c. Wi-Fi routers
5. b. Increasing demand due to remote work and online education

Descriptive Questions:

1. Refer to UNIT 1.1: Introduction to Telecom Sector
Topic 1.1.3 Role and Responsibilities of a Wireless Technician
2. Refer to UNIT 1.1: Introduction to Telecom Sector
Topic 1.1.4 Electrical and Electronic Components used for Wireless Installations
3. Refer to UNIT 1.1: Introduction to Telecom Sector
Topic 1.1.2 Wi-Fi Broadband Industry in India
4. Refer to UNIT 1.1: Introduction to Telecom Sector
Topic 1.1.6 Safety, Health and Environmental Regulations for Workplace
5. Refer to UNIT 1.1: Introduction to Telecom Sector
Topic 1.1.5 Wi-Fi Broadband Technology



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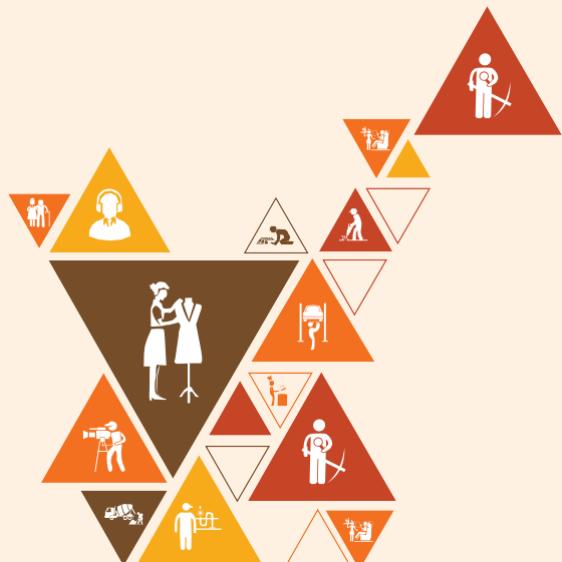
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2. Installation and Wiring of Wireless Communication Equipment

Unit 2.1 - Installation of Wi-Fi System

Unit 2.2 - Complete Documentation



TEL/N4122

Key Learning Outcomes



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

1. Describe the procedures for preparing, wiring, and installing a wireless communication system.
2. Explain the methods for conducting quality checks and performance testing on installed wireless equipment.
3. Discuss the steps involved in completing documentation and site cleanup after a wireless network installation.

Unit 2.1: Installation of Wi-Fi System

Unit Objectives



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

1. Describe industry standards, policies, and best practices for wireless equipment installation and structured cabling.
2. Explain different cable types and their respective connectors.
3. Discuss safety procedures for working at heights, handling electrical installations, and preventing hazards.
4. Describe structured cabling guidelines, including PoP setup, cable routing, and cable management techniques.
5. Determine methods of obtaining and handling installation materials, tools, and equipment at various sites.
6. Explain transmission loss testing methods, power level verification, and troubleshooting techniques.
7. Discuss basic Wi-Fi network principles, including signal propagation, interference, and coverage optimization.
8. Describe firmware updates, basic configurations, and network connectivity checks for wireless devices.
9. Demonstrate how to review and interpret installation plans, site layouts, and job specifications.
10. Show how to coordinate with superiors and site personnel to confirm job requirements and site access.
11. Demonstrate how to select and collect appropriate tools, equipment, and materials as per installation plans.
12. Show how to identify and use suitable cables and connectors based on site requirements.
13. Demonstrate how to measure and verify cable lengths, ensuring continuity and optimal performance.
14. Show how to inspect cable routes for electrical hazards, environmental constraints, and obstructions.
15. Demonstrate how to liaise with local authorities and comply with regulatory requirements for outdoor installations.
16. Show how to determine optimal installation locations adhering to structured cabling norms and signal coverage guidelines.
17. Demonstrate how to ensure systematic and organized wiring from Point of Presence (PoP) to designated sites.
18. Show how to secure and route cables neatly using appropriate clips, trays, and conduits.
19. Demonstrate how to install, terminate, and test feeder cables and connectors, ensuring minimal transmission loss.
20. Show how to mount equipment securely following manufacturer guidelines and electrical safety standards.
21. Demonstrate how to implement proper grounding and earthing techniques for system safety and reliability.

22. Show how to conduct initial equipment setup, firmware updates, and basic configuration as required.
23. Demonstrate how to test cable connectivity, transmission loss, and signal strength using appropriate testing tools.
24. Show how to re-terminate cables if the transmission loss exceeds prescribed limits.
25. Demonstrate how to verify power supply, grounding, and voltage levels to prevent equipment damage.
26. Show how to configure and test Wi-Fi backhaul and access point connectivity for seamless operation.
27. Demonstrate how to troubleshoot and rectify basic connectivity issues and escalate unresolved issues.
28. Show how to dispose of installation waste materials as per environmental and workplace safety guidelines.

Resources to be Used



Participant handbook, Presentation on installation of Wi-Fi system, Different types of cables, connectors, tools, and equipment required for installation, Work orders and job sheets, antenna and other equipment for installation, Transmission loss and strength testing equipment, Handouts with images and specifications of cables, connectors, and tools

Do



- Start the session by explaining the session objectives to the class.
- Encourage participation and create a positive learning environment.
- Use real-life examples to explain concepts and relate them to the participants' work experience.
- Demonstrate the practical aspects of Wi-Fi installation for better understanding.

Say



- We will cover topics such as work orders and job sheets, cable laying, electrical principles, safety measures for turning on the Wi-Fi system, installation steps, cable termination, and cable testing.
- We will learn how to analyse work orders and job sheets and distinguish between different types of cables, connectors, and equipment required for installation.
- Also, we will discuss how to ensure safety while turning on the Wi-Fi system and walk through the installation process.

Ask



- What are the different types of cables and connectors used in Wi-Fi installation?
- How do you ensure safety while turning on the Wi-Fi system?
- What are the different processes involved in cable laying and feeder cable laying?

Elaborate



- Work orders and job sheets provide essential information about the installation process, including equipment specifications, installation location, and requirements for testing and maintenance.
- Different types of cables, connectors, and equipment are required for Wi-Fi installation, including coaxial cables, N-type connectors, drilling machines, and antennas.
- Cable laying involves the installation of cables underground, while feeder cable laying involves the installation of cables above ground.
- Safety measures, such as grounding and equipment inspection, must be considered while turning on the Wi-Fi system.
- Wi-Fi system installation involves several steps: Site survey, equipment mounting, and cable termination.
- Cable termination involves connecting the cable to the equipment and antenna for proper signal transmission.
- Cable testing involves measuring transmission loss and strength to ensure the system functions correctly.

Demonstrate



- Demonstrate the installation of Wi-Fi system components such as cables, connectors, and equipment.
- Show how to terminate cables between the equipment and the antenna.
- Demonstrate the testing of cables and joints for transmission loss and strength.

Activity



1. **Activity name:** Cable Termination Practice
2. **Type:** Group Activity
3. **Objective of the activity:** To practice cable termination and testing skills
4. **Resources:** Cables, connectors, termination tools, and testing equipment.
5. **Time Duration:** 45 minutes
6. **Instructions:**
 - Divide the participants into groups of four.
 - Provide each group with cables, connectors, termination tools, and testing equipment.
 - Ask the groups to practice cable termination and testing under the guidance of the trainer.
- Once the groups have completed the termination and testing, ask them to swap their cables and connectors with other groups for testing.
 - Ask the groups to evaluate the cables and connectors they received and give feedback to the other groups.
 - Encourage group discussion and participation.
7. **Outcome:** By the end of this activity, participants will have practised their cable termination and testing skills, gained feedback from their peers, and improved their understanding of the installation process.

Notes for Facilitation



- Emphasise the importance of safety measures throughout the installation process.
- Encourage active participation and group discussion to create a positive learning environment.
- Encourage peer learning in the class.

Unit 2.2: Complete Documentation

Unit Objectives



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

1. Explain documentation processes, including technical reports, installation logs, and compliance records.
2. Describe customer handling protocols, payment procedures, and conflict resolution strategies.
3. Show how to maintain accurate records of installation, testing results, and equipment details.
4. Demonstrate how to complete all required installation documents and reports in the prescribed format.
5. Show how to collect customer acknowledgment and necessary payments, if applicable.

Resources to be Used



Participant handbook, Presentation slides, Whiteboard and markers, Technical forms and activity logs, Customer feedback forms, Emergency contact information

Do



- Start the session by welcoming the trainees.
- Provide an overview of the session objectives and the topics to be covered.
- Use the Presentation slides to explain the importance of documentation and its impact on customer service.
- Engage the trainees in discussion and encourage them to ask questions.

Say



- In this session, we will learn about the necessary documentation required for installation and the different payment modes.
- We will discuss writing and recording appropriate technical forms and activity logs.
- We will also cover safety norms, emergency contacts, and the escalation matrix for reporting incidents and emergencies.

Ask



- What documentation is required for installation and why is it important?
- How does documentation impact customer service?
- Have you ever experienced a situation where proper documentation would have helped resolve a customer issue?

Elaborate



- The importance of customer feedback in improving service quality and building customer loyalty.
- The necessary documentation required for installation, including technical forms and activity logs, and how to fill them out accurately.
- Different payment modes and the documentation required for each mode.
- Safety norms and emergency contacts need to be documented and easily accessible.
- The escalation matrix for reporting incidents and emergencies, including the process for fire, system and power failures.

Demonstrate



Demonstrate how to accurately fill out a technical form and activity log and properly document safety norms and emergency contacts.

Activity



1. **Activity name:** Documentation Review
2. **Type:** Group Activity
3. **Objective of the activity:** To review and improve technical forms and activity logs.
4. **Resources:** Technical forms and activity logs, Whiteboard and markers.
5. **Time Duration:** 30 minutes
6. **Instructions:**
 - Divide the trainees into groups of 3-4.
 - Provide each group with a set of technical forms and activity logs.
 - Instruct each group to review and discuss the forms and logs, and identify any areas for improvement.
 - Each group should then present their findings to the rest of the class.
 - Facilitate a discussion on the findings and encourage the trainees to suggest improvements.
7. **Outcome:** Trainees will have a better understanding of the importance of accurate documentation and will have identified areas for improvement in technical forms and activity logs.

Notes for Facilitation



- Emphasise the importance of accurate documentation in ensuring customer satisfaction and loyalty.
- Encourage trainees to ask questions and provide examples from their own experiences.
- Use real-life examples to help trainees understand the impact of inadequate documentation.
- Provide clear and concise instructions for the activity to ensure all trainees participate fully.
- Encourage collaboration and discussion during the activity to facilitate learning and knowledge sharing.

Answers to Exercises for PHB

Multiple Choice Questions:

1. 1. b. job-sheet
2. 2. a. Wi-Fi backhaul
3. 3. c. Feeder
4. 4. a. Site Survey Report
5. 5. b. escalation matrix

Descriptive Questions:

1. Refer to UNIT 2.1: Installation of Wi-Fi System
Topic 2.1.6 Wi-Fi System Installation
2. Refer to UNIT 2.2: Complete Documentation
Topic 2.2.5 General Safety Norms to be Followed at Workplace
3. Refer to UNIT 2.2: Complete Documentation
Topic 2.2.1 Importance of Satisfactory Customer Service
4. Refer to UNIT 2.2: Complete Documentation
Topic 2.2.6 Escalation Matrix for Reporting Incidents
5. Refer to UNIT 2.1: Installation of Wi-Fi System
Topic 2.1.9 Electrical Principles to be Considered while Turning on the Wi-Fi System



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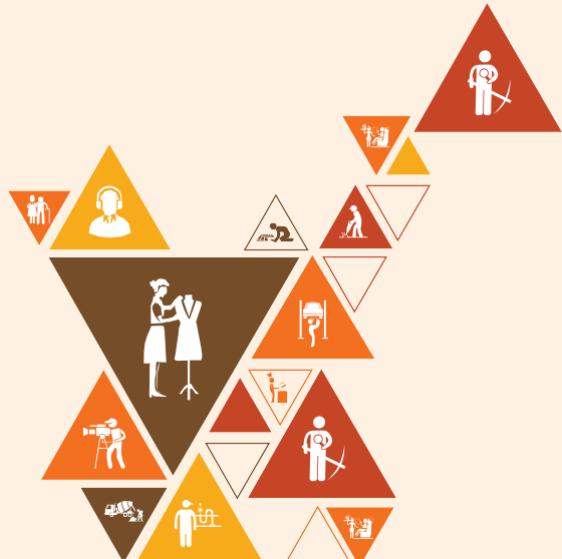
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3. Configuring Equipment and Establishing Wireless Network Connectivity

Unit 3.1 - Setting up Wi-Fi Network

Unit 3.2 - Establishing Connectivity



TEL/N4123

Key Learning Outcomes



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

1. Describe the process of configuring wireless network equipment.
2. Explain the steps involved in establishing and verifying wireless network connectivity.
3. Determine the methods for recording configuration settings and test results for wireless network deployments.

Unit 3.1: Setting up Wi-Fi Network

Unit Objectives



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

1. Describe the fundamental concepts of wireless networking, including IEEE 802.11 standards, frequency bands, and channel interference.
2. Explain network topologies, broadband network elements, gateways, TCP/IP, DHCP, and subnetting.
3. Discuss key performance parameters such as signal strength, VSWR, return loss, and link budget calculations.
4. Describe industry best practices for securing wireless networks, including encryption standards, firewall configurations, and intrusion prevention measures.
5. Determine tools and software used for configuring, testing, and monitoring network performance.
6. Elucidate the importance of firmware updates and software patches in maintaining network security and reliability.
7. Describe guidelines for proper cable management, grounding techniques, and protection against environmental damage.
8. Discuss basic electrical safety measures and first aid procedures for handling installation-related hazards.
9. Demonstrate how to install and securely mount Wi-Fi backhaul equipment and access points as per site specifications.
10. Show how to connect feeder cables with antennas and measure VSWR/return loss to ensure optimal signal transmission.
11. Demonstrate how to align antennas based on surveyed signal strength and adjust orientation for optimal connectivity.
12. Show how to establish physical connections between Wi-Fi backhaul equipment, Wi-Fi access points, and network switches.
13. Demonstrate how to configure equipment settings, including IP addresses, subnet masks, and default gateways, according to base configurations.
14. Show how to access network settings using default login credentials and update them with secure passwords.
15. Demonstrate how to apply encryption and authentication settings (WPA2/WPA3) to secure network access.
16. Show how to update firmware and software patches to ensure compliance with industry standards and security best practices.
17. Demonstrate how to ensure all cables and connectors are properly secured and free from damage.

Resources to be Used



Participant handbook, a laptop or PC with Wi-Fi capabilities, Wi-Fi backhaul equipment and Wi-Fi access points, Projector and screen for presenting slides, Handouts or digital resources on wireless technologies, network topologies, broadband network elements, TCP/IP, and configuration settings

Do

- Introduce the session and explain the objectives of the class.
- Present slides and demonstrate practical applications of the topics covered.
- Conduct an activity to engage the trainees in applying the concepts learned.
- Summarise the key takeaways from the session.

Say

- This session aims to understand the basic concepts of wireless technologies and how to connect a laptop/PC with Wi-Fi backhaul equipment.
- In this session, we will cover network topologies, broadband network elements, TCP/IP, IP address, subnet masks, Ethernet address, MAC address, IPv4, IPv6, command line access, and command prompts to execute basic commands.
- We will also discuss the procedure for recording configuration settings.

Ask

- What are some examples of wireless technologies that you use in your daily life?
- Have you ever connected a device to a Wi-Fi network before? If so, what was the process like?

Elaborate



- Basic concepts of wireless technologies:
 - Explain the difference between wired and wireless technologies.
 - Describe the types of wireless technologies, such as Wi-Fi, Bluetooth, and cellular.
 - Explain how wireless signals work and how they are transmitted.
- Network topologies and elements:
 - Describe the different network topologies, such as star, ring, and mesh.
 - Explain the elements of a broadband network, such as Wi-Fi routers, switches, and access points.
 - Describe what a Gateway is and its function in a network.
 - Define TCP/IP and explain its function in a network.
 - Explain IP address, subnet masks, Ethernet address, MAC address, IPv4, and IPv6.
- Steps to connect a laptop/PC with Wi-Fi backhaul equipment:
 - Explain the step-by-step process of connecting a laptop/PC to Wi-Fi backhaul equipment.
 - Demonstrate the process using practical examples.

- Command line access and prompts to execute basic commands:
 - Explain the command line access and command prompts to execute basic commands.
 - Describe the basic commands like ping and IP configuration.
- Configuration settings at Wi-Fi equipment and Wi-Fi access points:
 - Explain the configuration settings at Wi-Fi equipment and Wi-Fi access points.
 - Describe how to record configuration settings.

Demonstrate



- Demonstrate how to connect a laptop/PC to Wi-Fi backhaul equipment and access points.
- Demonstrate how to configure Wi-Fi equipment and access points.

Activity



1. **Activity name:** Cable "Connect and Configure" Activity
2. **Type:** Group Activity
3. **Objective of the activity:** To apply the concepts learned and connect a laptop/PC with Wi-Fi backhaul equipment.
4. **Resources:** Wi-Fi backhaul equipment and Wi-Fi access points
5. **Time Duration:** 30-45 minutes
6. **Instructions:**
 - Divide the trainees into groups of 2-3.
 - Provide each group with a laptop/PC, Wi-Fi backhaul equipment, and Wi-Fi access points.
 - Instruct the groups to connect their laptops/PCs to the Wi-Fi network using the concepts learned in the class.
 - Instruct the groups to configure the Wi-Fi backhaul equipment and Wi-Fi access points according to the configuration settings discussed in the class.
 - Monitor the groups' progress and provide assistance if needed.

Outcome: Trainees will be able to apply the concepts learned to connect a laptop/PC with Wi-Fi backhaul equipment and configure the equipment according to the required settings.

Notes for Facilitation



- Encourage trainees to ask questions and participate in the activity.
- Emphasise the importance of applying the concepts learned in a practical setting.
- Provide feedback and guidance during the activity.
- Remind trainees to take notes and ask questions throughout the session.
- Ensure that all trainees are following the activity and have access to the necessary resources.

Unit 3.2: Establishing Connectivity

Unit Objectives



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

1. Explain standard troubleshooting methodologies for network failures, slow speeds, and intermittent connectivity issues.
2. Explain best practices for maintaining customer satisfaction, including clear communication of service expectations and troubleshooting guidance.
3. Show how to conduct a ping test to the service provider gateway and analyze latency, packet loss, and jitter parameters.
4. Demonstrate how to validate throughput performance using network testing tools and document results.
5. Show how to configure end-user devices with appropriate SSIDs, security credentials, and DNS settings.
6. Demonstrate how to verify end-user connectivity by executing network diagnostic commands and troubleshooting connectivity issues.
7. Show how to perform a security compliance check by testing firewall settings, encryption status, and unauthorized access points.
8. Demonstrate how to maintain accurate records of network configurations, including IP assignments, security protocols, and firmware versions.
9. Show how to document testing procedures, expected results, and any deviations observed during connectivity tests.
10. Demonstrate how to create a troubleshooting log with identified issues, root causes, and corrective actions taken.
11. Show how to educate customers on basic troubleshooting techniques and network optimization tips.

Resources to be Used



Participant handbook, Wi-Fi backhaul equipment, Wi-Fi access points, End-user devices (laptop, smartphone, etc.), First-aid kit, Whiteboard and marker

Do 

- Begin the session by welcoming the participants and introducing the topics to be covered.
- Conduct a brief recap of the previous session to refresh the participants' memory.
- Demonstrate the practical steps involved in establishing connectivity with the service provider getaway and then between the Wi-Fi backhaul equipment, Wi-Fi access points, and end-user devices.
- Conduct a speed test to check the connection's functionality.

Say 

- In this session, we will learn how to establish connectivity between the service provider getaway and the end user devices via Wi-Fi backhaul equipment and Wi-Fi access points.
- We will also conduct a speed test to check the connectivity's functionality, which is crucial for ensuring that the customers are satisfied with the service.
- Additionally, we will discuss the importance of having a first-aid kit and help at the workplace to ensure the safety and well-being of the employees.

Ask 

- Have you ever faced connectivity issues while using Wi-Fi?
- What are some common causes of slow connectivity?
- Why do you think having a first-aid kit and help at the workplace is important?

Elaborate 

- Establishing connectivity involves configuring the Wi-Fi backhaul equipment and Wi-Fi access points, assigning IP addresses, and establishing a connection with the service provider getaway.
- Conducting a speed test is essential to ensure the connection functions correctly and meets the customer's expectations.
- Having a first-aid kit and help at the workplace is essential for addressing any health or safety concerns that may arise during work hours.

Demonstrate 

The facilitator will demonstrate the practical steps in establishing connectivity with the service provider getaway, Wi-Fi backhaul equipment, access points, and end-user devices.

Activity



1. **Activity name:** Connectivity Speed Test
2. **Type:** Individual activity
3. **Objective of the activity:** To conduct a speed test and check the connectivity's functionality.
4. **Resources:** Laptop, smartphone, or other end-user devices with Wi-Fi connectivity.
5. **Time duration:** 10 minutes
6. **Instructions:**
 - Connect your device to the Wi-Fi network.
 - Open any browser and go to the website www.speedtest.net.
 - Click on "Go" to conduct the speed test.
 - Note down the download and upload speeds.
 - Compare the speeds with the expected speeds to ensure the connectivity is functioning correctly.
7. **Outcome:** Participants will be able to conduct a speed test and check the connectivity's functionality.

Notes for Facilitation



- Emphasise the importance of checking the connectivity's functionality to ensure that the customers are satisfied with the service.
- Encourage participants to ask questions and clarify doubts during the session.
- Provide feedback and suggestions to participants while they conduct the activity.
- Ensure that the participants are following safety guidelines while conducting the activity.
- Provide information about the location of the first-aid kit and emergency contact numbers.

Answers to Exercises for PHB

Multiple Choice Questions:

1. b. Wireless technology
2. c. Topology
3. a. Modem
4. c. Gateway
5. b. First aid

Descriptive Questions:

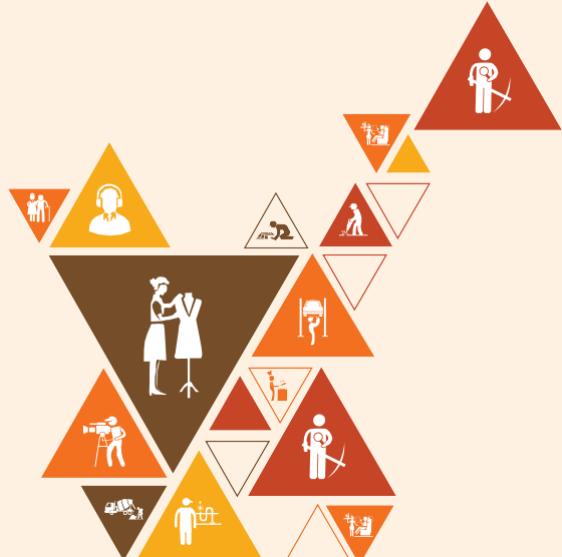
1. Refer to UNIT 3.1: Setting up Wi-Fi Network
Topic 3.1.1 Concept of Wireless Technology
2. Refer to UNIT 3.1: Setting up Wi-Fi Network
Topic 3.1.2 Network Topologies
3. Refer to UNIT 3.1: Setting up Wi-Fi Network
Topic 3.1.3 Broadband Network Elements
4. Refer to UNIT 3.1: Setting up Wi-Fi Network
Topic 3.1.11 Command Line Access / Command Prompts
5. Refer to UNIT 3.2: Establishing Connectivity
Topic 3.2.3 First-Aid Box



4. Diagnosing and Rectifying Wireless Network Faults

Unit 4.1 - Prepare for Troubleshooting Wi-Fi Backhaul Equipment

Unit 4.2 - Troubleshoot Wi-Fi Network Setup



TEL/N4124

Key Learning Outcomes



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

1. Determine the methods used to diagnose and rectify wiring faults in wireless networks.
2. Explain the process of troubleshooting and repairing Wi-Fi backhaul equipment operating at 5 Ghz.
3. Describe the procedures for troubleshooting and restoring Wi-Fi access points operating at 2.4 GHz.
4. Discuss the steps involved in carrying out documentation and restoring the worksite after wireless network fault rectification.

Unit 4.1: Prepare for Troubleshooting Wi-Fi Backhaul Equipment

Unit Objectives



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

1. Describe the types, specifications, and limitations of network cables, connectors, and feeder cables.
2. Explain industry standards and best practices for cable crimping, soldering, and termination.
3. Discuss the functionality and usage of test equipment such as network testers, spectrum analyzers, and cable testers.
4. Determine the impact of Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) on network performance.
5. Discuss safety procedures for handling electrical equipment, including grounding and surge protection.
6. Describe risk assessment techniques and incident response protocols for network failures.
7. Explain escalation processes for unresolved faults and emergency incidents, such as power failures and system crashes.
8. Demonstrate how to conduct continuity tests using appropriate tools and localize fault distance.
9. Show how to perform re-connectorization/crimping of cable pairs with connectors or replace faulty cables.
10. Demonstrate how to replace feeder cables or antennas as per network specifications.
11. Show how to conduct signal and interference tests to validate cable performance.
12. Demonstrate how to reconfigure network devices, if necessary, after cable replacement.
13. Show how to interpret status and error indicators on the Wi-Fi backhaul equipment.
14. Demonstrate how to connect and operate a handheld network tester for fault diagnosis.
15. Show how to use cable and antenna testers to check connectivity and performance.
16. Demonstrate how to verify and adjust antenna alignment for optimal signal strength.
17. Show how to analyze diagnostic results to localize and rectify faults in backhaul connectivity.

Resources to be Used



Participant handbook, Whiteboard and markers, Laptop with Projector or smart TV, Modems and network equipment for demonstration, Crimping and soldering tools, Handout materials on EMI/EMC concepts and fault rectification, Whiteboard and markers.

Do

- Introduce the objectives and expectations of the session.
- Encourage participation and questions throughout the session.

Say

- This session will cover important concepts related to establishing connectivity, including EMI/EMC, re-configuring Wi-Fi backhaul equipment, network equipment lights, fault rectification tools, and crimping/soldering.
- Our goal is to help you understand the technical aspects of establishing connectivity and provide practical tips for troubleshooting and maintenance.
- By the end of this session, you will better understand how to ensure reliable connectivity for your clients or customers.

Ask

- What challenges have you faced when establishing connectivity in the past?
- How familiar are you with EMI/EMC and network equipment maintenance?
- What specific topics would you like to learn more about during this session?

Elaborate

- EMI/EMC: Discuss the basics of electromagnetic interference and compatibility and how they affect modem performance. Explain different preventive approaches for different modems.
- Re-configuring Wi-Fi backhaul equipment: Discuss the value of re-configuring equipment and how to do it at the service provider gateway or end-user devices. Provide step-by-step instructions and best practices for re-configuring.
- Network equipment lights: Explain different indicative lights on network equipment and what they mean for connectivity.
- Fault rectification tools: List and explain the different tools required for fault rectification, including multimeters, cable testers, and tone generators.
- Crimping/soldering process: Explain the crimping and soldering process for terminating cables and connectors, and demonstrate proper technique and safety precautions.

Demonstrate

Demonstrate the proper use of a multimeter, cable tester, and tone generator, and demonstrate proper crimping and soldering techniques.

Activity



1. **Activity name:** Network Maintenance
2. **Type:** Group activity
3. **Objective of the activity:** To practice troubleshooting common connectivity issues and network maintenance tasks.
4. **Resources:** Hand out materials on common connectivity issues and maintenance tasks.
5. **Time Duration:** 30 minutes
6. **Instructions:**
 - Divide the group into teams of three or four.
 - Provide each team with a set of handout materials outlining different connectivity issues and maintenance tasks.
 - Instruct the teams to work together to identify and troubleshoot the issues described in the materials.
 - Encourage teams to use their own experience and knowledge, as well as the demonstration and explanation provided during the session.
 - After 20 minutes, reconvene the group and discuss the identified issues and solutions.
1. **Outcome:** The activity allows participants to practice troubleshooting common connectivity issues and network maintenance tasks in a group setting. By working together in teams, participants can collaborate and share their knowledge to identify and solve problems related to network connectivity.

Notes for Facilitation



- Emphasise the importance of understanding EMI/EMC and network equipment maintenance in establishing reliable connectivity.
- Encourage participation and questions throughout the session to facilitate learning and engagement.
- Be patient and supportive during the practical demonstration and activity, and provide feedback and guidance as needed.
- Be aware of time constraints and adjust the pace of the session accordingly.
- Encourage participants to take notes and ask questions throughout the session.

Unit 4.2: Troubleshoot Wi-Fi Network Setup

Unit Objectives



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

1. Describe standard commands and procedures for configuring and troubleshooting wireless networking equipment.
2. Explain the parameters affecting signal quality, including interference sources and signal attenuation.
3. Demonstrate how to perform firmware updates and configuration resets, if required.
4. Show how to identify status and diagnostic indicators on Wi-Fi access points.
5. Demonstrate how to connect and utilize network testing tools for fault detection.
6. Show how to interpret output from troubleshooting equipment and software diagnostics.
7. Demonstrate how to access Wi-Fi access point settings through a browser or application to perform configuration checks.
8. Show how to reset, update, or replace malfunctioning Wi-Fi access points based on diagnostic findings.
9. Demonstrate how to record troubleshooting steps and localized faults in logs or digital records.
10. Show how to document all modifications and replacements undertaken during fault rectification.
11. Demonstrate how to restore any worksite changes made during fault repair to meet client and workplace standards.

Resources to be Used



Participant handbook, Portable tester device, Feeder cable/antenna replacement tools, Laptop or other portable device, Handout materials on troubleshooting Wi-Fi networks, Whiteboard and markers.

Do



- Set up a workspace with the necessary tools and materials for hands-on troubleshooting.
- Prepare a demonstration of how to use the portable tester device and replace a faulty feeder cable/antenna.
- Provide each trainee with a laptop or other portable device for hands-on practice.
- Allocate time for trainees to practice each troubleshooting step under the guidance of the facilitator.

Say

- In this session, we will learn how to troubleshoot Wi-Fi network setups.
- Using a portable tester device, we will cover fault identification, isolation, and rectification techniques.
- We will also practice re-configuring Wi-Fi backhaul equipment and troubleshooting both 5Ghz and 2.4Ghz access points.

Ask

- What are some common issues you have experienced when setting up a Wi-Fi network?
- What techniques have you used to troubleshoot those issues?

Elaborate

- Locating and inspecting faults using a portable tester device.
- Replacing feeder cable/antenna if found faulty.
- Performing the steps for re-configuration of Wi-Fi backhaul equipment, if required.
- Troubleshooting Wi-Fi backhaul equipment (5 GHz) and access points (2.4 GHz).
- Recording steps were undertaken for fault localisation/isolation and fault rectification.
- Demonstrating the functioning of a laptop or other specific portable device to carry out fault diagnostics and repairs.

Demonstrate

Demonstrate how to use a portable tester device to locate and inspect faults, as well as how to replace a faulty feeder cable/antenna.

Activity

1. **Activity name:** Wi-Fi Network Troubleshooting
2. **Type:** Group activity
3. **Objective of the activity:** To practice fault identification, isolation, and rectification techniques using a portable tester device and re-configuring Wi-Fi backhaul equipment.
4. **Resources:** Handout materials on Wi-Fi network troubleshooting, portable tester devices, laptops or other portable devices.
5. **Time Duration:** 60 minutes
6. **Instructions:**
 - Divide the group into teams of three or four.
 - Provide each team with a set of handout materials outlining different Wi-Fi network troubleshooting scenarios.

- Instruct each team to use a portable tester device to locate and inspect faults, re-configure Wi-Fi backhaul equipment, and replace a faulty feeder cable/antenna.
- Encourage teams to use their own experience and knowledge, as well as the demonstration and explanation provided during the session.
- After 50 minutes, reconvene the group and have each team present their findings and solutions.

7. Outcome: Trainees will have hands-on practice in fault identification, isolation, and rectification techniques using a portable tester device and re-configuring Wi-Fi backhaul equipment. They will also gain experience in working collaboratively and presenting their findings to the group.

Notes for Facilitation



- Remind trainees to record steps for fault localisation/isolation and rectification.
- Encourage trainees to ask questions and seek guidance as needed.
- Provide feedback and positive reinforcement throughout the activity.
- Allocate sufficient time for each team to practice each troubleshooting step.

Answers to Exercises for PHB

Multiple Choice Question

1. a. Electromagnetic Interference
2. b. Subnet Mask
3. c. Gateway address
4. a. multimeter
5. a. Crimping

Descriptive Questions:

1. Refer to UNIT 4.1: Prepare for Troubleshooting Wi-Fi Backhaul Equipment
Topic 4.1.1 EMI/EMC Concepts
2. Refer to UNIT 4.1: Prepare for Troubleshooting Wi-Fi Backhaul Equipment
Topic 4.1.2 Re-Configuring the Wi-Fi Backhaul Equipment
3. Refer to UNIT 4.1: Prepare for Troubleshooting Wi-Fi Backhaul Equipment
Topic 4.1.5 Crimping/Soldering Process
4. Refer to UNIT 4.2: Troubleshoot Wi-Fi Network Setup
Topic 4.2.1 Locate and Inspect Faults using Portable Tester Device
5. Refer to UNIT 4.2: Troubleshoot Wi-Fi Network Setup
Topic 4.2.4 Troubleshoot Wi-Fi Access Points (2.4 GHz)



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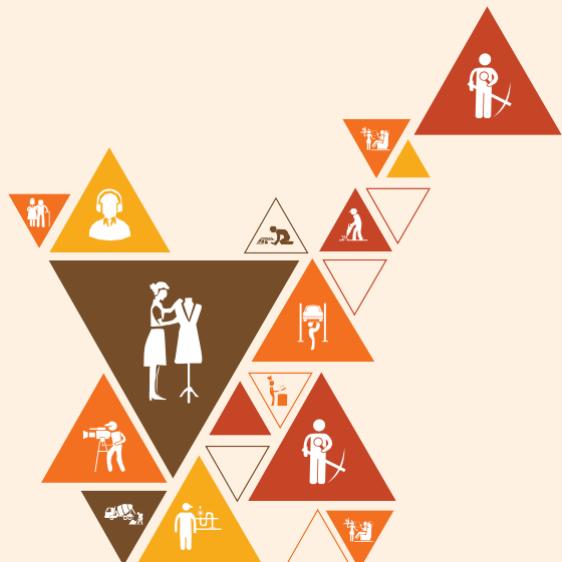
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5. Installing, Testing, and Maintaining UPS and Domestic Power Supply

Unit 5.1 - Plan for UPS Installation

Unit 5.2 - Install UPS and Check the Electrical Parameters



TEL/N4125

Key Learning Outcomes



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

1. Describe the procedures for installing a UPS system and checking electrical parameters.
2. Explain how to conduct power supply checks and ensure compliance with relevant standards.
3. Determine the steps involved in performing preventive maintenance and troubleshooting UPS systems.

Unit 5.1: Plan for UPS Installation

Unit Objectives

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

1. Describe standard voltage and current norms for domestic and small commercial power supply systems.
2. Explain guidelines for checking earthing, insulation resistance, and power continuity.
3. Discuss types of UPS systems (Offline, Line-interactive, Online) and their applications.
4. Describe UPS installation best practices, including wiring standards and safety protocols.
5. Determine UPS power ratings, load calculations, and capacity planning.
6. Explain the functioning and use of test equipment (multimeters, clamp meters, insulation testers).
7. Discuss types of batteries used in UPS, battery management practices, and charge cycles.
8. Describe common faults in UPS and troubleshooting methods.
9. Elucidate safety regulations, electrical codes, and protective measures for handling power systems.
10. Explain documentation and reporting procedures for installation, testing, and maintenance activities.
11. Demonstrate how to identify appropriate UPS type and capacity based on the equipment load and power requirements.
12. Demonstrate how to plan installation activities, ensuring adherence to manufacturer guidelines and safety protocols.
13. Show how to read and interpret wiring diagrams and circuit layouts to ensure correct installation.

Resources to be Used

Participant Handbook, Whiteboard, Marker, Whiteboard and markers, Handouts explaining types of UPS and batteries, Wiring diagrams of different types of UPS, Calculators, UPS specification sheets, and Safety equipment such as gloves and goggles.

Do

- Begin the session by introducing the topic and the learning outcomes for the session.
- Use a combination of lectures, discussions and practical activities to engage the participants.
- Demonstrate how to analyse basic wiring diagrams and calculate equipment loads.
- Encourage participants to ask questions and share their experiences.

Say

- Welcome to the Plan for UPS Installation class. In this session, we will cover various types of UPS, types of batteries compatible with UPS, installation activities and how to calculate equipment load vis-à-vis UPS rating.

- Our objective today is to ensure that all participants understand the fundamentals of UPS installation and can apply this knowledge in their work environment.
- We will be using a combination of lectures, discussions and practical activities to engage the participants.

Ask



- What is a UPS, and why is it important?
- What are the different types of UPS, and how are they used?
- Have you had any experience with installing a UPS? If so, what challenges did you face?

Elaborate



- Different types of UPS: Standby, line-interactive, and online.
- Types of batteries compatible with UPS: Lead-acid, nickel-cadmium, lithium-ion.
- UPS installation activities: Site survey, UPS placement, battery installation, wiring and grounding.
- Analysing basic wiring diagrams: Understanding the components, symbols and connections.
- Distinguishing UPS based on its power ratings: VA vs. Watts, load capacity, and runtime.
- Calculating equipment load vis-à-vis UPS rating: Understanding power factors, converting VA to Watts, and determining the total load.

Demonstrate



- Demonstrate how to analyse a wiring diagram for a specific UPS model.
- Show how to calculate equipment load for a specific power configuration.

Activity



1. **Activity name:** UPS Installation Planning
2. **Type:** Group Activity
3. **Objective of the Activity:** To plan for the installation of a UPS in a hypothetical environment.
4. **Resources:** Whiteboard, markers, handouts on UPS and battery types, wiring diagrams of different types of UPS, calculators, and UPS specification sheets.
5. **Time Duration:** 30 minutes
6. **Instructions:**
 - Divide the participants into groups of 3 or 4.
 - Provide each group with a hypothetical environment scenario where a UPS needs to be installed.
 - Each group must analyse the site survey, placement, battery requirements, and wiring diagrams to plan for the installation.
 - Encourage the participants to discuss and share their thought process with each other.
 - After 20 minutes, each group should present their installation plan to the class.
7. **Outcome:** Participants will gain experience planning for UPS installations and learn from each other's perspectives.

Notes for Facilitation



- Ensure that all participants understand the learning outcomes.
- Encourage participation and engagement from all participants.
- Provide ample opportunity for questions and discussions.
- Ensure that participants are following safety guidelines when working with electrical equipment.
- Emphasise the importance of proper planning and documentation for UPS installations.

Unit 5.2: Install UPS and Check the Electrical Parameters

Unit Objectives



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

1. Review wiring standards, polarity, and phase alignment for UPS systems.
2. Understand procedures for verifying grounding and power quality after installation.
3. Demonstrate how to inspect and verify power supply connections for voltage, current, earthing, and continuity.
4. Demonstrate how to install and securely mount UPS as per the specified standards.
5. Show how to route and connect power supply through UPS, ensuring proper input and output wiring.
6. Demonstrate how to check for polarity and phase alignment to avoid incorrect wiring.
7. Show how to verify the proper grounding of the UPS and connected equipment.
8. Demonstrate how to use multimeters and clamp meters to measure and validate voltage, current, and earthing resistance.
9. Show how to test power backup functionality by simulating a power failure scenario.
10. Demonstrate how to ensure the UPS output matches the required power quality standards.
11. Show how to identify and report fluctuations or irregularities in power supply that may affect equipment performance.
12. Demonstrate how to apply safety precautions while handling high-voltage connections and power tools.
13. Show how to inspect and test UPS batteries for charge retention and health status.
14. Demonstrate how to replace faulty or degraded batteries following standard replacement procedures.
15. Show how to clean and secure UPS ventilation to prevent overheating.
16. Demonstrate how to diagnose and troubleshoot common UPS faults such as overloading, short circuits, and failed inverters.
17. Show how to document test results, maintenance actions, and reported issues as per standard procedures.
18. Demonstrate how to communicate findings and recommendations to customers or supervisors.

Resources to be Used



Participant handbook, Whiteboard, Marker, Notepad, Pens, UPS kit, Multimeter, Electrical tools (pliers, screwdriver, etc.), Battery replacement kit (if available), User manuals for the UPS and multimeter, PowerPoint slides

Do

- Provide an overview of the session.
- Begin the session by covering the learning outcomes in a logical sequence.
- Conduct the activity and provide feedback to the trainees.
- Recap the session and summarise the key takeaways.
- Close the session and answer any remaining questions.

Say

- Today, we will learn how to install UPS and check the electrical parameters.
- We will start with a brief overview of the components of the UPS kit and how to use them.
- We will then move on to the installation process and cover the voltage, current, and earthing checks.
- Next, we will show you how to route the power supply through UPS and discuss the precautions to be taken while handling power supplies.
- Finally, we will cover the checks required to replace the battery in case of a defective UPS.

Ask

- What is your experience with installing UPS?
- Have you ever faced any issues with the electrical parameters of a UPS?
- How important is it to follow the manufacturer's instructions while installing UPS?

Elaborate

- Installing UPS involves several steps, including unpacking, assembling, connecting, and testing. It is crucial to follow the manufacturer's instructions carefully to ensure proper installation and avoid damage to the equipment.
- Checking voltage, current, and earthing is essential to ensure that the UPS is functioning correctly and is safe to use. Using a multimeter can help you measure these parameters accurately.
- Routing the power supply through the UPS involves connecting the power cord to the UPS's input port and the equipment's output port. Following the manufacturer's instructions and taking precautions to avoid electric shocks and fires is essential.
- Precautions to be taken while handling power supplies include wearing appropriate personal protective equipment, avoiding contact with water, and disconnecting the power supply before working on it.
- Replacing the battery in a defective UPS requires following the manufacturer's instructions carefully and using the right tools. Checking the battery regularly can help identify any defects early and prevent downtime.

Demonstrate



- Demonstrate the steps involved in installing the UPS, including unpacking, assembling, connecting, and testing.
- Demonstrate how to use a multimeter to check voltage, current, and earthing.
- Show how to route the power supply through the UPS and demonstrate the precautions to be taken while handling power supplies.
- If the resources are available, demonstrate how to replace the battery in a defective UPS.

Activity



1. **Activity name:** Installation and Testing of UPS
2. **Type:** Group activity
3. **Objective of the activity:** To apply the knowledge gained during the session and install and test a UPS.
4. **Resources:** UPS kit, multimeter, electrical tools, PowerPoint slides
5. **Time Duration:** 45 minutes
6. **Instructions:**
 - Divide the trainees into groups of 2-3 members each.
 - Provide each group with a UPS kit, a multimeter, and electrical tools.
 - Ask the groups to together to install the UPS following the manufacturer's instructions and using the tools provided.
 - Instruct the groups to use the multimeter to check the UPS's voltage, current, and earthing.
 - Ask the groups to test the UPS by connecting it to a device and verifying that it is working correctly.
 - Provide feedback to the groups and answer any questions they may have.
7. **Outcome:** By the end of this activity, trainees will have hands-on experience installing and testing a UPS and will have a better understanding of the installation process and the checks required to ensure proper functioning of the UPS.

Notes for Facilitation



- Ensure that trainees follow safety guidelines while handling the equipment.
- Encourage trainees to ask questions and clarify any doubts they may have.
- Emphasise the importance of following the manufacturer's instructions and taking necessary precautions while installing and handling power supplies.
- Provide feedback to the trainees on their performance during the activity.
- Summarise the key takeaways from the session and encourage trainees to apply their knowledge in real-world scenarios.

Answers to Exercises for PHB

Multiple Choice Questions:

1. d. All of the above
2. d. All of the above
3. a. To ensure the UPS is not overloaded
4. d. Replace the battery with any type of battery available
5. b. ANSI and IEC standards

Descriptive Questions:

1. Refer to UNIT 5.2: Install UPS and Check the Electrical Parameters
Topic 5.2.6 Precautions While Handling Power Supplies
2. Refer to UNIT 5.1: Plan for UPS Installation
Topic 5.1.2 Types of Batteries Compatible with UPS
3. Refer to UNIT 5.1: Plan for UPS Installation
Topic 5.1.6 Power Rating of UPS
4. Refer to UNIT 5.2: Install UPS and Check the Electrical Parameters
Topic 5.2.1 Installing UPS
5. Refer to UNIT 5.2: Install UPS and Check the Electrical Parameters
Topic 5.2.5 Replace Faulty Battery



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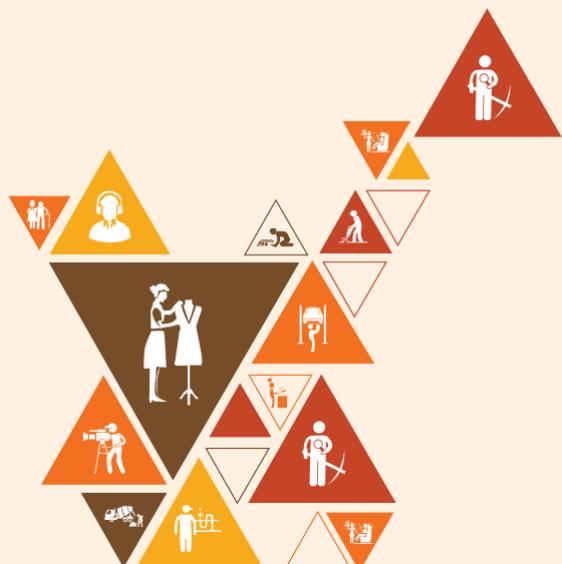
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6. Sustainability Practices in Telecom Infrastructure Installation

Unit 6.1- Environmental Sustainability and Waste Management in the
Telecommunications Industry



TEL/N9105

Key Learning Outcomes



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

1. Explain sustainable practices in telecom infrastructure installation, including waste management and energy efficiency.
2. Discuss compliance with environmental regulations and the importance of maintaining records of sustainability measures

Unit 6.1: Environmental Sustainability and Waste Management in the Telecommunications Industry

Unit Objectives



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

1. Explain national and international environmental laws and regulations governing telecom infrastructure installation.
2. Describe e-waste management and recycling policies applicable to telecom sites.
3. Identify occupational safety and health standards related to environmental practices.
4. List recyclable and refurbishable telecom components and their proper handling techniques.
5. Define methods for reducing electronic waste through responsible procurement and reuse.
6. Explain advancements in eco-friendly telecom infrastructure and the use of renewable energy sources.
7. Elucidate techniques for optimizing energy consumption in telecom operations.
8. Describe proper disposal methods for hazardous and non-hazardous waste.
9. Explain procedures for collaborating with authorized agencies for waste collection and disposal.
10. Identify best practices for reducing the carbon footprint of telecom installations.
11. Show how to identify telecom components suitable for recycling or refurbishment.
12. Demonstrate the process of sorting electronic and non-electronic waste according to disposal protocols.
13. Show the correct labeling and storage of recyclable and refurbishable components.
14. Demonstrate the safe handling and disposal of hazardous and non-hazardous waste.
15. Show the proper coordination process with authorized e-waste recycling units or disposal agencies.
16. Demonstrate the use of energy-efficient tools and equipment during telecom installations.
17. Show how to optimize infrastructure placement to minimize energy consumption.
18. Demonstrate the maintenance of records for waste disposal and sustainability measures.
19. Show how to guide team members on sustainable practices and encourage environmentally responsible habits.

Resources to be Used



Participant Handbook, Whiteboard, Marker, PowerPoint presentation on quality standards, Handouts on key performance indicators and feedback processes, Flipchart and markers, Notepad and Pens

Do

- Welcome the trainees and introduce yourself.
- Provide an overview of the session objectives and what will be covered.
- Facilitate discussions and activities that reinforce the session objectives.

Say

- This session aims to help you understand the importance of Environmental Sustainability and Waste Management in the Telecommunications Industry and provide you with the knowledge and tools necessary to do so.
- Throughout the session, we will be discussing various strategies, performance indicators, feedback processes, timelines and goals, recording and documenting tasks, escalation matrix, problem analysis, and cost and time management.

Ask

- What does sustainability mean to you?
- Why is proper segregation of telecom e-waste important for environmental sustainability?
- How should batteries and plastic parts be disposed of in the telecom industry?

Elaborate

- Begin with a brief overview of environmental sustainability in telecom and explain the key laws and regulations using simple real-life examples.
- Use a short case study to explain e-waste policies and show images/videos of hazardous vs. non-hazardous telecom waste for better clarity.
- Demonstrate safety practices by showing PPE, checklists, and standard procedures followed during environmentally sensitive tasks.
- Bring sample components (old cables, small PCB, connectors) to help trainees identify recyclable and refurbishable items; conduct a quick sorting activity.
- Explain responsible procurement and reuse practices through a short discussion on how reuse reduces waste and cost.
- Show examples of green telecom solutions, such as solar-powered sites or energy-efficient equipment; use slides or short videos for better impact.
- Teach documentation skills by showing students how to fill waste tracking sheets and how coordination with authorized recyclers works.
- End with a group activity where students discuss how they can reduce carbon footprint and apply sustainable practices during fieldwork.

Activity



1. **Name of the Activity:** Green Telecom Practice Drill
2. **Type:** Group Activity
3. **Objective of the Activity:** To apply environmental compliance, waste-handling, and sustainability practices to a real telecom scenario.
4. **Resources:** Sample components/images, waste category sheets, flipchart, markers
5. **Time Duration:** 45 minutes
6. **Instructions:**
 - o Divide the trainees into small groups of 3–4 participants.
 - o Provide each group with a scenario involving telecom site waste generation and energy usage.
 - o Instruct them to identify recyclable items, hazardous components, and areas where energy efficiency can be improved.
 - o Ask each group to prepare a brief plan on waste sorting, safe handling, and coordination with authorized disposal agencies.
 - o Provide flipcharts and markers for groups to record their waste-handling steps and sustainability measures.
- Allocate 20–25 minutes for group work and 10–15 minutes for presentations.
7. **Outcome:** By the end of the activity, trainees should be able to apply waste management rules, identify recyclable components, suggest energy-saving measures, and present a compliant sustainability plan for telecom operations.

Notes for Facilitation



- Ensure that the trainees understand the importance of sustainability.
- Provide the trainees with the necessary knowledge and tools to work towards sustainability.
- Listen actively and respond appropriately to questions and comments.
- Ensure that the session remains on track and that all objectives are covered.
- Provide feedback and reinforcement to the trainees.
- Encourage the trainees to take ownership of their learning experience.

Answers to Exercises for PHB

Multiple Choice Questions:

1. b) To avoid damage to the cable core
2. c) Duct laying method
3. b) Cable winch machine
4. b) To avoid excessive friction and damage
5. b) Using approved cable ties or clamps

Descriptive Questions:

1. Direct burial cable laying procedure Dig trench → Prepare sand bedding → Lay cable carefully → Add protective sand layer → Place bricks/warning tape → Backfill and compact.
2. Safety precautions for underground cable laying Use PPE, barricade the area, check utility maps, avoid live lines, handle cables gently, and ensure trench stability.
3. Difference between aerial and underground cable laying Aerial: cheaper, faster, more exposed, higher maintenance. Underground: costlier, more durable, safer, low maintenance but harder to repair.
4. Importance of cable jointing and termination Ensures proper electrical connection, insulation, mechanical strength, and prevents faults or moisture entry.
5. Challenges in urban cable laying and solutions Limited space, traffic, existing utilities; solved by planning, duct systems, surveys, permissions, off-peak work, and coordination.



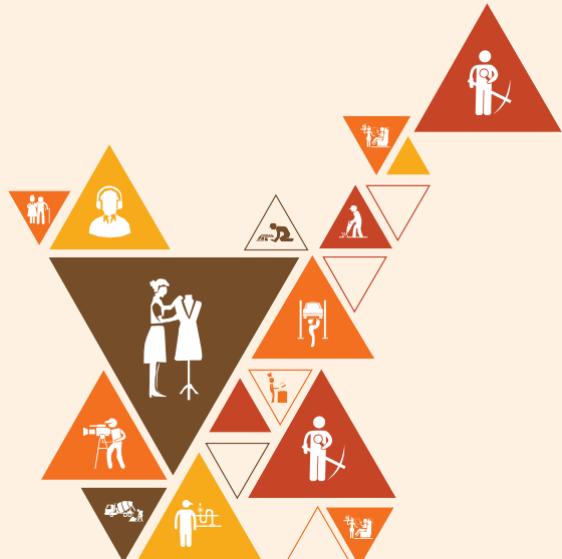
Skill India
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सत्यमेव जयते
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MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
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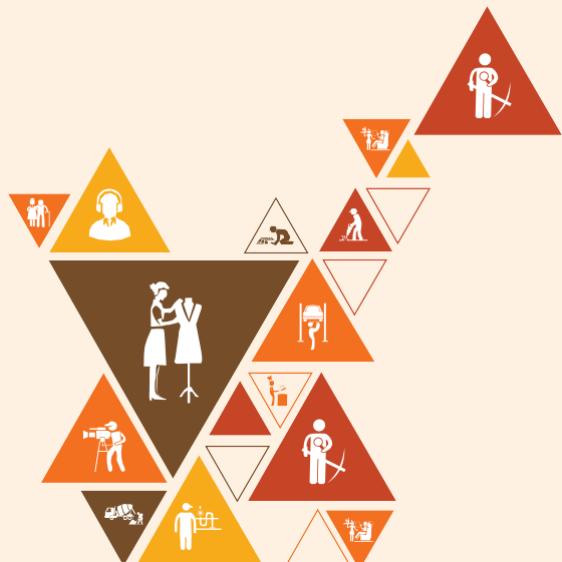


9. Annexures

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:	Wireless Technician		
Qualification Pack Name & Ref. ID	TEL/Q4105, V4.0		
Version No.	4.0	Version Update Date	31/03/2022
Pre-requisites to Training (if any)	Not Applicable		
Training Outcomes	<p>By the end of this program, the participants will be able to:</p> <ol style="list-style-type: none"> 1. Wiring and installing equipment at different sites 2. Configure equipment and establishing connectivity 3. Troubleshooting to localize and rectify faults 4. UPS installation and domestic power supply checks 5. Organize work and resources as per health and safety standards 6. Inclusive Communication interpersonal skills, and sensitization towards gender and persons with disability 		

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
1	Introduction to the role of a Wireless Technician	Role of a Wireless Technician	<ul style="list-style-type: none"> • Explain the role and responsibilities of Wireless Technician • Discuss the scope/ future and industry of the Wi-Fi broadband 	Bridge Module	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Laptop, white board, marker, projector, Documents of standard operating procedures, code of conduct, checklists, installation and troubleshooting tools/ equipment's, status report	7 Theory (5:00) Practical (2:00)
		Electrical and Electronic Components	<ul style="list-style-type: none"> • Identify the various electrical and electronic components and their specifications. 				7 Theory (5:00) Practical (2:00)
		Installation of Wi-Fi Broadband	<ul style="list-style-type: none"> • Explain the processes and technologies used in installation of Wi-Fi broadband 				8 Theory (5:00) Practical (3:00)
		Safety, Health and Environmental Policies	<ul style="list-style-type: none"> • State the safety, health and environmental policies and regulations for the workplace as well as for telecom sites in general 				8 Theory (5:00) Practical (3:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
2	Installation and Wiring of Wireless Communication Equipment	Planning and Preparation	<ul style="list-style-type: none"> Identify job requirements Plan access to sites for installation/testing activities Collect required tools, equipment, and materials 	TEL/N4122 PC1, PC2, PC3	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Laptop, white board, marker, projector, Cables and equipment, Wi-Fi	8 Theory (4:00) Practical (4:00)
		Cable Selection and Verification	<ul style="list-style-type: none"> Select cable type and connectors based on installation environment/site requirements Check cable length for continuity Verify that the cable running length is free of electrical hazards and outdoors/indoors obstructions 	TEL/N4122 PC4, PC5, PC6		Laptop, white board, marker, projector, Cables and equipment, Wi-Fi backhaul, Service Manual/ User Manuals, Program Authentication Form, Customer Feedback form, Personal Protection Equipment: safety glasses, head protection, warning signs and tapes	8 Theory (4:00) Practical (4:00)
		Site Selection and Structured Wiring	<ul style="list-style-type: none"> Liase with local authorities especially for outdoor cabling Select suitable location for equipment installation at different sites Ensure structured wiring from PoP to different sites 	TEL/N4122 PC7, PC8, PC9			8 Theory (4:00) Practical (4:00)
		Installation and Termination	<ul style="list-style-type: none"> Install neat wiring and clipping at all points up to the equipment Use proper cable terminators/ connectors Install proper feeder cable termination between equipment and antenna 	TEL/N4122 PC10, PC11, PC12			8 Theory (4:00) Practical (4:00)
		Testing and Verification	<ul style="list-style-type: none"> Test the cable/joints for transmission loss and strength Re-terminate if loss exceeds prescribed limits 	TEL/N4122 PC13			8 Theory (3:00) Practical (5:00)
		Equipment Installation	<ul style="list-style-type: none"> Install equipment following electrical safety principles and manufacturer's instructions 	TEL/N4122 PC14			8 Theory (3:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Earthing and Waste Disposal	<ul style="list-style-type: none"> Arrange proper earthing to power-up the system Remove/dispose installation waste properly 	TEL/N4122 PC15, PC16			7 Theory (3:00) Practical (4:00)
		Site Restoration	<ul style="list-style-type: none"> Restore worksite to customer's satisfaction 	TEL/N4122 PC17			7 Theory (3:00) Practical (4:00)
		Record Keeping	<ul style="list-style-type: none"> Update records with details of installation and test results 	TEL/N4122 PC18			7 Theory (3:00) Practical (4:00)
		Documentation	<ul style="list-style-type: none"> Complete all installation documents 	TEL/N4122 PC19			7 Theory (3:00) Practical (4:00)
		Payment Collection	<ul style="list-style-type: none"> Collect necessary payments if any 	TEL/N4122 PC19			7 Theory (3:00) Practical (4:00)
		Customer Communication	<ul style="list-style-type: none"> Interact with the superiors to understand the job requirements Communicate effectively with the customer to ensure satisfaction 	TEL/N4122 PC1, PC17			7 Theory (3:00) Practical (4:00)
3	Configuring Equipment and Establishing Wireless Connectivity	Introduction to Wi-Fi Broadband Installation	<ul style="list-style-type: none"> Define Wi-Fi broadband installation and its importance Identify different components involved in Wi-Fi broadband installation process Explain the purpose of each component 	TEL/N4123 PC1, PC2	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	Laptop, white board, marker, projector, Cables and equipment, Wi-Fi backhaul, Service Manual/ User Manuals,	8 Theory (4:00) Practical (4:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Feeder Cable Connection and Testing	<ul style="list-style-type: none"> Demonstrate the process of connecting feeder cable with antenna at different sites Explain the concept of VSWR/return loss and how to measure it 	TEL/N4123 PC1		Program Authentication Form, Customer Feedback form, Personal Protection Equipment: safety glasses, head protection, warning signs and tapes	8 Theory (4:00) Practical (4:00)
		Wi-Fi Backhaul Equipment Connection and Orientation Check	<ul style="list-style-type: none"> Demonstrate the process of connecting Wi-Fi backhaul equipment with feeder cable Explain the importance of antenna orientation for surveyed receive levels 	TEL/N4123 PC2			8 Theory (4:00) Practical (4:00)
		Wi-Fi Access Point Connection and Configuration	<ul style="list-style-type: none"> Demonstrate the process of connecting Wi-Fi backhaul equipment with Wi-Fi access points Explain the importance of proper configuration of Wi-Fi access points 	TEL/N4123 PC3			8 Theory (4:00) Practical (4:00)
		End User Device Connectivity	<ul style="list-style-type: none"> Demonstrate the process of connecting laptop/PC, and other appropriate device to the interface equipment at Wi-Fi backhaul equipment Explain the process of establishing connectivity with Wi-Fi access points 	TEL/N4123 PC4			8 Theory (3:00) Practical (5:00)
		Default Login Credentials and Base Setting Configuration	<ul style="list-style-type: none"> Explain the importance of default login credentials for equipment configuration Demonstrate the process of configuring equipment as per the base setting (IP, Gateway, Mask etc.) 	TEL/N4123 PC5, PC6			8 Theory (3:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Cable and Connector Check	<ul style="list-style-type: none"> • Demonstrate the process of checking whether all cables/ connectors are correctly plugged in • Explain the importance of proper cable and connector check 	TEL/N4123 PC7			7 Theory (3:00) Practical (4:00)
		Service Provider Gateway Ping	<ul style="list-style-type: none"> • Demonstrate the process of applying steps to ping service provider gateway • Explain the purpose of service provider gateway ping 	TEL/N4123 PC8			7 Theory (3:00) Practical (4:00)
		Test Results Analysis	<ul style="list-style-type: none"> • Demonstrate the process of analyzing test results for connectivity and throughout parameters • Explain the significance of test results analysis 	TEL/N4123 PC9			7 Theory (3:00) Practical (4:00)
		End User Device Configuration	<ul style="list-style-type: none"> • Demonstrate the process of configuring end user device to establish connectivity with the Wi-Fi access point • Explain the importance of proper end user device configuration 	TEL/N4123 PC10			7 Theory (3:00) Practical (4:00)
		Wi-Fi Access Point Ping and Response Analysis	<ul style="list-style-type: none"> • Demonstrate the process of using commands and processes to ping the Wi-Fi access point from the end user device • Explain the process of analyzing the response of the command/process 	TEL/N4123 PC11			7 Theory (3:00) Practical (4:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Record Keeping and Basic Troubleshooting	<ul style="list-style-type: none"> Demonstrate the process of recording Wi-Fi backhaul equipment (5 GHz) configuration settings and test results at all sites Demonstrate the process of recording Wi-Fi access equipment (2.4 GHz) configuration settings and test results at all sites Demonstrate the process of recording end user device configuration setting Demonstrate the process of recording pinging procedure and expected result parameters Explain the importance of basic troubleshooting steps and self-help for customer support 	TEL/N4123 PC12, PC13, PC14, PC15, PC16			7 Theory (3:00) Practical (4:00)
4	Diagnose and rectify wireless network faults	Cable Identification and Localization	<ul style="list-style-type: none"> Differentiate between various types of cables Identify correct cable pairs Undertake continuity check and localize fault distance 	TEL/N4124 PC1, PC2, PC3	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	White board/ black board marker / chalk, duster, computer or Laptop attached to LCD projector, Cables, portable tester device, network tester, antenna tester, laptop with required softwares, soldering machines,	7 Theory (4:00) Practical (3:00)
		Cable Repair and Replacement	<ul style="list-style-type: none"> Carry out re-connectorization/ crimping (of cable pairs with connector) or replace cable, if required Replace feeder cable/ antenna, if required 	TEL/N4124 PC4, PC5			7 Theory (4:00) Practical (3:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Wi-Fi Backhaul Equipment	<ul style="list-style-type: none"> • Re-configure the Wi-Fi backhaul equipment to correct settings at service provider gateway/end user devices, if required • Identify relevance of various indicative lights on the Wi-Fi backhaul equipment • Analyse output of trouble shooting equipment/device • Access Wi-Fi access point through browser/software application to run diagnostic application 	TEL/N4124 PC6, PC8, PC15, PC16		Service Manual/ User Manuals Personal Protection Equipment: safety glasses, head protection, rubber gloves, safety footwear, warning signs and tapes, fire extinguisher and first aid kit	8 Theory (4:00) Practical (4:00)
		Wi-Fi Access Points	<ul style="list-style-type: none"> • Reset Wi-Fi access points, if required • Identify relevance of various indicative lights on the Wi-Fi access point equipment • Connect handheld network tester portable device for fault diagnostic • Analyse output of trouble shooting equipment/device • Access Wi-Fi access point through browser/software application to run diagnostic application 	TEL/N4124 PC7, PC13, PC14, PC15, PC16			8 Theory (4:00) Practical (4:00)
		Cable and Antenna Testing	<ul style="list-style-type: none"> • Connect handheld network tester portable device for fault diagnostic • Connect cable and antenna tester, if required 	TEL/N4124 PC9, PC10			8 Theory (4:00) Practical (4:00)
		Antenna Orientation	<ul style="list-style-type: none"> • Check for antenna orientation, if required 	TEL/N4124 PC11			8 Theory (4:00) Practical (4:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Fault Localization and Isolation	<ul style="list-style-type: none"> Obtain results to localize fault Record steps undertaken for fault localization/isolation 	TEL/N4124 PC12, PC17			7 Theory (3:00) Practical (4:00)
		Record Keeping and Site Restoration	<ul style="list-style-type: none"> Record changes undertaken for fault rectification Restore any changes made to the worksite during fault repair to the client's satisfaction 	TEL/N4124 PC18, PC19			7 Theory (3:00) Practical (4:00)
5	Install, Test and Maintain UPS and Domestic Power Supply	Pre-installation Checks	<ul style="list-style-type: none"> Perform checks for voltage, current and earthing 	TEL/N4125 PC1		White board/ black board marker / chalk, duster, computer or Laptop attached to LCD projector, UPS, wiring diagrams, batteries, service/ user man- uals, test equipment	7 Theory (4:00) Practical (3:00)
		Planning	<ul style="list-style-type: none"> Plan installation activities 	TEL/N4125 PC2			7 Theory (4:00) Practical (3:00)
			<ul style="list-style-type: none"> Analyse basic wiring diagrams to facilitate correct installation of UPS 	TEL/N4125 PC3			8 Theory (4:00) Practical (4:00)
		Installation Process	<ul style="list-style-type: none"> Install UPS as per manufacturer's instructions 	TEL/N4125 PC4			8 Theory (4:00) Practical (4:00)
		Power Supply Management	<ul style="list-style-type: none"> Route the power supply through UPS 	TEL/N4125 PC5			8 Theory (4:00) Practical (4:00)
			<ul style="list-style-type: none"> Calculate equipment load vis-à-vis UPS rating 	TEL/N4125 PC6			8 Theory (4:00) Practical (4:00)
		Precautions	<ul style="list-style-type: none"> Exercise precautions while handling power supplies 	TEL/N4125 PC7			7 Theory (3:00) Practical (4:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Battery Replacement	<ul style="list-style-type: none"> Perform checks to replace the battery in case of a defective UPS 	TEL/N4125 PC8			7 Theory (3:00) Practical (4:00)
5	Follow Sustainable practices in telecom infrastructure installation	Recycling & Waste Segregation	<ul style="list-style-type: none"> Identify telecom components suitable for recycling or refurbishment Sort electronic and non-electronic waste based on disposal protocols Label and store recyclable and refurbishable components separately 	TEL/N9105 PC1, PC2, PC3	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	White board/ black board marker / chalk, duster, computer or laptop attached to LCD projector, Personal Protection Equipment: safety glasses, head protection, rubber gloves, safety footwear, warning signs and tapes, fire extinguisher and first aid kit	6 Theory (2:00) Practical (4:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Waste Disposal & Safety	<ul style="list-style-type: none"> Follow approved procedures for the safe disposal of hazardous and non-hazardous waste Coordinate with authorized e-waste recycling units or certified disposal agencies Handle batteries, cables, and electronic circuits safely to prevent environmental hazards 	TEL/N9105 PC4, PC5, PC6			6 Theory (2:00) Practical (4:00)
		Energy Efficiency in Telecom Installation	<ul style="list-style-type: none"> select and use energy-efficient tools and equipment during telecom installations apply best practices to minimize energy consumption position and install telecom infrastructure to optimize efficiency and sustainability 	TEL/N9105 PC7, PC8, PC9			6 Theory (2:00) Practical (4:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Environmental Compliance & Documentation	<ul style="list-style-type: none"> adhere to national and international environmental regulations for telecom infrastructure installation maintain records of waste disposal, recycling, and sustainability measures assist in periodic audits to assess compliance with green standards follow workplace sustainability protocols and report non-compliance 	TEL/N9105 PC10, PC11, PC12, PC13			6 Theory (2:00) Practical (4:00)
		Team Guidance & Sustainable Behavior	<ul style="list-style-type: none"> guide team members on sustainable telecom installation guidelines and practices encourage environmentally responsible work habits 	TEL/N9101 PC14, PC15			

Annexure II

Assessment Criteria

CRITERIA FOR ASSESSMENT OF TRAINEES

Assessment Criteria for Wireless Technician	
Job Role	Wireless Technician
Qualification Pack	TEL/Q4105 V4.0
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	Theory Marks	Practical Marks	Viva Marks
TEL/N4122 (Carry out installation and wiring of wireless communication equipment)	Prepare, wire, and install the system	16	20	11
	PC1. review and interpret installation plans, site layouts, and job specifications	1	2	0.5
	PC2. coordinate with superiors and site personnel to confirm job requirements and site access	1	1	0.5
	PC3. select and collect appropriate tools, equipment, and materials as per installation plans	1	1	0.5
	PC4. identify and use suitable cables (OFC, UTP/STP, coaxial, feeder cable) and connectors based on site requirements	1	1	0.5
	PC5. measure and verify cable lengths, ensuring continuity and optimal performance	1	1	1
	PC6. inspect cable routes for electrical hazards, environmental constraints, and obstructions	1	2	0.5
	PC7. liaise with local authorities and comply with regulatory requirements for outdoor installations	2	1	0.5
	PC8. determine optimal installation locations adhering to structured cabling norms and signal coverage guidelines	2	2	1
	PC9. ensure systematic and organized wiring from Point of Presence (PoP) to designated sites	1	1	1
	PC10. secure and route cables neatly using appropriate clips, trays, and conduits	1	2	1
	PC11. install, terminate, and test feeder cables and connectors, ensuring minimal transmission loss	1	1	1

	PC12. mount equipment securely following manufacturer guidelines and electrical safety standards	1	2	1
	PC13. implement proper grounding and earthing techniques for system safety and reliability	1	1	1
	PC14. conduct initial equipment setup, firmware updates, and basic configuration as required	1	2	1
	Conduct quality checks and performance testing	5	15	4
	PC15. test cable connectivity, transmission loss, and signal strength using appropriate testing tools	1	2	0.5
	PC16. re-terminate cables if the transmission loss exceeds prescribed limits	1	3	0.5
	PC17. verify power supply, grounding, and voltage levels to prevent equipment damage	1	3	1
	PC18. configure and test Wi-Fi backhaul and access point connectivity for seamless operation	1	5	1
	PC19. troubleshoot and rectify basic connectivity issues and escalate unresolved issues	1	2	1
	Complete documentation and site cleanup	9	15	5
	PC20. dispose of installation waste materials as per environmental and workplace safety guidelines	2	2	1
	PC21. restore the site to its original or improved condition, ensuring customer satisfaction	1	3	1
	PC22. maintain accurate records of installation, testing results, and equipment details	2	4	1
	PC23. complete all required installation documents and reports in the prescribed format	2	3	1
	PC24. collect customer acknowledgment and necessary payments, if applicable	2	3	1
	NOS Total	30	50	20
	Configure the equipment	14	18	8
TEL/N4123 (Configure equipment and establish wireless network connectivity)	PC1. install and securely mount Wi-Fi backhaul equipment and access points as per site specifications	1	2	1
	PC2. connect feeder cables with antennas and measure VSWR/return loss to ensure optimal signal transmission	2	2	1
	PC3. align antennas based on surveyed signal strength and adjust orientation for optimal connectivity	2	2	1
	PC4. establish physical connections between Wi-Fi backhaul equipment, Wi-Fi access points, and network switches	2	2	1
	PC5. configure equipment settings, including IP addresses, subnet masks, and default gateways, according to base configurations	2	3	1
	PC6. access network settings using default login credentials and update them with secure passwords	1	3	1
	PC7. apply encryption and authentication settings (WPA2/WPA3) to secure network access	2	2	1
	PC8. update firmware and software patches to ensure compliance with industry standards and security best practices	2	2	1
	Establish and verify connectivity	10	12	7
	PC9. ensure all cables and connectors are properly secured and free from damage	1	2	1
	PC10. conduct a ping test to the service provider gateway and analyze latency, packet loss, and jitter parameters	2	2	2
	PC11. validate throughput performance using network testing tools and document results	2	2	1
	PC12. configure end-user devices with appropriate SSIDs, security credentials, and DNS settings	2	2	1
	PC13. verify end-user connectivity by executing network diagnostic commands and troubleshooting connectivity issues	2	2	1
	PC14. perform a security compliance check by testing firewall settings, encryption status, and unauthorized access points	1	2	1
	Record configuration settings and test results	6	20	5
	PC15. maintain accurate records of network configurations, including IP assignments, security protocols, and firmware versions	1	6	1
	PC16. document testing procedures, expected results, and any deviations observed during connectivity tests	2	6	2
	PC17. create a troubleshooting log with identified issues, root causes, and corrective actions taken	2	7	1
	PC18. educate customers on basic troubleshooting techniques and network optimization tips	1	1	1
	NOS Total	30	50	20

TEL/N4124 (Diagnose and rectify wireless network faults)	Diagnose and rectify wiring faults	10	13	5
	PC1. conduct continuity tests using appropriate tools and localize fault distance	2	2	1
	PC2. perform re-connectorization/crimping of cable pairs with connectors or replace faulty cables	2	3	1
	PC3. replace feeder cables or antennas as per network specifications	2	3	1
	PC4. conduct signal and interference tests to validate cable performance	2	2	1
	PC5. reconfigure network devices, if necessary, after cable replacement	2	3	1
	Troubleshoot and repair Wi-Fi backhaul equipment (5 GHz)	11	15	6
	PC6. interpret status and error indicators on the Wi-Fi backhaul equipment	2	5	1
	PC7. connect and operate a handheld network tester for fault diagnosis	2	2	1
	PC8. use cable and antenna testers to check connectivity and performance	2	2	1
	PC9. verify and adjust antenna alignment for optimal signal strength	2	2	1
	PC10. analyze diagnostic results to localize and rectify faults in backhaul connectivity	2	2	1
	PC11. perform firmware updates and configuration resets, if required	1	2	1
	Troubleshoot and restore Wi-Fi access points (2.4 GHz)	5	12	5
	PC12. identify status and diagnostic indicators on Wi-Fi access points	1	3	1
	PC13. connect and utilize network testing tools for fault detection	1	2	1
	PC14. interpret output from troubleshooting equipment and software diagnostics	1	3	1
	PC15. access Wi-Fi access point settings through a browser or application to perform configuration checks	1	2	1
TEL/N4125 (Install, test, and maintain UPS and domestic power supply)	PC16. reset, update, or replace malfunctioning Wi-Fi access points based on diagnostic findings	1	2	1
	Carry out documentation and restore worksite	4	10	4
	PC17. record troubleshooting steps and localized faults in logs or digital records	1	3	1
	PC18. document all modifications and replacements undertaken during fault rectification	1	2	1
	PC19. restore any worksite changes made during fault repair to meet client and workplace standards	1	3	1
	PC20. dispose of damaged components and materials following environmental and safety guidelines	1	2	1
	NOS Total	30	50	20
	Install UPS and check electrical parameters	13	18	8
	PC1. inspect and verify power supply connections for voltage, current, earthing, and continuity	1	2	1
	PC2. identify appropriate UPS type and capacity based on the equipment load and power requirements	2	2	1
	PC3. plan installation activities, ensuring adherence to manufacturer guidelines and safety protocols	2	2	1
	PC4. read and interpret wiring diagrams and circuit layouts to ensure correct installation	2	2	1
	PC5. install and securely mount UPS as per the specified standards	2	3	1
	PC6. route and connect power supply through UPS, ensuring proper input and output wiring	1	3	1
	PC7. check for polarity and phase alignment to avoid incorrect wiring	1	2	1
	PC8. verify the proper grounding of the UPS and connected equipment	2	2	1
	Conduct power supply checks and ensure compliance	9	10	5
	PC9. use multimeters and clamp meters to measure and validate voltage, current, and earthing resistance	1	2	1
	PC10. test power backup functionality by simulating a power failure scenario	2	2	1
	PC11. ensure the UPS output matches the required power quality standards	2	2	1
	PC12. identify and report fluctuations or irregularities in power supply that may affect equipment performance	2	2	1
	PC13. apply safety precautions while handling high-voltage connections and power tools	2	2	1
	Perform preventive maintenance and troubleshooting	8	22	7
	PC14. inspect and test UPS batteries for charge retention and health status	1	6	1
	PC15. replace faulty or degraded batteries following standard replacement procedures	2	6	2
	PC16. clean and secure UPS ventilation to prevent overheating	2	7	1
	PC17. diagnose and troubleshoot common UPS faults such as overloading, short circuits, and failed inverters	1	1	1
	PC18. document test results, maintenance actions, and reported issues as per standard procedures	1	1	1
	PC19. communicate findings and recommendations to customers or supervisors	1	1	1
	NOS Total	30	50	20

TEL/N9105 (Follow sustainable practices in telecom infrastructure installation)	Segregate recyclable and refurbishable components	6	12	6
	PC1. identify telecom components suitable for recycling or refurbishment	2	4	2
	PC2. sort electronic and non-electronic waste based on disposal protocols	2	4	2
	PC3. label and store recyclable and refurbishable components separately	2	4	2
	Dispose of waste	6	10	5
	PC4. follow approved procedures for the safe disposal of hazardous and non-hazardous waste	2	4	2
	PC5. coordinate with authorized e-waste recycling units or certified disposal agencies	2	3	2
	PC6. handle batteries, cables, and electronic circuits safely to prevent environmental hazards	2	3	1
	Use Energy-Efficient Methods	6	10	3
	PC7. select and use energy-efficient tools and equipment during telecom installations	2	4	1
	PC8. apply best practices to minimize energy consumption	2	3	1
	PC9. position and install telecom infrastructure to optimize efficiency and sustainability	2	3	1
	Follow environmental standards and compliance guidelines	8	12	4
	PC10. adhere to national and international environmental regulations for telecom infrastructure installation	2	3	1
	PC11. maintain records of waste disposal, recycling, and sustainability measures	2	3	1
	PC12. assist in periodic audits to assess compliance with green standards	2	3	1
	PC13. follow workplace sustainability protocols and report non-compliance	2	3	1
	Guide team members	4	6	2
	PC14. guide team members on sustainable telecom installation guidelines and practices	2	3	1
	PC15. encourage environmentally responsible work habits	2	3	1
	NOS Total	30	50	20
DGT/VSQ/N0102 (Employability 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	0

Annexure III

List of QR Codes Used in PHB

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
Module 1: Introduction to the role of a Wireless Technician	Unit 1.1: Introduction to Telecom Sector	1.1.1 Telecom Sector in India	https://www.youtube.com/ watch?v=PiRV-lZn9yl	 Telecom Sector of India
Module 2: Pre-req- uisites of Wiring and Wi-Fi backhaul equipment	Unit 2.1: Installation of Wi-Fi System	2.1.5 Feeder Cable Laying	https://youtu.be/Od0k9n- gtoCM	 Feeder Cable Laying
		2.1.6 Wi-Fi Sys- tem Installation	https://youtu.be/PJi- 5WnUXcek	 Wi-Fi System Installation
	Unit 2.2: Complete Documenta- tion	2.2.1 Impor- tance of Satis- factory Custom- er Service	https://www.youtube.com/ watch?v=xaGBp9o83Bw	 Importance of Satisfactory Cus- tomer Service
Module 3: Configuring Equipment and Establishing Con- nectivity	Unit 3.1: Set- ting up Wi-Fi Network	3.1.1 Concept of Wireless Technology	https://www.youtube.com/ watch?v=l2PKjslPObM	 Concept of Wireless Tech- nology

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
		3.1.2 Network Topologies	https://www.youtube.com/watch?v=uSKdjjw5zow	 Network Topologies
		3.1.4 Gateways	https://www.youtube.com/watch?v=ai5bFPVToMU	 Gateways
Module4: Trouble- shoot to Localize and Rectify Faults	Unit 4.1: Prepare for Troubleshooting Wi-Fi Backhaul Equipment	4.1.1 EMI/EMC Concepts	https://www.youtube.com/watch?v=cWo_svDTszY	 EMI/EMC Concepts
		4.1.3 Various Indicative Lights on Network Equipment	https://www.youtube.com/watch?v=6AdgdRH3frA	 Various Indicative Lights on Network Equipment
		4.1.5 Crimping/Soldering Process	https://www.youtube.com/watch?v=r7GIDBge_WU	 Crimping/Soldering Process

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
Module 5: UPS Installation and Domestic Power Supply Checks	Unit 5.1: Plan for UPS Installation	5.1.1 Uninterruptible Power Supply (UPS)	https://www.youtube.com/watch?v=X3wZA-GJuwE	 Uninterruptable Power Supply
	Unit 5.2: Install UPS and Check the Electrical Parameters	5.2.1 Installing UPS	https://www.youtube.com/watch?v=fP9ylsLtjaw	





Address: **Telecom Sector Skill Council of India**
Estel House, 3rd Floor, Plot No:- 126, Sector 44
Gurugram, Haryana 122003
Email: tssc@tsscindia.com
Web: www.tsscindia.com
Phone: 0124-2222222

Price: