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Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

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Telecom Sector Skill Council

Facilitator Guide

Sector
Telecom

Sub-Sector
Network Managed Services

Occupation
Project Engineering

Reference ID: **TEL/Q6306,** Version **3.0**
NSQF Level **5**

Project Supervisor - 5G Networks

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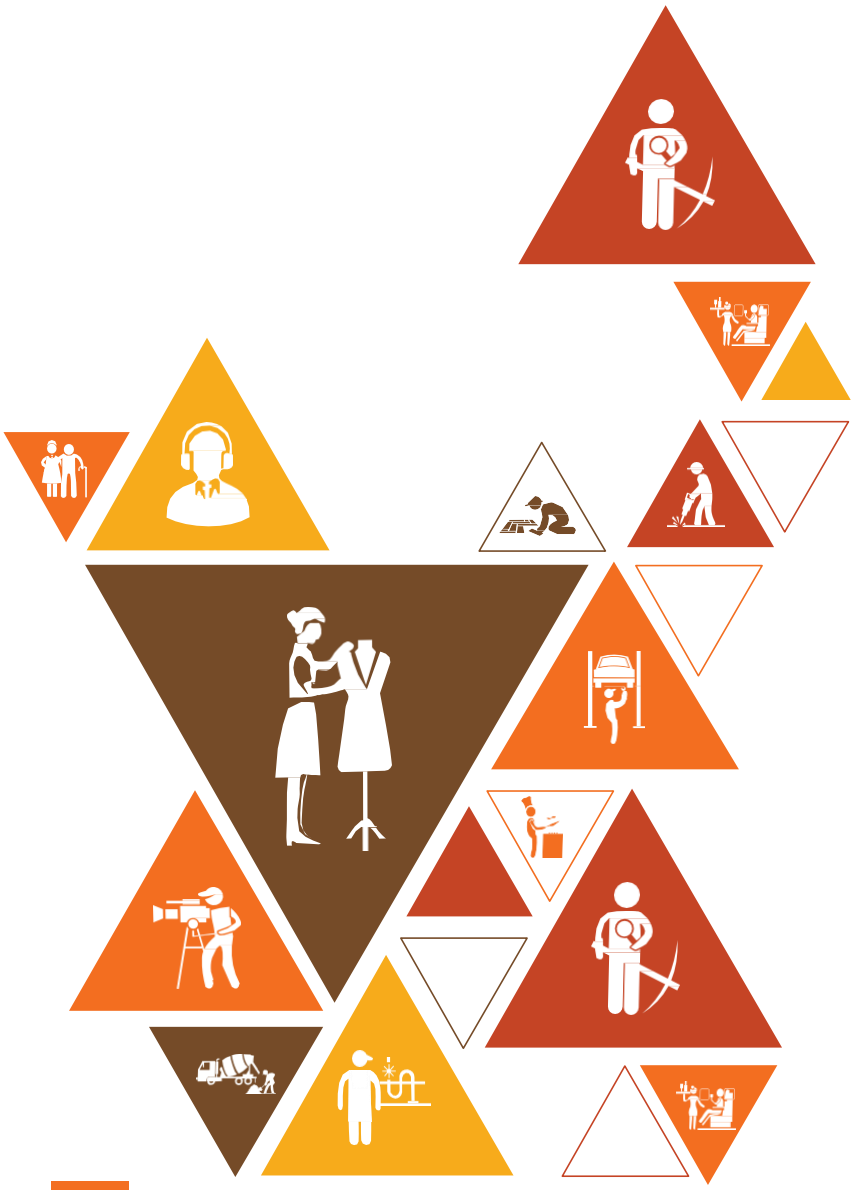
"Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission."

Shri Narendra Modi
Prime Minister of India



Acknowledgements

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 facilitator guide could not have been completed without their active contribution. Special gratitude is extended to those who collaborated during the preparation 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 their 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 which will be a lifelong asset for their future endeavours.

About this Guide

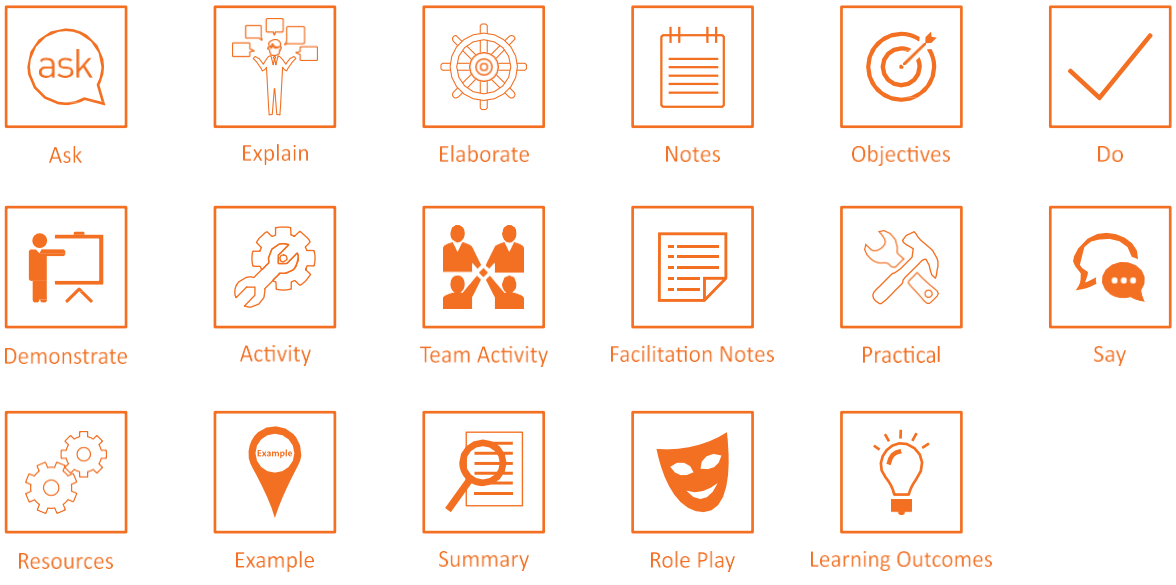
The facilitator guide (FG) for Project Supervisor - 5G Networks is primarily designed to facilitate skill development and training of people, who want to become professional Project Supervisor in infrastructure establishment. The facilitator guide is aligned to the Qualification Pack (QP) and the National 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/N6319 – Check Availability of Hardware Equipment at the Site Location
2. TEL/N6320 – Perform installation and commissioning of 5G tower site
3. TEL/N6321 – Perform Compliance and Quality Check
4. TEL/N6322: Carry out Acceptance Testing and Site Monitoring
5. TEL/N9109 – Follow sustainable practices in telecom infrastructure management
6. TEL/N9104 – Manage work and safety at workplace
7. DGT/VSQ/N0102 - Employability Skills (60 Hours)

Post this training, the participants will be able to overseeing installation, configuration, testing, and acceptance of equipment, antennas, and supporting infrastructure. We hope that this Facilitator Guide provides a sound learning support to our young friends to build a lucrative career in the Telecom Skill Sector of our country.

Symbols Used



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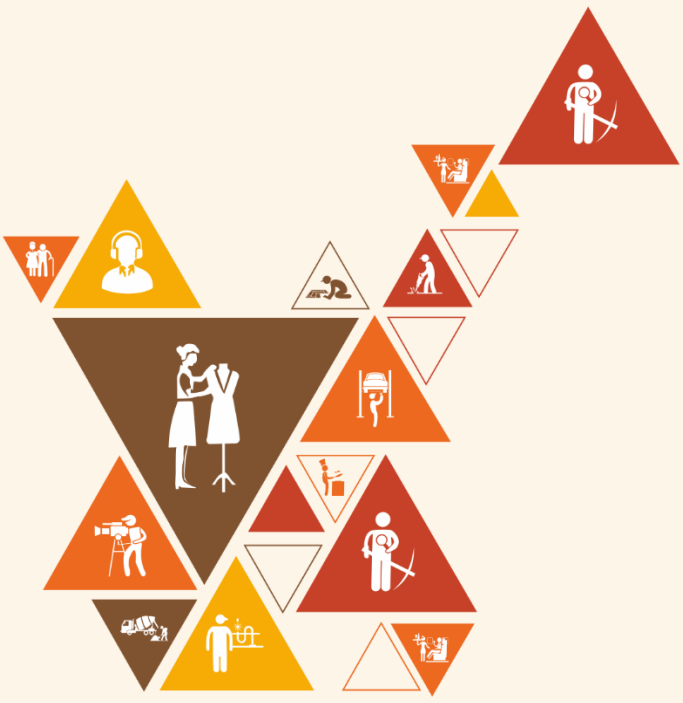


TEL/N6319

Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Explain the role and responsibilities of the Project Supervisor – 5G Network
2. Describe the various electrical and electronic components.
3. Prepare a list of the standard operating procedures (SOP) for using tools and equipment, service, and minor repairs.
4. Discuss the documentation involved in the different processes of maintenance.
5. State the safety, health and environmental policies and regulations for the workplace and telecom sites in general.

UNIT 1.1: Introduction to the Telecom Sector

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Outline the growth of the Telecom Sector in India.
2. Describe the size and scope of the Telecom industry and its sub-sectors.
3. Describe the evolution of mobile networks, highlighting the transition from 4G to 5G.
4. Elucidate the key features and benefits of 5G technology, such as ultra-low latency, enhanced bandwidth, and massive device connectivity.
5. Identify the primary components of 5G infrastructure, including gNodeB, fiber optic backhauls, and antenna systems.

Resources to be Used

Participant handbook, notepad, pen, whiteboard, markers, presentation slides, overhead projector or large screen, computer/laptop with internet connection.

Say

- Welcome to the 'Introduction to the Telecom Sector' class. Today, we will explore the exciting world of telecommunications, exploring its growth, size, scope, documentation, safety measures, and environmental regulations.
- We'll discuss how the telecom sector has evolved in India and its significant impact on various industries.
- Before we move ahead with the topics, let us play a game.

Team Activity

- Activity name: Ice Breaker - Two Truths and a Lie
- Objective of the Activity: To help participants get to know each other in a fun and interactive way by sharing interesting facts about themselves.
- Resources: None
- Time Duration: 15-20 minutes
- Instructions:
  - Gather all participants in a circle or seated in a comfortable arrangement.
  - Explain the game: Each participant will share two truths and one lie about themselves.
  - Emphasise that the challenge is to make the lie sound convincing, making it harder for others to identify.
  - Start by giving an example yourself: Hi, I'm [Your Name]. I have visited three countries, am fluent in four languages, and have a pet horse.
  - Participants take turns sharing their statements in any order they prefer.

- After each participant shares their statements, the rest of the group discusses and guesses which statement is a lie.
- After everyone has shared, reveal the truths and lies, and have a brief conversation about the interesting facts shared.

6. **Outcome:** Participants will have an opportunity to learn unique facts about each other, fostering a relaxed and friendly atmosphere for the training session.

Ask

- Raise your hand if you've ever used a smartphone or made a phone call?
- Can anyone share a situation where you think the telecom sector plays a crucial role?

Do

- Encourage participants to share their experiences and thoughts on the telecom sector, creating a comfortable and interactive learning environment.
- Utilise presentation slides, whiteboard diagrams, and relevant online resources to enhance understanding and engagement.
- Prompt participants to ask questions, share opinions, and discuss real-world examples to deepen their understanding.

Elaborate

- Growth of the Telecom Sector in India: Explore the historical development of the telecom industry in India, from its early stages to the current digital era.
- Size and Scope of the Telecom Industry and Its Sub-sectors: Discuss the different components of the telecom industry, including network providers, equipment manufacturers, service providers, and emerging trends like 5G technology.
- Documentation Involved in Different Maintenance Processes: Explain the essential documentation practices for maintenance processes, such as work orders, maintenance logs, and compliance reports.
- Safety, Health, and Environmental Policies: Highlight the importance of workplace safety, health regulations, and environmental policies in the telecom sector to ensure a secure and sustainable working environment.

Activity

- Activity Name: Telecom Scavenger Hunt
- Objective of the Activity: To familiarise participants with key telecom terms and concepts while promoting teamwork and engagement.
- Resources: Participant handbook, markers, whiteboard, presentation slides.
- Time Duration: 20 minutes

- **Instructions:**
  - Divide participants into small groups.
  - Provide each group with a list of telecom-related terms or concepts (e.g., 4G, fiber optics, and bandwidth).
  - Instruct groups to find these terms within the provided resources (handbook, slides) and write a brief explanation for each term on the whiteboard.
  - After the allocated time, have each group present their findings and explanations.
  - Facilitate a short discussion about the terms and concepts, clarifying misconceptions and reinforcing the learning points.
- **Outcome:** Participants will better understand telecom terminology and concepts, fostering collaboration and active participation.

Notes for Facilitation

- Encourage active participation by using open-ended questions and inviting group discussions.
- Keep the pace of the session dynamic to maintain engagement.
- Relate concepts to real-life examples to make the content more relatable and understandable.
- Ensure a respectful and inclusive environment for all participants to share their perspectives.
- If participants are curious about certain sub-topics, be prepared to elaborate on their interests.

UNIT 1.2: Roles and Responsibilities of Project Supervisor - 5G Network

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Elucidate the role and responsibilities of the Project Supervisor – 5G Network
2. Discuss the significance of the role of a Project Supervisor – 5G Network.
3. Illustrate the career progression of a Project Supervisor - 5G Network.
4. Discuss basic project management principles, including planning, execution, and monitoring.

Resources to be Used

Participant handbook, notepad, pen, whiteboard, markers, presentation slides, overhead projector or large screen, computer/laptop with internet connection.

Say

- Welcome to the 'Roles and Responsibilities of Project Supervisor - 5G Network' class. Today, we'll explore the critical role of a Project Supervisor in the context of 5G networks.
- By the end of this session, you will clearly understand the responsibilities of a Project Supervisor in the 5G network field and its significance in the technology landscape.
- We will also delve into career progression opportunities and the fundamental principles of project management.

Ask

- Raise your hand if you're familiar with the term 'Project Supervisor.'
- Can anyone share their thoughts on why the role of a Project Supervisor is important in developing 5G networks?

Do

- Encourage participants to share their initial thoughts and experiences related to project Supervisoring and 5G networks to create a participatory atmosphere.
- Employ presentation slides and whiteboard diagrams to visually represent the key points and concepts discussed.
- Prompt participants to ask questions, express opinions, and share real-world examples to enrich the discussion.

Elaborate

- Elucidate the Role and Responsibilities:
  - Explain the various tasks and duties that a Project Supervisor in the 5G network domain is responsible for, such as network design, implementation, testing, troubleshooting, and documentation.
- Significance of the Role:
  - Discuss how a Project Supervisor is pivotal in ensuring the successful deployment and maintenance of 5G networks, enabling advanced communication technologies and supporting innovation.
- Career Progression:
  - Illustrate the potential career paths for a Project Supervisor in the 5G network field, including advancement to roles such as Senior Supervisor, Project Manager, or specialised roles in network optimisation or research.
- Basic Project Management Principles:
  - Introduce fundamental project management concepts, including project planning, execution, monitoring, risk management, and communication.

Activity

- Activity Name: Role Play - Project Planning
- Objective of the Activity: To simulate the process of project planning, fostering a practical understanding
  - of project management principles.
- Resources: Participant handbook, notepads, pens.
- Time Duration: 30 minutes
- Instructions:
  - Divide participants into small groups.
  - Assign each group a hypothetical 5G network deployment project.
  - Instruct each group to brainstorm and outline the project's key tasks, timeline, resources required, potential risks, and communication plan.
  - Groups present their project plans to the class, followed by a brief discussion on the challenges they encountered and the strategies they employed.
- Outcome: Participants will grasp the essential elements of project planning and management through active engagement in a simulated scenario.

Notes for Facilitation

- Emphasise the practical relevance of the role of a Project Supervisor in real-world technological advancements.
- Keep the pace of the session dynamic to maintain participant engagement.
- Encourage participants to relate concepts to their own experiences for better comprehension.
- Be prepared to address questions about career prospects and technical aspects of 5G networks.
- Foster an open and inclusive environment for participants to share ideas and ask questions.

Exercise

Answers to exercises for PHB

Multiple Choice Question

1. b) 1.2 billion
2. d) Pharmaceutical Services
3. b) TRAI
4. b) Planning, deploying, and maintaining 5G network infrastructure
5. c) 90.1%

Short Answer Questions – Answers

1. Strategic implementation of advanced technology allows a Project Engineer to deploy 5G networks efficiently, improve speed and reliability, and support future applications like IoT, automation, and smart services.

2. Any four:

- E-Waste Management Rules, 2016
- CPCB guidelines for handling hazardous waste
- IS 14489 Occupational Safety and Health guidelines
- DoT EMF radiation safety norms

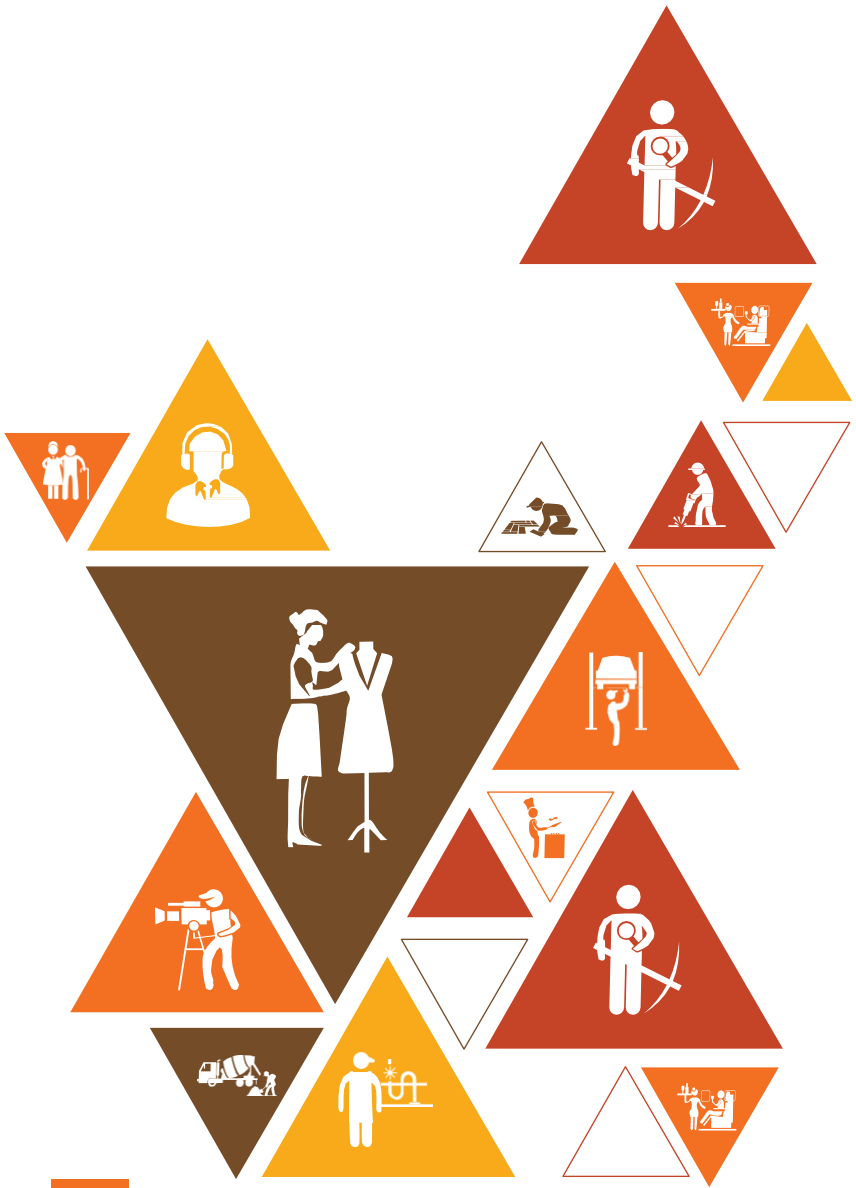
3. Two responsibilities:

- Monitoring and optimizing network KPIs to reduce latency, call drops, and congestion
- Implementing actions such as load balancing, parameter tuning, or equipment upgrades to improve user experience

True/False – Answers

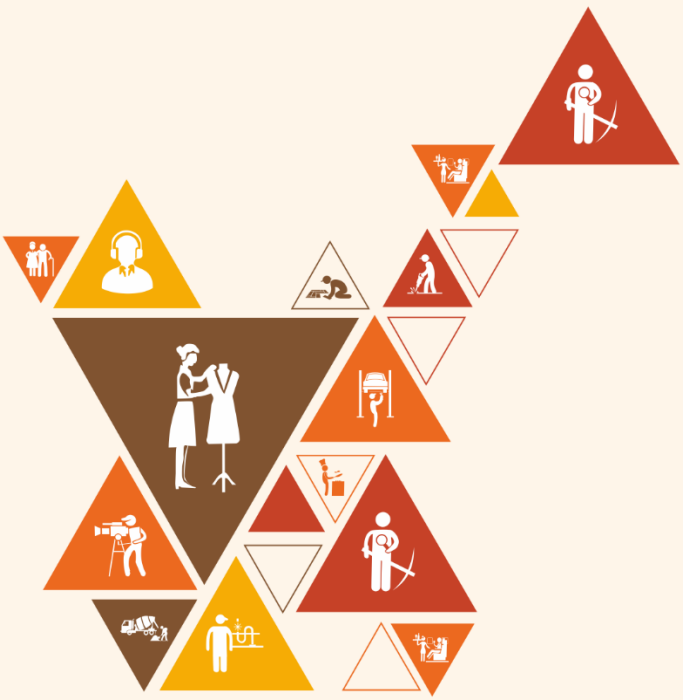
1. True
2. False
3. True
4. True

Notes



2. Assess Hardware and Equipment Readiness for 5G Site Deployment

Unit 2.1 - Install 5G NR Site Hardware Equipment
Unit 2.2 - Implement STEPs to Prepare Site for 5G Implementation



TEL/N6319

Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Explain the principles of radio access technology (4G/5G) and their deployment frameworks, highlighting key differences and implementation strategies.
2. Discuss the fifth-generation (5G) access domain, including 3GPP specifications and standards across L1, L2, and L3 layers, and their significance in modern telecommunications.
3. Explain the role of cloud technologies, Open Edge Servers, and xHaul deployments within cloud environments and their impact on 5G network efficiency.
4. Describe the key concepts of VoLTE, VoWiFi, Virtualized RAN (vRAN), O-RAN, and Management and Orchestration (MANO), and their roles in advanced mobile networks.
5. Explain system integration principles, focusing on API management, virtualized network function (VNF) compatibility, and interoperability testing in telecom infrastructures.
6. Explain the process of software testing and automation in 5G environments, and mapping of backhaul network structures with site configurations.
7. Show how to conduct pre-deployment software testing using automated scripts and verify backhaul network integration for 5G sites.
8. Show how to implement orchestration between teams, NFVI, and cloud-native network functions to optimize site deployment.
9. Explain system integration and orchestration concepts across teams, NFVI, and cloud-native environments.
10. Show how to implement orchestration between teams, NFVI, and cloud-native network functions to optimize site deployment and productivity.
11. Explain the concept and purpose of Proof of Concepts (PoCs) in validating new 5G solutions.
12. Show how to execute Proof of Concepts (PoC) and present findings to stakeholders.
13. Explain methods of analyzing signal strength and understanding antenna orientation parameters (tilt, zenith, azimuth).
14. Demonstrate signal strength analysis and adjustment of antenna tilt, zenith, and azimuth angles for optimal coverage.
15. Show how to review and interpret 3GPP standards, project budgets, architectural blueprints, and client-specific design documents.
16. Elucidate the message flows, parameters, and signaling procedures used in 5G networking, and their importance in maintaining seamless communication.
17. Show how to assess and validate MIMO antenna parameters, including diversity gain, MIMO capacity, and beamforming requirements.
18. Demonstrate evaluation of MIMO antenna radiation patterns for performance optimization.
19. Demonstrate how to verify the availability of passive equipment (battery banks, power plants, antennas, feeder cables, mounting accessories, etc.) ensuring operational readiness.
20. Show how to ensure readiness of active equipment including gNodeB, fiber transmission networks, microwave links, and edge computing units for deployment.

21. Demonstrate installation, configuration, and commissioning of equipment at designated locations while ensuring safety compliance.
22. Show how to conduct pre-activation checks to validate equipment readiness and network synchronization.
23. Explain the concept and purpose of Proof of Concepts (PoCs) in validating new 5G solutions.
24. Show how to execute Proof of Concepts (PoC) and present findings to stakeholders.
25. Demonstrate coordination with cross-functional teams to translate high-level architecture into deployment deliverables.
26. Determine the appropriate escalation processes and incident management frameworks for reporting system failures, security threats, and environmental hazards.
27. Demonstrate reporting and handling of emergency incidents such as passive equipment failures, fire, and power loss in accordance with safety norms.

UNIT 2.1: Install 5G NR Site Hardware Equipment

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Explain the principles of radio access technology (4G/5G) and their deployment frameworks, highlighting key differences and implementation strategies.
2. Discuss the fifth-generation (5G) access domain, including 3GPP specifications and standards across L1, L2, and L3 layers, and their significance in modern telecommunications.
3. Explain the role of cloud technologies, Open Edge Servers, and xHaul deployments within cloud environments and their impact on 5G network efficiency.
4. Describe the key concepts of VoLTE, VoWiFi, Virtualized RAN (vRAN), O-RAN, and Management and Orchestration (MANO), and their roles in advanced mobile networks.
5. Explain system integration principles, focusing on API management, virtualized network function (VNF) compatibility, and interoperability testing in telecom infrastructures.
6. Explain the process of software testing and automation in 5G environments, and mapping of backhaul network structures with site configurations.
7. Show how to conduct pre-deployment software testing using automated scripts and verify backhaul network integration for 5G sites.
8. Show how to implement orchestration between teams, NFVI, and cloud-native network functions to optimize site deployment.
9. Explain system integration and orchestration concepts across teams, NFVI, and cloud-native environments.
10. Show how to implement orchestration between teams, NFVI, and cloud-native network functions to optimize site deployment and productivity.
11. Explain the concept and purpose of Proof of Concepts (PoCs) in validating new 5G solutions.
12. Show how to execute Proof of Concepts (PoC) and present findings to stakeholders.
13. Explain methods of analyzing signal strength and understanding antenna orientation parameters (tilt, zenith, azimuth).
14. Demonstrate signal strength analysis and adjustment of antenna tilt, zenith, and azimuth angles for optimal coverage.

Say

- Greetings, everyone! In this session, we'll dive into the intricacies of installing 5G NR site hardware equipment.
- Let's explore the concepts of radio access technology, cloud technologies, virtualised network functions, and project orchestration.

Resources to be Used

Participant handbook, notepad, pen, whiteboard, markers, presentation slides, overhead projector or large screen, computer/laptop with internet connection.

Ask

- Who can define what radio access technology is?
- Raise your hand if you've heard of cloud technologies and their relevance to 5G networks.

Do

- Initiate discussions by inviting participants to share their understanding of relevant terms, fostering an interactive atmosphere.
- Utilise presentation slides and diagrams to aid in conveying complex concepts related to 5G site hardware installation.
- Prompt participants to ask questions and exchange insights, enhancing overall understanding.

Elaborate

- Radio Access Technology and 5G Access Domain:
  - Explain the role of radio access technology in 4G/5G networks and introduce the 5G access domain concept.
- Cloud Technologies and Edge Servers:
  - Detail cloud technologies, the significance of open edge servers, and the deployment of xHaul in a cloud environment.
- Key Network Concepts:
  - Provide explanations for various terms such as VoLTE, VoWiFi, Advanced Messaging (RCS), Multi-ID, vEPC, Virtualized RAN (vRAN), O-RAN, MANO, and VNFs.
- Project Planning and Testing:
  - Discuss the planning process for software tests using automated scripts and mapping backhaul networks with 5G site programs post-installation.
- Orchestration and Productivity:
  - Explore techniques for integrating orchestration across teams to enhance overall productivity.
- Proof of Concepts (PoC):
  - Describe the importance of PoCs in ensuring delivery as per requirements and validating the installation process.
- Antenna Adjustment Techniques:
  - Provide insights into adjusting/tilting antennas to achieve appropriate zenith and azimuth angles.

Demonstrate

- Visually demonstrate the technique of adjusting antennas for optimal performance.

Activity

- **Activity name:** 5G Site Hardware Project Planning
- **Objective of the Activity:** To simulate the planning process for a 5G site hardware installation project, enhancing participants' understanding of project management.
- **Resources:** Participant handbook, notepads, pens, presentation slides.
- **Time Duration:** 30 minutes
- **Instructions:**
  - Divide participants into small groups.
  - Provide each group with a hypothetical 5G site installation scenario.
  - Instruct groups to collaboratively plan the project, considering components, timelines, teams involved, and testing procedures.
  - Groups present their project plans, followed by a discussion on the key challenges and strategies discussed.
- **Outcome:** Participants will gain practical insights into project planning and management within the context of 5G site hardware installations.

Notes for Facilitation

- Emphasise the importance of hands-on experience in installing 5G hardware for effective learning.
- Create an interactive environment by encouraging participants to share their perspectives and questions.
- Use relatable examples to explain complex technological concepts.
- Be prepared to address questions about specific technologies, network components, and project management strategies.
- Ensure participants understand the practical applications of the discussed concepts in real-world scenarios.

UNIT 2.2: Implement STEPs to Prepare Site for 5G Implementation

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Show how to review and interpret 3GPP standards, project budgets, architectural blueprints, and client-specific design documents.
2. Elucidate the message flows, parameters, and signaling procedures used in 5G networking, and their importance in maintaining seamless communication.
3. Show how to assess and validate MIMO antenna parameters, including diversity gain, MIMO capacity, and beamforming requirements.
4. Demonstrate evaluation of MIMO antenna radiation patterns for performance optimization.
5. Demonstrate how to verify the availability of passive equipment (battery banks, power plants, antennas, feeder cables, mounting accessories, etc.) ensuring operational readiness.
6. Show how to ensure readiness of active equipment including gNodeB, fiber transmission networks, microwave links, and edge computing units for deployment.
7. Demonstrate installation, configuration, and commissioning of equipment at designated locations while ensuring safety compliance.
8. Show how to conduct pre-activation checks to validate equipment readiness and network synchronization.
9. Explain the concept and purpose of Proof of Concepts (PoCs) in validating new 5G solutions.
10. Show how to execute Proof of Concepts (PoC) and present findings to stakeholders.
11. Demonstrate coordination with cross-functional teams to translate high-level architecture into deployment deliverables.
12. Determine the appropriate escalation processes and incident management frameworks for reporting system failures, security threats, and environmental hazards.
13. Demonstrate reporting and handling of emergency incidents such as passive equipment failures, fire, and power loss in accordance with safety norms.

Resources to be Used

Participant handbook, notepad, pen, whiteboard, markers, presentation slides, overhead projector or large screen, computer/laptop with internet connection.

Say

- Welcome to the class on 'Implementing STEPs to Prepare Site for 5G Implementation.' This session will delve into the crucial steps required to prepare a site for the deployment of 5G networks.
- By the end of this session, you'll have a comprehensive understanding of the technical and operational aspects involved in transforming architectural designs into practical deployment and managing emergency incidents.
- We'll cover topics ranging from design documents and equipment requirements, to implementation processes and incident reporting.

Ask

- Who can name some of the design documents that are essential for preparing a site for 5G implementation?
- If you've heard of MIMO antennas and their role in 5G networks, raise your hand.

Do

- Encourage participants to share their initial understanding of site preparation for 5G deployment, facilitating active participation.
- Utilise presentation slides, diagrams, and message flow to help participants visualise complex concepts and procedures.

Elaborate

- 3GPP Specs/Standards and Design Documents:
  - Discuss the importance of 3GPP specifications, design documents, budget considerations, and architectural designs in preparation.
- Message Flows and Parameters for 5G Procedures:
  - Explain the message flows and parameters used in the messages for various 5G procedures, emphasising their role in successful implementation.
- MIMO Antennas and Equipment Requirements:
  - Detail the significance of Multiple Input, Multiple Output (MIMO) antennas and list both passive and active equipment required at the site.
- Installation and Commissioning:
  - Summarise the equipment installation and commissioning processes, outlining the crucial steps and considerations.
- Proof of Concepts and Transformation:
  - Define proof of concepts, preparation processes, and transformation of top-level designs into deployment deliverables on-site.
- Incident Reporting:
  - Illustrate the process of reporting emergency incidents related to passive equipment, fire, and power failures to management.

Activity

- Activity name: 5G Site Preparation Scenario Analysis
- Objective of the Activity: To engage participants in analysing a hypothetical 5G site preparation scenario, enhancing their problem-solving skills.
- Resources: Participant handbook, notepads, pens, presentation slides.
- Time Duration: 30 minutes
- Instructions:
  - Divide participants into small groups.
  - Provide each group with a scenario involving challenges in preparing a site for 5G implementation.
  - Instruct groups to brainstorm solutions, considering design documents, equipment requirements, and implementation procedures.
  - Groups present their solutions, followed by a discussion on the effectiveness of different approaches.
- Outcome: Participants will improve their critical thinking and analytical skills by applying theoretical concepts to practical scenarios.

Notes for Facilitation

- Encourage participants to actively contribute by sharing their insights and experiences related to site preparation.
- Ensure that complex technical terms are explained using relatable examples.
- Promote an atmosphere of open dialogue and respect for diverse viewpoints.
- Provide real-world examples whenever possible to enhance the practical understanding of the content.
- Address any concerns participants may have regarding emergency incident reporting and handling.

Exercise

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

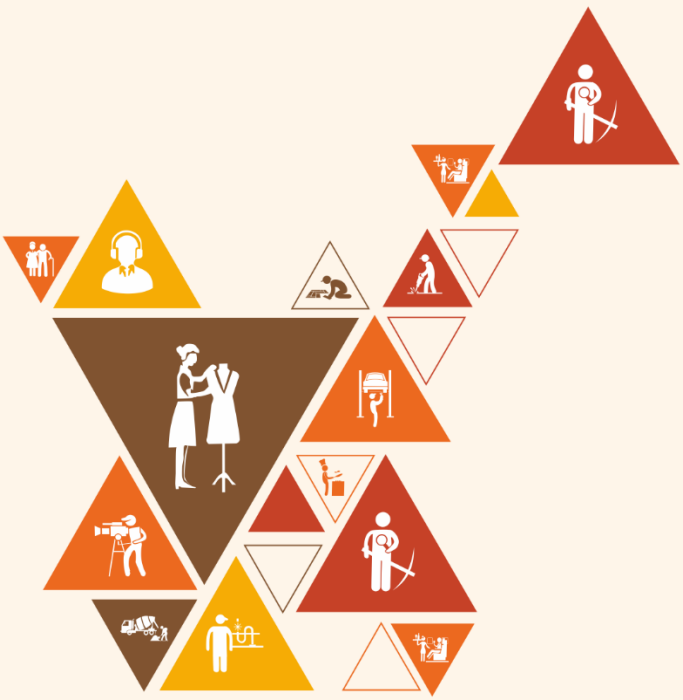
Descriptive Questions:

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

Notes

3. Pre-Installation Activities and Cable Routing

Unit 3.1 - Pre-Installation Activities and Cable Routing



TEL/N6320

Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Explain radio network design principles, KPI analysis, parameter tuning, and optimization techniques for LTE and 5G.
2. Show how to interpret and assess installation plans, recommending modifications if necessary.
3. Show how to verify the availability and integrity of all gNodeB and transmission units required for installation, ensuring they match the Bill of Materials (BoM).
4. Demonstrate the process of verifying transmission rack suitability and equipment arrangement for optimal performance.
5. Show the installation and selection of Miniature Circuit Breakers (MCBs) at the rack, ensuring proper voltage and grounding connectivity.
6. Identify application traffic generators and analyzers like iPerf and IxLoad, and their role in assessing network performance.
7. Describe containerization technologies such as Kubernetes and Docker, and the use of CI/CD tools like Ansible and Jenkins.
8. Explain Layer 2 and Layer 3 protocols relevant to LTE and 5G networks, such as RRC, RLC, and PDCP.
9. Demonstrate the process of configuring and verifying all network equipment and transmission units.
10. Demonstrate the measurement of current capacity in cables and equipment to ensure load compatibility.
11. Show how to verify the availability and integrity of all gNodeB and transmission units required for installation, ensuring they match the Bill of Materials (BoM).
12. Verify all received equipment for shipping damages and missing items.
13. Demonstrate the correct procedure for mounting antennas on various structures as per design specifications.
14. Show how to route power and data cables according to specified architecture and industry standards.
15. Demonstrate proper cable labeling, ensuring easy identification and maintenance.
16. Show the process of inspecting and verifying the interconnection of jumper, CPRI, RF, and other cables.
17. Demonstrate proper handling of cables and connectors to prevent damage during connection and disconnection.

UNIT 3.1: Perform Pre-Installation Activities

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Explain radio network design principles, KPI analysis, parameter tuning, and optimization techniques for LTE and 5G.
2. Show how to interpret and assess installation plans, recommending modifications if necessary.
3. Show how to verify the availability and integrity of all gNodeB and transmission units required for installation, ensuring they match the Bill of Materials (BoM).
4. Demonstrate the process of verifying transmission rack suitability and equipment arrangement for optimal performance.
5. Show the installation and selection of Miniature Circuit Breakers (MCBs) at the rack, ensuring proper voltage and grounding connectivity.
6. Identify application traffic generators and analyzers like iPerf and IxLoad, and their role in assessing network performance.
7. Describe containerization technologies such as Kubernetes and Docker, and the use of CI/CD tools like Ansible and Jenkins.
8. Explain Layer 2 and Layer 3 protocols relevant to LTE and 5G networks, such as RRC, RLC, and PDCP.
9. Demonstrate the process of configuring and verifying all network equipment and transmission units.
10. Demonstrate the measurement of current capacity in cables and equipment to ensure load compatibility.
11. Show how to verify the availability and integrity of all gNodeB and transmission units required for installation, ensuring they match the Bill of Materials (BoM).
12. Verify all received equipment for shipping damages and missing items.
13. Demonstrate the correct procedure for mounting antennas on various structures as per design specifications.
14. Show how to route power and data cables according to specified architecture and industry standards.
15. Demonstrate proper cable labeling, ensuring easy identification and maintenance.
16. Show the process of inspecting and verifying the interconnection of jumper, CPRI, RF, and other cables.
17. Demonstrate proper handling of cables and connectors to prevent damage during connection and disconnection.

Resources to be Used

Participant handbook, notepad, pen, whiteboard, markers, presentation slides, overhead projector or large screen, computer/laptop with internet connection.

Say

- Welcome to the class on 'Performing Pre-Installation Activities.' In this session, we'll delve into the essential steps and considerations before embarking on the installation process.
- By the end of this class, you'll be equipped with the knowledge to analyse installation plans, gather necessary materials, assess safety aspects, and ensure a smooth transition into the installation phase.

Ask

- Who can define what pre-installation activities entail?
- Raise your hand if you've ever been involved in or witnessed the installation of telecom equipment.

Do

- Foster an interactive environment by prompting participants to ask questions, share opinions, and contribute their thoughts.

Elaborate

- Analysing Installation Plan:
  - Explain the process of reviewing the installation plan received from the planning team and how to make necessary amendments to align with practical requirements.
- Material Specifications:
  - List the specifications of materials required for installation, including g-NodeB, transmission units, racks, and MCBs (Miniature Circuit Breakers).
- Tools and Equipment:
  - Discuss the different types of tools and equipment needed for installation and commissioning, such as radio network design tools, parameter tuning tools, and RAN optimisation tools.
- Configuration Processes:
  - Describe the configuration processes of equipment and network elements, emphasising the importance of accurate setup.
- Verification and Safety Checks:
  - Detail the process of verifying received telecom equipment against purchase orders, ensuring all components are present and in good condition. Also, discuss assessing safety aspects and complying with safety standards.
- Gathering Materials:
  - Explain the steps to gather all necessary tools, cables, connectors, and mounting brackets required for the specific telecom equipment.
- Risk Assessment:
  - Highlight the importance of identifying potential risks or challenges that may affect the installation process and addressing them proactively.

Activity

- Activity name: Pre-Installation Checklist Creation
- Objective of the Activity: To engage participants in creating a comprehensive pre-installation checklist based on a given scenario.
- Resources: Participant handbook, notepads, pens, presentation slides.
- Time Duration: 30 minutes
- Instructions:
  - Divide participants into small groups.
  - Provide each group with a hypothetical pre-installation scenario involving different equipment types.
  - Instruct groups to collaborate and create a detailed checklist covering all the necessary pre-installation activities for the given scenario.
    Groups present their checklists, followed by a discussion on the completeness and accuracy of each checklist.
- Outcome: Participants will develop a deeper understanding of pre-installation activities by actively constructing a checklist for a real-world scenario.

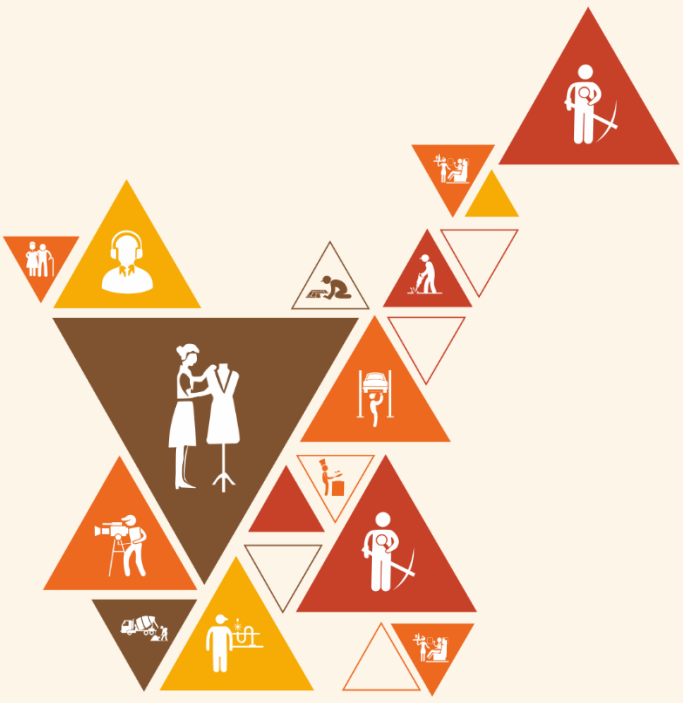
Notes for Facilitation

- Encourage participants to share insights from their own experiences and consider real-world challenges.
- Emphasise the importance of meticulous planning to ensure a smooth installation process.
- Address any questions related to specific tools, equipment, and safety protocols.
- Promote an open dialogue and collaborative learning atmosphere among participants.
- Reinforce the significance of accurate material verification and thorough safety assessments.

Notes

4. Install and Commission gNodeB

Unit 4.1 - Install and Commission gNodeB



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Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Show how to install the gNodeB unit at indoor or outdoor locations, ensuring structural stability.
2. Demonstrate the installation of 5G equipment in Non-Standalone (NSA) mode, ensuring coexistence with existing networks.
3. Explain the process of configuring network equipment to ensure proper data flow and connectivity as per technical specifications.
4. Demonstrate the installation of 5G equipment in NSA mode.
5. Demonstrate the interconnection of gNodeB and microwave equipment for seamless integration with existing network components.
6. Show the process of establishing reliable power connections, verifying voltage levels, and ensuring proper grounding.
7. Explain the process of configuring network equipment to ensure proper data flow and connectivity.
8. Identify the importance of Quality of Service (QoS) parameters in ensuring optimal performance for OAM.
9. Show how to measure and analyze QoS parameters, ensuring compliance with operational standards.
10. Demonstrate the execution of network rollout activities and software upgrades post-installation.
11. Show the onboarding and validation of VNFs to meet service requirements.
12. Describe the integration process for new sites and network expansion to reduce congestion and improve coverage.
13. Demonstrate integration processes for expanding existing sites, enhancing coverage, and reducing network congestion.
14. Explain the use of scientific computation, data acquisition, and processing techniques in successful site installation and commissioning.

UNIT 4.1: Install and Commission gNodeB

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Show how to install the gNodeB unit at indoor or outdoor locations, ensuring structural stability.
2. Demonstrate the installation of 5G equipment in Non-Standalone (NSA) mode, ensuring coexistence with existing networks.
3. Explain the process of configuring network equipment to ensure proper data flow and connectivity as per technical specifications.
4. Demonstrate the installation of 5G equipment in NSA mode.
5. Demonstrate the interconnection of gNodeB and microwave equipment for seamless integration with existing network components.
6. Show the process of establishing reliable power connections, verifying voltage levels, and ensuring proper grounding.
7. Explain the process of configuring network equipment to ensure proper data flow and connectivity.
8. Identify the importance of Quality of Service (QoS) parameters in ensuring optimal performance for OAM.
9. Show how to measure and analyze QoS parameters, ensuring compliance with operational standards.
10. Demonstrate the execution of network rollout activities and software upgrades post-installation.
11. Show the onboarding and validation of VNFs to meet service requirements.
12. Describe the integration process for new sites and network expansion to reduce congestion and improve coverage.
13. Demonstrate integration processes for expanding existing sites, enhancing coverage, and reducing network congestion.
14. Explain the use of scientific computation, data acquisition, and processing techniques in successful site installation and commissioning.

Resources to be Used

Participant handbook, notepad, pen, whiteboard, markers, presentation slides, overhead projector or large screen, computer/laptop with internet connection.

Say

- Welcome to the class on 'Performing Pre-Installation Activities.' In this session, we'll delve into the essential steps and considerations before embarking on the installation process.
- By the end of this class, you'll be equipped with the knowledge to analyse installation plans, gather necessary materials, assess safety aspects, and ensure a smooth transition into the installation phase.

Ask

- Who can define what pre-installation activities entail?
- Raise your hand if you've ever been involved in or witnessed the installation of telecom equipment.

Do

- Lead participants in exploring different types of tools and equipment required for installation and commissioning, such as radio network design tools, parameter tuning tools, radio network optimisation tools, OSS, and RAN optimisation tools.
- Facilitate a guided review of the installation plan, emphasising the importance of aligning it with practical considerations. Encourage participants to share any modifications they would make based on their understanding.
- Encourage participants to discuss the functions of each tool and their significance in the installation process.
- Walk participants through the step-by-step configuration processes of equipment and network elements. Use examples to illustrate how configurations are done and how accuracy is crucial to the overall functioning of the network.

Elaborate

- Analysing Installation Plan:
  - Explain the process of reviewing the installation plan received from the planning team and how to make necessary amendments to align with practical requirements.
- Material Specifications:
  - List the specifications of materials required for installation, including g-NodeB, transmission units, racks, and MCBs (Miniature Circuit Breakers).
- Tools and Equipment:
  - Discuss the tools and equipment needed for installation and commissioning, such as radio network design tools, parameter tuning tools, and RAN optimisation tools.
- Configuration Processes:
  - Describe the configuration processes of equipment and network elements, emphasising the importance of accurate setup.
- Verification and Safety Checks:
  - Detail the process of verifying received telecom equipment against purchase orders, ensuring all components are present and in good condition. Also, discuss assessing safety aspects and complying with safety standards.
- Gathering Materials:
  - Explain the steps to gather all necessary tools, cables, connectors, and mounting brackets required for the specific telecom equipment.
- Risk Assessment:
  - Highlight the importance of identifying potential risks or challenges affecting the installation process and addressing them proactively.

Demonstrate

Conduct a hands-on demonstration or simulation of verifying received telecom equipment against a mock purchase order and packing list. Provide participants with sample equipment and engage them in identifying any discrepancies or damages and discussing potential safety concerns.

Activity

- Activity name: Pre-Installation Checklist Creation
- Objective of the Activity: To engage participants in creating a comprehensive pre-installation checklist based on a given scenario.
- Resources: Participant handbook, notepads, pens, presentation slides.
- Time Duration: 30 minutes
- Instructions:
  - Divide participants into small groups.
  - Provide each group with a hypothetical pre-installation scenario involving different equipment types.
  - Instruct groups to collaborate and create a detailed checklist covering all the necessary pre-installation activities for the given scenario.
  - Groups present their checklists, followed by a discussion on the completeness and accuracy of each checklist.
- Outcome: Participants will develop a deeper understanding of pre-installation activities by actively constructing a checklist for a real-world scenario.

Notes for Facilitation

- Encourage participants to share insights from their own experiences and consider real-world challenges.
- Emphasise the importance of meticulous planning to ensure a smooth installation process.
- Address any questions related to specific tools, equipment, and safety protocols.
- Promote an open dialogue and collaborative learning atmosphere among participants.
- Reinforce the significance of accurate material verification and thorough safety assessments.

Exercise

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

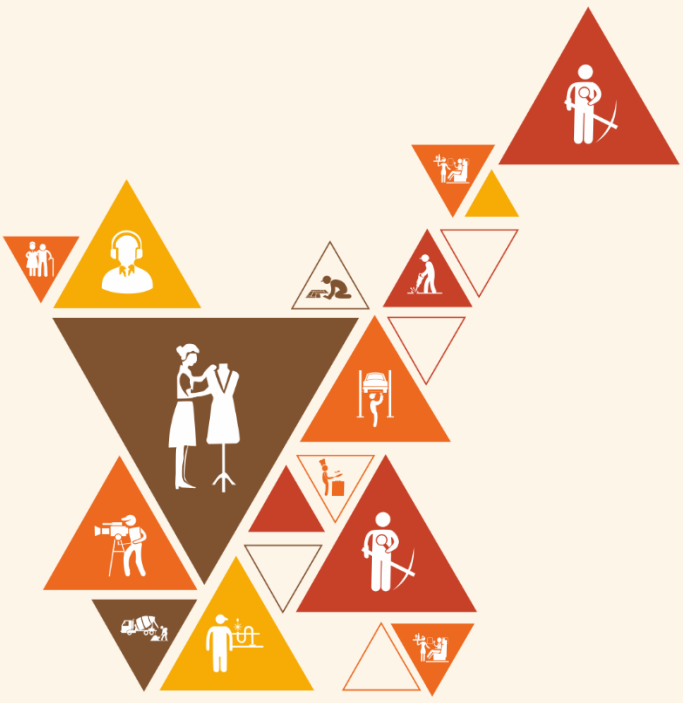
Descriptive Questions:

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

Notes

5. 5G Network Compliance and Quality Verification

Unit 5.1 - Perform Quality Checks Pertaining to Installation and Commissioning
Unit 5.2 - Prepare Compliance Reports



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Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Show how to verify site commissioning requirements as per network planning guidelines and technical specifications
2. Demonstrate the process of conducting power-on tests and validating equipment configurations such as gNodeB, microwave equipment, and NSA 5G mode
3. Define network emulation technologies and their applications in simulating real-world network conditions
4. Describe the use of UE simulators such as Aeroflex TM500 and Keysight for device testing and validation
5. Explain the purpose of debugging tools like QXDM, XCAL, and TEMS in network troubleshooting
6. Show the procedure for performing functional tests using tools like IXIA, Spirent, and user equipment (UE) simulators
7. Show how to identify and document technical issues, software bugs, or misconfigurations encountered during the test run
8. Demonstrate coordination with the technical team to troubleshoot and resolve installation or commissioning issues
9. Identify industry-standard test tools like IXIA and Spirent, and explain their role in network traffic generation and performance analysis
10. Show the procedure for performing functional tests using tools like IXIA, Spirent, and user equipment (UE) simulators
11. Demonstrate the steps for ensuring all processes align with service provider guidelines to confirm site readiness
12. Describe site-specific safety and operational guidelines for 5G network infrastructure Demonstrate coordination with the technical team to troubleshoot and resolve installation or commissioning issues
13. Show the process of conducting a retest after issue resolution to validate corrective measures and confirm site stability.
14. Demonstrate how to log and analyze test results in predefined report formats, ensuring compliance with performance benchmarks
15. List reporting standards, formats, and regulatory requirements for compliance documentation
16. Explain the applicable documentation requirements and the significance of maintaining accurate records
17. Describe the consequences of non-compliance with network installation and quality assurance standards
18. Demonstrate the submission of compliance reports for review and approval by authorized personnel before site handover
19. Show the process of obtaining official sign-off from stakeholders, confirming compliance, operational readiness, and closure of site installation

UNIT 5.1: Perform Quality Checks Pertaining to Installation and Commissioning

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Show how to verify site commissioning requirements as per network planning guidelines and technical specifications
2. Demonstrate the process of conducting power-on tests and validating equipment configurations such as gNodeB, microwave equipment, and NSA 5G mode
3. Define network emulation technologies and their applications in simulating real-world network conditions
4. Describe the use of UE simulators such as Aeroflex TM500 and Keysight for device testing and validation
5. Explain the purpose of debugging tools like QXDM, XCAL, and TEMS in network troubleshooting
6. Show the procedure for performing functional tests using tools like IXIA, Spirent, and user equipment (UE) simulators
7. Show how to identify and document technical issues, software bugs, or misconfigurations encountered during the test run
8. Identify industry-standard test tools like IXIA and Spirent, and explain their role in network traffic generation and performance analysis
9. Show the procedure for performing functional tests using tools like IXIA, Spirent, and user equipment (UE) simulators
10. Demonstrate the steps for ensuring all processes align with service provider guidelines to confirm site readiness
11. Describe site-specific safety and operational guidelines for 5G network infrastructure Demonstrate coordination with the technical team to troubleshoot and resolve installation or commissioning issues
12. Show the process of conducting a retest after issue resolution to validate corrective measures and confirm site stability

Resources to be Used

Participant handbook, notepad, pen, whiteboard, markers, presentation slides, overhead projector or large screen, computer/laptop with internet connection.

Say

- Welcome to the session on 'Performing Quality Checks Pertaining to Installation and Commissioning.'
- Throughout this class, we will delve into essential steps and processes that guarantee the quality of installation and commissioning activities.
- Our exploration will encompass testing tools, effective troubleshooting strategies, and the significance of consistent maintenance practices.

Ask

- Who can explain the significance of testing and quality checks during the installation and commissioning process?
- Raise your hand if you're familiar with any testing tools used for network performance assessment.

Elaborate

- Analysing Commissioning Requirements:
  - Explain the process of analysing specific commissioning requirements based on factors such as coverage area, capacity, and network topology.
  - Emphasise the importance of aligning the installation process with the unique needs of the service provider and the network's objectives.
- Testing gNodeBs and Simulating Networks:
  - Provide a detailed overview of the procedure for testing 5G gNodeBs.
  - Discuss the significance of using testing tools like channel and network emulators to simulate real-world network conditions, ensuring thorough and accurate testing.
- UE Simulators and Debuggers:
  - Explore the world of UE simulators like Aeroflex TM500 and Keysight and UE debuggers like QXDM, XCAL, and TEMS.
  - Highlight how these tools contribute to testing and troubleshooting user equipment, improving network performance and user experience.
- Comprehensive Test Run:
  - Break down the process of conducting a comprehensive test run of upgraded software and equipment.
  - Discuss the step-by-step STEPs to ensure a thorough assessment of the network's functionality and the identification of any potential issues.
- Issue Identification and Resolution:
  - Explain the various issues and bugs that may surface during the test run. Provide insights into possible solutions and corrective measures for each issue, stressing the importance of efficient problem-solving.
- Testing Tools for Traffic Generation and Monitoring:
  - Elaborate on using testing tools such as IXIA and Spirent for traffic generation and monitoring. Discuss their roles in evaluating network performance, capacity, and responsiveness at the local level.
- Routine Maintenance Overview:
  - Detail the essential processes and tasks to maintain the site's operational status. Discuss routine maintenance, system updates, and hardware inspections to ensure the equipment's longevity and optimal performance.
- Incorporating Necessary Changes:
  - Discuss the techniques and approaches to incorporating necessary changes efficiently based on identified issues.
  - Emphasise adapting to evolving network demands and swiftly resolving challenges to ensure seamless operation.

Do

- Initiate a discussion about the importance of analysing specific commissioning requirements based on factors like coverage area, capacity, and network topology. Encourage participants to share their thoughts and experiences.
- Utilise presentation slides and diagrams to summarise the procedure for testing 5G gNodeBs, emphasising the use of testing tools like channel and network emulators for accurate testing. Facilitate discussions on real-world network simulation.
- Engage participants in exploring UE simulators such as Aeroflex TM500 and Keysight and UE debuggers like QXDM, XCAL, and TEMS.
- Walk participants through the steps required to complete a comprehensive test run of upgraded software and equipment. Showcase the process of identifying issues and bugs during testing and troubleshooting.
- Encourage participants to brainstorm and list different issues and bugs that may arise during the test run. Facilitate a discussion on possible solutions and corrective measures for each issue.
- Engage participants in a hypothetical scenario where they must efficiently resolve an identified issue. Facilitate discussions on the incorporation of necessary changes for smooth equipment operation.

Demonstrate

Simulate the use of IXIA on a computer to demonstrate traffic generation and monitoring in a controlled environment.

Activity

- Activity name: Maintenance Planning Simulation
- Objective of the Activity: To engage participants in planning routine maintenance tasks for a hypothetical 5G site.
- Resources: Participant handbook, notepads, pens.
- Time Duration: 30 minutes
- Instructions:
  - Divide participants into small groups.
  - Provide each group with a scenario of a 5G site requiring routine maintenance.
  - Instruct groups to collaboratively create a maintenance plan, including tasks, schedules, and responsibilities.
  - Groups present their maintenance plans, followed by a discussion on the effectiveness of each plan.
- Outcome: Participants will develop practical skills in planning routine maintenance activities for 5G sites.

Notes for Facilitation

- Foster an interactive and collaborative learning environment by encouraging participants to share insights and experiences.
- Address any technical questions participants may have regarding testing tools and troubleshooting techniques.
- Use real-world examples and case studies to enhance participants' understanding of the concepts.
- Emphasise the importance of routine maintenance in ensuring the smooth operation of network equipment.
- Reinforce the significance of efficient issue resolution and incorporating necessary changes for optimal network performance.

UNIT 5.2: Prepare Compliance Reports

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Demonstrate how to log and analyze test results in predefined report formats, ensuring compliance with performance benchmarks
2. List reporting standards, formats, and regulatory requirements for compliance documentation
3. Explain the applicable documentation requirements and the significance of maintaining accurate records
4. Describe the consequences of non-compliance with network installation and quality assurance standards
5. Demonstrate the submission of compliance reports for review and approval by authorized personnel before site handover
6. Show the process of obtaining official sign-off from stakeholders, confirming compliance, operational readiness, and closure of site installation
7. Demonstrate the submission of compliance reports for review and approval by authorized personnel before site handover
8. Show the process of obtaining official sign-off from stakeholders, confirming compliance, operational readiness, and closure of site installation

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.

Say

- Welcome to the class on 'Preparing Compliance Reports.' Today, we'll delve into the crucial process of documenting and reporting network performance and regulatory compliance.
- By the end of this session, you'll understand the importance of accurate documentation, compliance reporting, and the steps involved in getting reports signed off.
- Let's explore how proper reporting ensures transparency, regulatory adherence, and optimal network performance tracking.

Ask

- Can anyone share an example of why accurate documentation is important in the context of network deployment?
- Raise your hand if you've ever been involved in preparing compliance reports.

Elaborate

- Pre-Defined Report Format:
  - Explain the components of a pre-defined report format, including essential elements like KPIs, signal strength, handover success rates, and other performance metrics.
  - Highlight how adherence to this format ensures accurate record-keeping and standardised reporting.
- Documentation Importance:
  - Elaborate on the significance of maintaining documentation, reports, and logs to demonstrate regulatory compliance and track network performance over time.
  - Discuss how these records contribute to transparency and accountability.
- Compliance Closure:
  - Provide a comprehensive overview of the compliance closure process.
  - Explain the steps in obtaining signoff on reports from the concerned authority, ensuring the site meets all requirements before deployment.
  - Explain the significance of obtaining signoff on all reports from the concerned authority and the role of these reports in demonstrating site readiness.

Do

- Initiate a discussion about the significance of a pre-defined report format for accurate test result recording. Discuss the inclusion of KPIs, signal strength, handover success rates, and other performance metrics. Encourage participants to share their insights and experiences.
- Utilise presentation slides to outline the importance of maintaining different types of documentation, reports, and logs. Discuss how installation and commissioning compliance reports contribute to regulatory compliance and performance monitoring.
- Guide participants in recalling the process of compliance closure for a site after successful inspection.

Activity

- Activity name: Compliance Reporting Simulation
- Objective of the Activity: To engage participants in collaboratively preparing compliance reports for different scenarios.
- Resources: Participant handbook, notepads, pens.
- Time Duration: 30 minutes
- Instructions:
  - Divide participants into small groups.
  - Provide each group with a compliance scenario related to network deployment.
  - Instruct groups to outline the steps, documentation, and report format required to prepare accurate compliance reports for their scenarios.
  - Groups present their findings, followed by a discussion on effective reporting strategies and challenges.
- Outcome: Participants will develop practical skills in preparing accurate compliance reports for diverse scenarios.

Notes for Facilitation

- Encourage active participation and discussion among participants.
- Emphasise the importance of accurate reporting in maintaining regulatory compliance and tracking network performance.
- Address any questions participants may have regarding compliance procedures and documentation.
- Use real-world examples and case studies to reinforce the concepts covered.
- Reinforce the significance of thorough documentation for transparency, accountability, and regulatory adherence.

Exercise

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

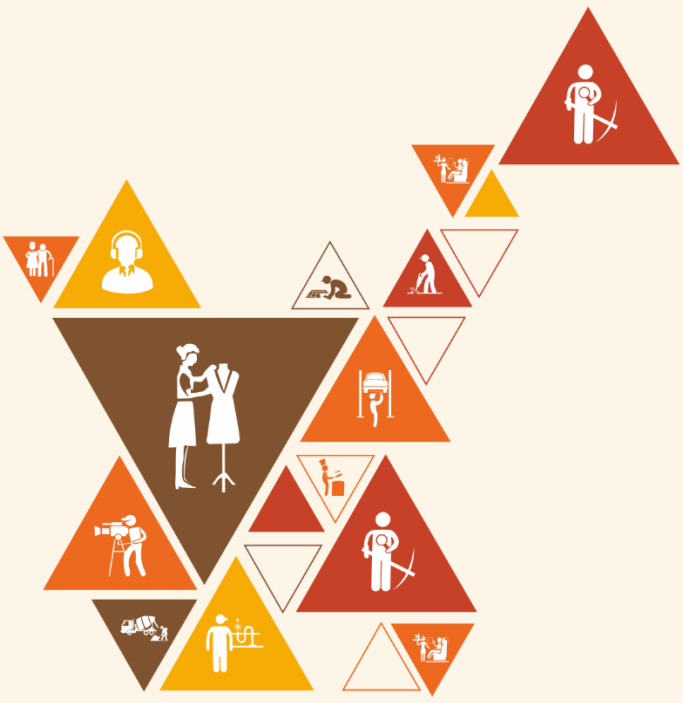
Descriptive Questions:

1. Refer to UNIT 5.1: Prepare for Troubleshooting Wi-Fi Backhaul Equipment
   Topic 5.1.1 EMI/EMC Concepts
2. Refer to UNIT 5.1: Prepare for Troubleshooting Wi-Fi Backhaul Equipment
   Topic 5.1.2 Re-Configuring the Wi-Fi Backhaul Equipment
3. Refer to UNIT 5.1: Prepare for Troubleshooting Wi-Fi Backhaul Equipment
   Topic 5.1.5 Crimping/Soldering Process
4. Refer to UNIT 5.2: Troubleshoot Wi-Fi Network Setup
   Topic 5.2.1 Locate and Inspect Faults using Portable Tester Device
5. Refer to UNIT 5.2: Troubleshoot Wi-Fi Network Setup
   Topic 4.2.4 Troubleshoot Wi-Fi Access Points (2.4 GHz)

Notes

6. Prepare and Perform Acceptance Testing of 5G Sites

Unit 6.1 - Prepare and Perform for Acceptance Testing and Monitoring



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Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Explain the purpose and significance of acceptance testing in 5G network deployment.
2. Show how to develop a test strategy using available resources, test tools, and simulators.
3. Describe the regulatory and industry standards applicable to 5G site testing and monitoring.
4. Show the process of documenting SOPs for acceptance testing and ensuring clarity for all stakeholders.
5. Identify the principles of 5G gNodeB architecture, including Standalone (SA) and Non-Standalone (NSA) configurations.
6. Demonstrate the design of comprehensive test cases aligned with 3GPP standards and client requirements.
7. Explain test strategies and methodologies for 5G network acceptance and validation.
8. Demonstrate the setup of test environments, including configuring hardware and software according to the finalized strategy.
9. List the standard operating procedures (SOPs) involved in acceptance testing.
10. Show the process of obtaining site-specific documentation such as checklists and safety guidelines.
11. Define the site infrastructure requirements, covering power supply, environmental protection, and connectivity.
12. Show how to inspect physical site compliance, covering structural integrity, weatherproofing, and equipment placement.
13. Describe the role of passive and active infrastructure elements in ensuring optimal network performance.
14. Demonstrate the coordination with infrastructure teams to validate passive infrastructure elements.
15. Identify the safety protocols and risk mitigation strategies to be followed during telecom site testing.
16. Demonstrate the verification of equipment installation, including software versions and cabling.
17. Explain test result analysis and corrective approach (implied through validation activities).
18. Demonstrate the execution of test cases and validation of expected results against actual outcomes.
19. Show how to perform logical tests such as VSWR levels, alarm connectivity, and equipment connectivity.
20. Show the identification and debugging of anomalies, replicating issues in lab environments for further analysis.
21. Demonstrate the analysis of test results and recommend corrective actions for any deviations.

UNIT 6.1: Prepare and Perform for Acceptance Testing and Monitoring

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Explain the purpose and significance of acceptance testing in 5G network deployment.
2. Show how to develop a test strategy using available resources, test tools, and simulators.
3. Describe the regulatory and industry standards applicable to 5G site testing and monitoring.
4. Show the process of documenting SOPs for acceptance testing and ensuring clarity for all stakeholders.
5. Identify the principles of 5G gNodeB architecture, including Standalone (SA) and Non-Standalone (NSA) configurations.
6. Demonstrate the design of comprehensive test cases aligned with 3GPP standards and client requirements.
7. Explain test strategies and methodologies for 5G network acceptance and validation.
8. Demonstrate the setup of test environments, including configuring hardware and software according to the finalized strategy.
9. List the standard operating procedures (SOPs) involved in acceptance testing.
10. Show the process of obtaining site-specific documentation such as checklists and safety guidelines.
11. Define the site infrastructure requirements, covering power supply, environmental protection, and connectivity.
12. Show how to inspect physical site compliance, covering structural integrity, weatherproofing, and equipment placement.
13. Describe the role of passive and active infrastructure elements in ensuring optimal network performance.
14. Demonstrate the coordination with infrastructure teams to validate passive infrastructure elements.
15. Identify the safety protocols and risk mitigation strategies to be followed during telecom site testing.
16. Demonstrate the verification of equipment installation, including software versions and cabling.
17. Explain test result analysis and corrective approach (implied through validation activities).
18. Demonstrate the execution of test cases and validation of expected results against actual outcomes.
19. Show how to perform logical tests such as VSWR levels, alarm connectivity, and equipment connectivity.
20. Show the identification and debugging of anomalies, replicating issues in lab environments for further analysis.
21. Demonstrate the analysis of test results and recommend corrective actions for any deviations.

Resources to be Used

Test tools and simulators, Sample SOPs and acceptance checklists,3GPP standard documents, Safety gear and site guidelines, Laptops, test software, and configuration tools, Visual aids showing 5G architecture, SA/NSA layouts, and sample test cases

Say

- Today we will explore Acceptance Testing and Monitoring—a critical process that ensures a 5G site is technically sound, safe, compliant, and ready for integration.
- The session focuses on understanding test strategies, standards, documentation, infrastructure validation, and analyzing test results.
- By the end, you will be able to plan and conduct acceptance testing confidently using industry-aligned procedures.
- Acceptance testing is the final checkpoint before a site goes live, making accuracy, safety, and documentation essential.

Ask

- Have you ever observed or participated in any form of network testing? What challenges did you notice?
- Why do you think acceptance testing is so important before a site goes on air?
- What tools or documents do you think are necessary before starting a test at a 5G site?
- What could happen if a site is commissioned without following proper SOPs?

Do

- Share any personal experiences related to telecom installation, testing, or troubleshooting.
- Identify tools you think are required for 5G site acceptance.
- Discuss with peers how safety protocols impact field testing activities.
- Observe how infrastructure elements influence test outcomes.

Elaborate

- Introduce the acceptance testing workflow—pre-checks, test setup, test execution, documentation, and reporting.
- Explain the importance of SA/NSA architecture knowledge in building test cases and selecting test tools.
- Discuss regulatory standards like 3GPP and local DoT requirements to highlight the importance of compliance.
- Describe the need for accurate test case design, proper site documentation, and maintaining SOP consistency.
- Explain how analyzing test results helps identify deviations and supports corrective actions.

Demonstrate

- Perform a simple logical check such as alarm connectivity or equipment status validation.
- Display how site documents like checklists, safety guidelines, and SOPs are used during testing.

Activity

- Activity Name: Acceptance Test Flow Mapping
- Objective: Understand the complete sequence from site readiness to test completion.
- Type of Activity: Group
- Resources: Sample SOPs, test checklists, flowchart sheets
- Time Duration: 30 minutes
- Instructions:
    - Each group will create a flowchart representing acceptance testing steps including pre-checks, test execution, documentation, and issue reporting.
- Outcome: Participants understand the structure and documentation flow involved in acceptance testing.

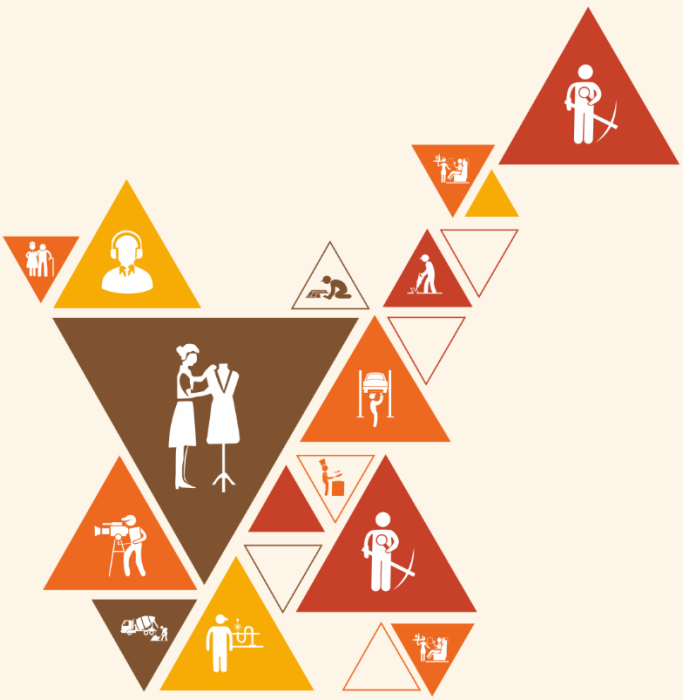
Notes for Facilitation

- Encourage trainees to connect concepts with real telecom field experiences.
- Reinforce the need for strict adherence to standards, safety protocols, and SOPs.
- Use practical examples of test failures and corrective actions to build clarity.
- Guide trainees through understanding how gNodeB architecture impacts testing.
- Emphasize the importance of documentation accuracy and stakeholder coordination.
- Provide examples of common site issues such as high VSWR, alarm failures, or configuration mismatches.
- Ensure trainees actively participate in discussions, demonstrations, and group activity

Notes

7. Monitor Site Performance and Communicate Test Results

Unit 7.1 - Monitor and Report Site Performance and Traffic



TEL/N6322

Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Explain the importance of real-time performance monitoring in maintaining 5G site efficiency.
2. Show how to conduct real-time performance monitoring of radio networks using authorized test instruments.
3. Describe common network performance indicators used to assess site performance.
4. Demonstrate the process of performing network health checks, including node status and sector-wise traffic analysis.
5. Identify the process of diagnosing and rectifying network issues to optimize site performance.
6. Show how to diagnose and rectify network issues to optimize site performance.
7. List the protocols for taking system backups before critical operations such as OMC stop/start or database re-syncs.
8. Demonstrate taking system backups before operations such as OMC stop/start and database re-syncs.
9. Explain data logging, storage, and retrieval methods for test results and network monitoring.
10. Demonstrate how to maintain system logs and test tool logs for future debugging and root cause analysis.
11. Describe the communication protocols and procedures for coordinating with cross-functional teams.
12. Demonstrate the process of communicating test results with relevant stakeholders, including the NOC team and project managers.
13. Identify the key elements of site performance reports, including test results and pending site issues.
14. Show the process of updating site records and maintaining documentation as per organizational standards.
15. Explain the significance of maintaining historical test records to support future troubleshooting and optimization.
16. Show how to analyze performance trends and identify recurring issues to implement proactive monitoring strategies.
17. Show the process of scheduling regular backups (daily, weekly, monthly) as per maintenance protocols.
18. Demonstrate the collection and analysis of customer-reported issues to improve site reliability and service quality.

UNIT 7.1: Monitor and Report Site Performance and Traffic

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Explain the importance of real-time performance monitoring in maintaining 5G site efficiency.
2. Show how to conduct real-time performance monitoring of radio networks using authorized test instruments.
3. Describe common network performance indicators used to assess site performance.
4. Demonstrate the process of performing network health checks, including node status and sector-wise traffic analysis.
5. Identify the process of diagnosing and rectifying network issues to optimize site performance.
6. Show how to diagnose and rectify network issues to optimize site performance.
7. List the protocols for taking system backups before critical operations such as OMC stop/start or database re-syncs.
8. Demonstrate taking system backups before operations such as OMC stop/start and database re-syncs.
9. Explain data logging, storage, and retrieval methods for test results and network monitoring.
10. Demonstrate how to maintain system logs and test tool logs for future debugging and root cause analysis.
11. Describe the communication protocols and procedures for coordinating with cross-functional teams.
12. Demonstrate the process of communicating test results with relevant stakeholders, including the NOC team and project managers.
13. Identify the key elements of site performance reports, including test results and pending site issues.
14. Show the process of updating site records and maintaining documentation as per organizational standards.
15. Explain the significance of maintaining historical test records to support future troubleshooting and optimization.
16. Show how to analyze performance trends and identify recurring issues to implement proactive monitoring strategies.
17. Show the process of scheduling regular backups (daily, weekly, monthly) as per maintenance protocols.
18. Demonstrate the collection and analysis of customer-reported issues to improve site reliability and service quality.

Resources to be Used

Laptops with sample monitoring dashboards, authorized RF test tools or simulators, sample log files, backup scripts/templates, communication templates for NOC reporting, site performance report samples, and minimal reference documents such as KPI threshold sheets and backup SOPs. These are lightweight resources that can be easily arranged in a classroom with basic digital access.

Say

- Today we will focus on performance monitoring, health checks, reporting, and coordination, which form the backbone of site maintenance activities.
- You will learn how to use real-time test tools, interpret KPIs, take backups safely, and communicate findings effectively.
- Monitoring is not just about detecting faults—it enables optimization, proactive action, and reliable customer experience.
- By the end of this session, you will be confident in executing monitoring tasks, recording results, and coordinating them with technical teams.

Ask

- Why do you think live performance monitoring is important for 5G sites?
- Have you ever observed KPIs or alarms being used to detect network issues?
- What could happen if backup protocols are skipped before major system operations?
- Why is documentation and reporting as important as testing itself?
- How do you think customer-reported issues impact network improvement efforts?

Do

- Discuss in groups what immediate actions should be taken when KPIs such as throughput or PRB utilization show abnormal values.
- Identify the minimum information that should be included in a site performance report.
- Observe how live monitoring dashboards or sample logs show patterns in traffic or fault trends.
- Compare different backup intervals—daily, weekly, monthly—and why each is necessary.

Elaborate

- Explain how KPIs like RSRP, SINR, throughput, call setup success rate, and traffic distribution influence site performance decisions.
- Discuss how node status, hardware alarms, sector loading, and neighbor relations impact health check results.
- Highlight why consistent log retention supports root cause analysis, audits, and long-term trend mapping.
- Describe how coordination with NOC, RF teams, and implementation teams ensures timely issue resolution.
- Emphasize how customer feedback often reveals hidden issues like intermittent congestion or coverage gaps.

Demonstrate

- Walk through a live or sample process of checking node status, sector load, and traffic distribution.
- Show how to use a test tool/dashboard to capture real-time KPIs and interpret threshold breaches.
- Demonstrate taking a pre-operation backup and validating its integrity.
- Display how system and test logs are stored, labeled, and archived for traceability.
- Demonstrate the format and flow for communicating performance issues to NOC and project managers.
- Perform a sample trend analysis by comparing KPI logs from different days.
- Show how customer-reported tickets can be categorized and analyzed for patterns.

Activity

- Activity Name: Performance & Health Check Mapping
  Objective: Understand the complete workflow from monitoring to reporting and escalation.
  Type: Group Activity
  Resources: Sample KPI sheets, health-check templates, flowchart paper
  Duration: 30 minutes
- Instructions:
  - Each group will create a flowchart showing real-time monitoring steps—KPI observation, threshold comparison, backup requirement, issue diagnosis, logging, reporting, and escalation.
  - Include decision points such as “alarm triggered?”, “backup required?”, or “trend deviation observed?”.
- Outcome:
  Participants gain clarity on structured processes for monitoring, logging, diagnosing, and reporting site performance issues.

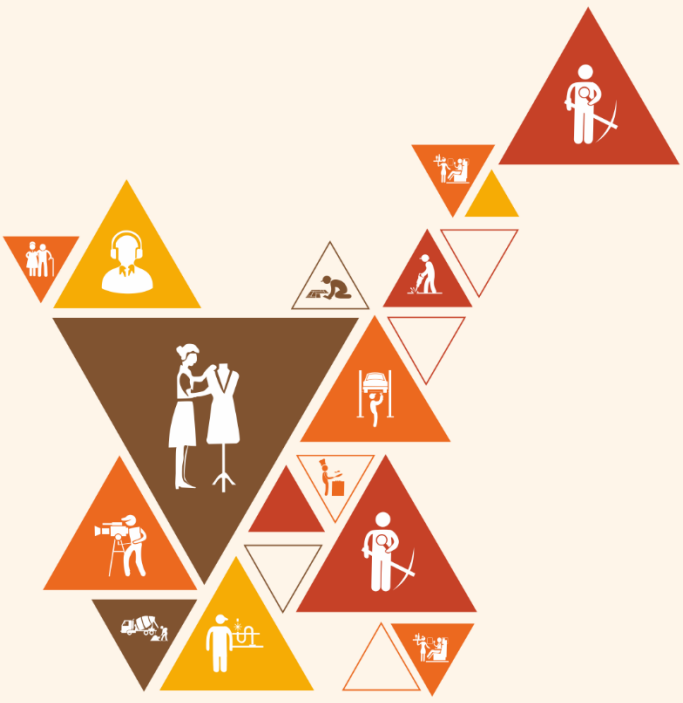
Notes for Facilitation

- Encourage participants to relate each KPI or alarm type to real field experiences.
- Reinforce the importance of following SOPs strictly before backups or system operations.
- Provide simple examples of common field failures such as high utilization, node down events, or poor SINR.
- Stress the role of detailed documentation in smooth handovers and audits.
- Promote active participation during demonstrations and group problem-solving tasks.
- Use simplified datasets to help learners understand trend analysis and recurring issue identification.

Notes

8. Sustainability Practices in Telecom Infrastructure Management

Unit 8.1 - Sustainability Practices in Telecom Infrastructure Management



TEL/N9109

Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Explain the e-waste management rules applicable to the telecom sector.
2. Show how to identify, segregate, and categorize e-waste and hazardous waste at telecom sites.
3. Describe Central Pollution Control Board (CPCB) guidelines for telecom site waste disposal.
4. Demonstrate the process of maintaining logs and records for disposed, recycled, or repurposed telecom waste.
5. Identify safety standards for battery handling and disposal, including lead-acid and lithium-ion batteries.
6. Demonstrate safe handling procedures for hazardous materials, including the use of protective gear.
7. List recyclable telecom components and methods for minimizing telecom waste.
8. Demonstrate the reduction of packaging waste through the reuse of telecom materials and accessories.
9. Elucidate techniques for energy optimization, such as smart cooling, LED lighting, and hybrid power systems.
10. Demonstrate energy-efficient practices, such as optimizing power usage and using smart cooling systems.
11. Explain the role of renewable energy sources, like solar energy, in reducing telecom carbon footprint.
12. Show how to assist in adopting solar-powered telecom towers and integrating hybrid energy systems.
13. Describe best practices for managing telecom tower site waste and reducing fuel consumption in Diesel Generators (DG) sets.
14. Demonstrate guiding co-workers on eco-friendly practices and waste management policies.
15. Define water conservation principles and sustainable telecom site design.
16. Explain the importance of training telecom employees on environmental awareness and compliance.
17. Show how to conduct periodic environmental audits to ensure sustainability compliance.

UNIT 8.1: Sustainability Practices in Telecom Infrastructure Management

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Explain the e-waste management rules applicable to the telecom sector.
2. Show how to identify, segregate, and categorize e-waste and hazardous waste at telecom sites.
3. Describe Central Pollution Control Board (CPCB) guidelines for telecom site waste disposal.
4. Demonstrate the process of maintaining logs and records for disposed, recycled, or repurposed telecom waste.
5. Identify safety standards for battery handling and disposal, including lead-acid and lithium-ion batteries.
6. Demonstrate safe handling procedures for hazardous materials, including the use of protective gear.
7. List recyclable telecom components and methods for minimizing telecom waste.
8. Demonstrate the reduction of packaging waste through the reuse of telecom materials and accessories.
9. Elucidate techniques for energy optimization, such as smart cooling, LED lighting, and hybrid power systems.
10. Demonstrate energy-efficient practices, such as optimizing power usage and using smart cooling systems.
11. Explain the role of renewable energy sources, like solar energy, in reducing telecom carbon footprint.
12. Show how to assist in adopting solar-powered telecom towers and integrating hybrid energy systems.
13. Describe best practices for managing telecom tower site waste and reducing fuel consumption in Diesel Generators (DG) sets.
14. Demonstrate guiding co-workers on eco-friendly practices and waste management policies.
15. Define water conservation principles and sustainable telecom site design.
16. Explain the importance of training telecom employees on environmental awareness and compliance.
17. Show how to conduct periodic environmental audits to ensure sustainability compliance.

Resources to be Used

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

Say

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

Ask

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

Do

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

Elaborate

Understanding E-Waste

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

Concept of Waste Management

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

Recycling Process of E-Waste

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

Demonstrate

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

Activity

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

Notes for Facilitation

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

Exercise

Answers to exercises for PHB

A. Multiple Choice Questions:

1. b) E-Waste Management Rules
2. b) Lead-acid or lithium-ion battery
3. b) To track waste movement and ensure compliance
4. c) Metal frames and cables
5. b) Reducing carbon footprint

B. Fill in the Blanks:

1. handling and disposal of telecom waste.
2. hazardous
3. energy

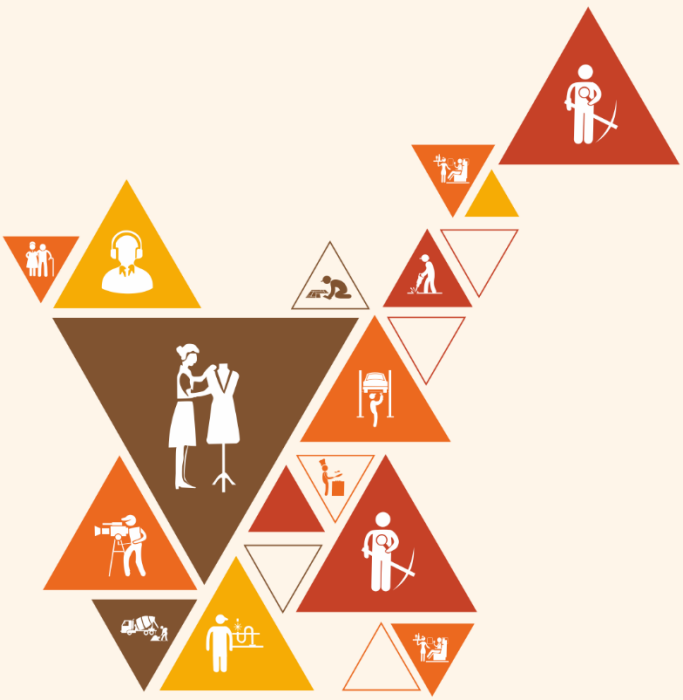
D. Short Answer Questions:

1. To ensure safe, compliant, and environmentally responsible disposal that avoids pollution and legal violations.
2. Smart cooling systems, LED lighting, hybrid power systems, or solar energy (any two).
3. To track waste movement, ensure regulatory compliance, support audits, and promote responsible waste management.

Notes

9. Workplace Management, Safety, and Resource Optimization

Unit 9.1 - Skill Development and Work Planning
Unit 9.2 - Safety, Resource Management, and Team Motivation



TEL/N9104

Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Explain strategies to pursue skill advancement relevant to the industry.
2. Show how to develop technical and personal skills for staying updated with industry advancements.
3. Describe key performance indicators (KPIs) for task evaluation and improvement.
4. Show techniques to guide the team in being accountable for timely completion of tasks.
5. Explain feedback processes and formats to guide performance improvement.
6. Show methods to train the team on adapting to new products, services, and technologies.
7. Discuss the significance of setting timelines and goals for work allocation.
8. Show the process of creating schedules and rosters to ensure smooth workflow.
9. Describe the importance of quality and timely delivery of products and services.
10. Show supervision techniques to ensure work is done according to assigned requirements.
11. Explain the layout of the workstation and equipment used in daily tasks.
12. Show ways to maintain efficiency and productivity while performing assigned tasks.
13. Discuss the escalation matrix and its importance, especially in emergencies.
14. Show problem-solving skills by analyzing workplace issues and providing appropriate solutions.
15. Explain techniques for time and cost management in workplace operations.
16. Show how to train the team to estimate the root cause of problems and validate solutions.
17. Show identification of organizational health, safety, and security policies and procedures.
18. Explain different types of hazards and associated risks in the workplace.
19. Show handling of hazards like illness, accidents, fires, or natural calamities as per organizational procedures.
20. Discuss the procedures for reporting breaches in health, safety, and security.
21. Show how to instruct the team to report breaches in health, safety, and security.
22. Show the process of reporting hazards outside individual authority and warning others who may be affected.
23. Describe methods for efficient resource and material management.
24. Show practices to optimize material usage, including water, in daily activities.
25. Show supervision of the team to ensure responsible use of workplace resources.
26. Explain common electrical problems and practices for conserving electricity.
27. Show methods to guide the team in optimizing energy usage in various processes.
28. Show techniques to motivate the team for routine cleaning of tools, machines, and equipment.
29. Show periodic checks to ensure the proper functioning of machines and equipment.
30. Show guidance on reporting malfunctions and lapses in equipment maintenance.
31. Show identification of opportunities for team-building workshops and motivational training.

UNIT 9.1: Skill Development and Work Planning

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Explain strategies to pursue skill advancement relevant to the industry.
2. Show how to develop technical and personal skills for staying updated with industry advancements.
3. Describe key performance indicators (KPIs) for task evaluation and improvement.
4. Show techniques to guide the team in being accountable for timely completion of tasks.
5. Explain feedback processes and formats to guide performance improvement.
6. Show methods to train the team on adapting to new products, services, and technologies.
7. Discuss the significance of setting timelines and goals for work allocation.
8. Show the process of creating schedules and rosters to ensure smooth workflow.
9. Describe the importance of quality and timely delivery of products and services.
10. Show supervision techniques to ensure work is done according to assigned requirements.
11. Explain the layout of the workstation and equipment used in daily tasks.
12. Show ways to maintain efficiency and productivity while performing assigned tasks.
13. Discuss the escalation matrix and its importance, especially in emergencies.
14. Show problem-solving skills by analyzing workplace issues and providing appropriate solutions.
15. Explain techniques for time and cost management in workplace operations.
16. Show how to train the team to estimate the root cause of problems and validate solutions.

Resources to be Used

Participant handbook, laptop, monitoring dashboard or sample test tool screens, pen, notebook, markers, projector, backup SOP templates, sample log files, printouts of KPI threshold charts, and performance report formats. These resources can be easily arranged in a training room with basic digital equipment.

Say

Good morning and welcome back to this training session on Site Performance Monitoring and Reporting.In this unit, we will learn how to observe real-time KPIs, interpret site health indicators, carry out backups safely, and communicate the test results to the concerned teams.By understanding these procedures, you will be able to maintain smooth site operations and ensure consistent service quality.

Ask

- Can anyone share an example of why accurate documentation is important in the context of network deployment?
- Raise your hand if you've ever been involved in preparing compliance reports.

Elaborate

- Explain how KPIs like RSRP, SINR, and PRB utilization indicate site performance.
- Describe how node status, alarms, and traffic patterns reveal network health.
- Clarify why detailed logs support RCA and long-term optimization.
- Discuss how coordination with NOC and RF teams ensures faster issue resolution.
- Highlight how customer complaints help detect hidden service issues.

Do

- Initiate a discussion about the significance of a pre-defined report format for accurate test result recording. Discuss the inclusion of KPIs, signal strength, handover success rates, and other performance metrics. Encourage participants to share their insights and experiences.
- Utilise presentation slides to outline the importance of maintaining different types of documentation, reports, and logs. Discuss how installation and commissioning compliance reports contribute to regulatory compliance and performance monitoring.
- Guide participants in recalling the process of compliance closure for a site after successful inspection.

Activity

- Activity name: Compliance Reporting Simulation
- Objective of the Activity: To engage participants in collaboratively preparing compliance reports for different scenarios.
- Resources: Participant handbook, notepads, pens.
- Time Duration: 30 minutes
- Instructions:
  - Divide participants into small groups.
  - Provide each group with a compliance scenario related to network deployment.
  - Instruct groups to outline the steps, documentation, and report format required to prepare accurate compliance reports for their scenarios.
  - Groups present their findings, followed by a discussion on effective reporting strategies and challenges.
- Outcome: Participants will develop practical skills in preparing accurate compliance reports for diverse scenarios.

Notes for Facilitation

- Encourage active participation and discussion among participants.
- Emphasise the importance of accurate reporting in maintaining regulatory compliance and tracking network performance.
- Address any questions participants may have regarding compliance procedures and documentation.
- Use real-world examples and case studies to reinforce the concepts covered.
- Reinforce the significance of thorough documentation for transparency, accountability, and regulatory adherence.

UNIT 9.2: Safety, Resource Management, and Team Motivation

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Describe workplace health and safety regulations and their implementation.
2. Show identification of organizational health, safety, and security policies and procedures.
3. Explain different types of hazards and associated risks in the workplace.
4. Show handling of hazards like illness, accidents, fires, or natural calamities as per organizational procedures.
5. Discuss the procedures for reporting breaches in health, safety, and security.
6. Show how to instruct the team to report breaches in health, safety, and security.
7. Show the process of reporting hazards outside individual authority and warning others who may be affected.
8. Describe methods for efficient resource and material management.
9. Show practices to optimize material usage, including water, in daily activities.
10. Show supervision of the team to ensure responsible use of workplace resources.
11. Explain common electrical problems and practices for conserving electricity.
12. Show methods to guide the team in optimizing energy usage in various processes.
13. Show techniques to motivate the team for routine cleaning of tools, machines, and equipment.
14. Show periodic checks to ensure the proper functioning of machines and equipment.
15. Show guidance on reporting malfunctions and lapses in equipment maintenance.
16. Show identification of opportunities for team-building workshops and motivational training.

Resources to be Used

Participant handbook, notebook, pens, markers, whiteboard, safety posters, sample hazard charts, workplace SOPs, projector, organizational safety guidelines, checklists for resource usage, equipment maintenance templates.

Say

Welcome the trainees and introduce the topic of workplace health, safety, and responsible resource usage. Explain that understanding safety rules and practicing efficient material handling helps create a secure and productive work environment.

Ask

Ask the trainees the following questions:

- What workplace hazards have you seen or heard about?
- Why is it important to follow safety procedures?
- How can material and resource usage be optimized in daily tasks?
- Why should equipment maintenance and reports be taken seriously? Write the responses on the board and connect them to the objectives of the lesson.

Elaborate

- Explain major workplace hazards such as slips, electrical faults, fire risks, and chemical exposure.• Discuss how safety policies guide hazard prevention, response, and reporting.
- Highlight the importance of conserving materials, water, and electricity for operational efficiency.
- Describe how regular equipment checks prevent breakdowns and ensure smooth functioning.
- Explain how motivating the team improves workplace hygiene and cleanliness.
- Discuss how team-building workshops enhance communication and cooperation.

Do

- Discuss in small groups how safety rules are applied in daily work.
- Identify common workplace hazards from sample photos or descriptions.
- Review a sample safety breach report and identify what information is essential.
- Observe a mock scenario and list materials or resources that can be conserved.
- Check any simple tool/equipment in the classroom and note basic maintenance needs.
- Share examples of how team motivation or training improved workplace behavior.

Activity

- Activity Name: Workplace Safety & Resource Mapping
  Objective: Understand safety procedures and efficient resource use in real work situations.
  Type: Group Activity
  Resources: Hazard charts, safety SOPs, resource usage checklist, chart paper, markers
  Duration: 25–30 minutes
- Instructions:
  - Each group selects one scenario—fire risk, electrical fault, accident, water wastage, or equipment malfunction.
  - Identify the hazard, possible risks, and steps to handle it as per procedures.
  - Map the correct reporting process and the person responsible.
  - List opportunities to conserve resources (materials, water, electricity) in the scenario.
  - Present the flowchart to the class.
- Outcome: Participants understand hazard identification, safe handling, proper reporting flow, and methods to optimize resource usage.

Notes for Facilitation

- Encourage trainees to relate safety and resource issues to real work situations.
- Reinforce the need to follow safety policies and reporting procedures.• Use simple examples to explain hazards and safe responses.
- Emphasize saving materials, water, and electricity during tasks.
- Guide trainees on the importance of regular equipment checks.
- Promote active participation in discussions and activities.
- Highlight teamwork and communication for a safer workplace.

Exercise

Answers to exercises for PHB

A. Multiple Choice Questions

1. c. Central Pulmonary Resuscitation
2. a. Incineration
3. c. Composting
4. d. All of the above
5. a. Eyestrain

B. Answer the following:

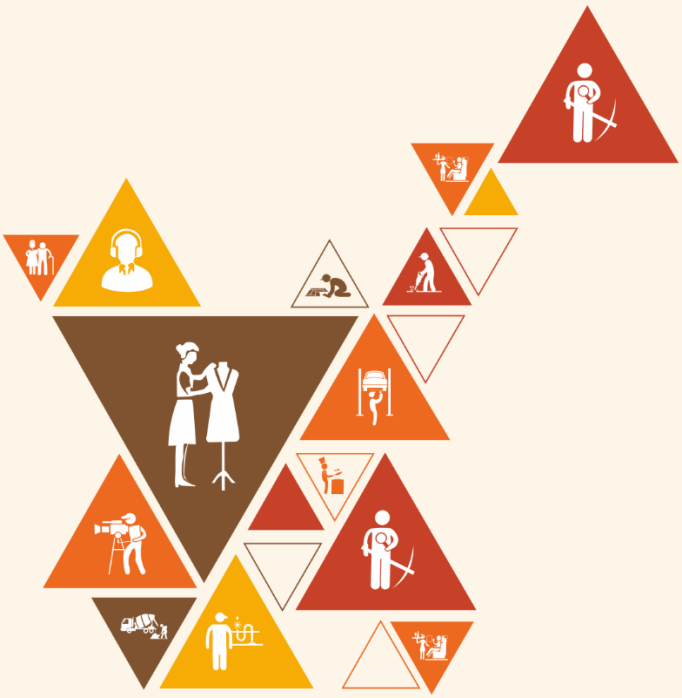
1. Refer UNIT 9.1: Importance of Safe Working Practices
   Topic - 9.2.3 Safe Workplace Practices
2. Refer UNIT 6.1: Workplace Hygiene and Safety
   Topic - 9.1.1 Organisational Hazards
3. Refer UNIT 9.1: Workplace Hygiene and Safety
   Topic - 9.1.5 Sanitising and Disinfecting Work Area
4. Refer UNIT 9.2: Optimal Utilisation of Resources
   Topic - 9.2.1 Efficient Utilisation of Water
5. Refer UNIT 9.2: Waste Management
   Topic - 9.2.7 Waste Disposal Methods

Notes

Telecom Sector Skill Council

10. Employability Skills (60 Hours)

It is recommended that all training include the appropriate. Employability Skills Module. Content for the same can be accessed https://www.skillindiadigital.gov.in/content/list



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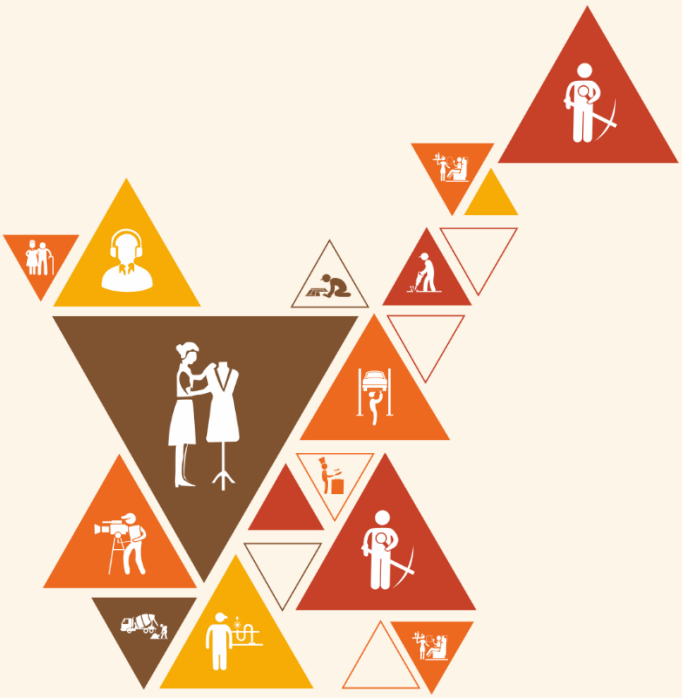
11. Annexure

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:	Project Supervisor – 5G Networks		
Qualification Pack Name & Ref. ID	Project Supervisor – 5G Networks, TEL/6306, V3.0		
Version No.	3.0	**Version Update Date**	30/04/2028
Pre-requisites to Training (if any)	Not Applicable		
Training Outcomes	**After the completion of this unit, the participant will be able to:** 1. Verify availability and condition of 5G site hardware. 2. Install, commission, and configure 5G tower equipment. 3. Conduct quality checks, compliance inspections, and document findings. 4. Perform acceptance testing, monitor site performance, and coordinate issue resolution. 5. Follow safe, sustainable practices and manage resources efficiently.		

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
1	Introduction to the Role of a Project Supervisor – 5GNetworks	Role of a Project Supervisor – 5GNetworks	• Overview of the telecom sector and the significance of 5G networks • Explain the role and responsibilities of a 5G Project Supervisor • Describe various electrical and electronic components in 5G networks • List the standard operating procedures (SOPs) for equipment usage, service, and minor repairs • Discuss the documentation involved in the different processes of maintenance.	Bridge Module	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	White-board and Markers, Chart paper and sketch pens, LCD Projector and Laptop for presentations, Internet with Wi-Fi (Min 2 Mbps Dedicated) Documents of standard operating procedures, code of conduct, checklists, schedules tools and equipment, status report	8 Theory (8:00) Practical (0:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			• State the safety, health and environmental policies and regulations for the workplace as well as for telecom sites in general. • Demonstrate how to conduct research to evaluate new emerging technologies and maintain up-to-date trends in cellular / mobile network communication with focus on 5G. • Ensure the specifications and configuration • of the 5G core solutions implemented are inline with the best practices. • Analyze and troubleshoot different 5G core deployments and solutions.				
2	Assess Hardware and Equipment Readiness for 5G Site Deployment (TEL/N6319)	Introduction to 5G Network and Cloud Technologies	• Define radio access technology (4G/5G) and 5G access domain. • Elaborate cloud technologies, open edge server, and xHaul deployments in a cloud environment.	TEL/N6319 KU1, KU5	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	White-board and Markers, Chart paper and sketch pens, LCD Projector and Laptop for pre-sentations, Network cables, electrical wires, alarms, indicators, tools and equipment, AC, DG, PIU, SMPS and battery bank,	8 Theory (4:00) Practical (4:00)
		Telecom Standards and Design Documents	• Discuss 3GPP specs/ standards, budget, architectural, and other design documents.	TEL/N6319 PC1			8 Theory (4:00) Practical (4:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Advanced Services and Virtualization in 5G	• Describe VoLTE, VoWiFi, Advanced Messaging (RCS), Multi-ID, vEPC, Virtualized RAN (vRAN), O-RAN, network function virtualization orchestration (MANO), Virtualized Network Functions (VNF). • Explain the message flows and parameters used in the messages for 5G procedures. • Outline the basic parameters for the implementation of 5G antenna viz. Multiple Input, Multiple Output (MIMO) antenna.	TEL/N6319 PC3, KU2, KU4		Auto Man Failure (AMF) panel, alarm panel, tools like pliers, power drill, screwdrivers, spanner, measurement tools, like multi-meter and thermometer, diagnostic tools, Sample of preventive and corrective maintenance formats and checklists, Laptop with software such as MS Office and CRM	8 Theory (4:00) Practical (4:00)
		Equipment Overview and Installation	• List all passive and active equipment required at the site. • Summarize the processes of installation and commissioning of the equipment.	TEL/N6319 PC12			8 Theory (4:00) Practical (4:00)
		Solution Management and Transformation	• Describe solution life cycle management activities and ways to analyze the solutions. • Define the proof of concepts as well as the process of preparation and implementation. • Illustrate the process of transforming top-level architectures and designs into deployment deliverables at a site.	TEL/N6319 PC2, PC10, PC11			8 Theory (4:00) Practical (4:00)
		Signal Strength and Antenna Patterns	• Outline the parameters to check the signal strength. • Employ suitable techniques to analyze the radiation pattern of MIMO antenna.	TEL/N6319 PC4, PC13			7 Theory (3:00) Practical (4:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Network Orchestration and Integration	• Apply suitable ways to integrate orchestration among teams for effective productivity. • Prepare proof of concepts (PoC) to assure delivery as per requirements.	TEL/N6319 PC9, PC11			7 Theory (3:00) Practical (4:00)
		Equipment Installation and Commissioning Demonstration	• Demonstrate how to install and commission the equipment.	TEL/N6319 PC12			7 Theory (3:00) Practical (4:00)
		Utility Checks and Emergency Incident Reporting	• Perform steps to check the working of different utilities as required. • Perform steps to report emergency incidents like passive equipment failures, fire, and power failures, etc. to the management.	TEL/N6319 PC8, KU7			7 Theory (3:00) Practical (4:00)
		Ensuring Compliance and Network Performance	• Discuss the importance of maintaining documentation and logs in 5G networks. • State the safety, health, and environmental policies and regulations for the workplace as well as for telecom sites in general.	TEL/N6319 KU6			8 Theory (2:00) Practical (6:00)
		Continuous Evaluation and Technology Trends	• Demonstrate how to conduct research to evaluate new emerging technologies and maintain up-to-date trends in cellular/ mobile network communication, with a focus on 5G.	TEL/N6319 KU5			8 Theory (2:00) Practical (6:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Core Solutions and Troubleshooting	• Ensure the specifications and configuration of the 5G core solutions implemented are in line with the best practices. • Analyze and troubleshoot different 5G core deployments and solutions.	TEL/N6319 PC10			8 Theory (2:00) Practical (6:00)
		Ensuring Network Performance and Maintenance	• Plan software tests with automated scripts and mapping of backhaul network with 5G site programs after installation. • Employ appropriate techniques to adjust/ tilt the antenna for appropriate zenith and azimuth angle.	TEL/N6319 PC5, PC14			8 Theory (2:00) Practical (6:00)
3	Install and Commission 5G Tower Site (TEL/N6320)	Installation Planning and Material Specification	• Analyze installation plan received from the planning team and make required amendments. • List the specification of the material required for installation viz. g-NodeB, transmission units, transmission racks, MCB.	TEL/N6320 PC1, PC2, PC3, PC4	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	White-board and Markers, Chart paper and sketch pens, LCD Projector and Laptop for presentations, Network cables, electrical wires, alarms, indicators, tools and equipment, AC, DG, PIU, SMPS and battery bank,	8 Theory (4:00) Practical (4:00)
		Cloud Technologies, Continuous Integration, and Software Upgradation	• Elaborate Kubernetes/ Dockers, continuous integration (CI)/ continuous delivery (CD) (Ansible, Jenkins's pipeline). • Discuss the use of basic Python in software upgradation.	TEL/N6320 KU3			8 Theory (4:00) Practical (4:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Traffic Generators and Protocol Discussion	• List the application of traffic generators such as iPerf, IxLoad, etc. • Discuss Layer 2-3G/ LTE/5G or Layer 3 Protocols RRC, RLC, PDCP.	TEL/N6320 KU2, KU5		Auto Mains Failure (AMF) panel, alarm panel tools like pliers, power drill, screw-drivers, spanner, measurement tools like multi-meter andthermometer, diagnostic tools	8 Theory (4:00) Practical (4:00)
		Tools and Equipment for Installation and Commissioning	• Discuss the different types of tools and equipment required to carry out installation and commissioning such as radio Network Design, Parameter Tuning, Radio network optimization, OSS, RAN optimization tools.	TEL/N6320 PC4, KU1			8 Theory (4:00) Practical (4:00)
		Equipment Installation and Configuration	• Explain the installation process of gNode inside/ outside of the tower and Non Stand Alone (NSA) mode of 5G equipment. • Describe configuration processes of all equipment and network elements including network equipment. • Discuss the parameters of Quality of Service (QoS) for Operations, Administration and Maintenance (OAM) parameter and their methods of measurement. • List the parameters to measure performance for monitoring day-to-day network operations.	TEL/N6320 KI21, PC22, PC24, KU6			8 Theory (4:00) Practical (4:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Material Availability and Cable Capacity Measure-ment	• Demonstrate how to verify the availability of material in line with Bill of Material (BoM) and requirement of any additional equipment/ accessories. • Perform steps to measure the current capacity of cables and equipment using appropriate tools.	TEL/N6320 PC1, PC5			7 Theory (3:00) Practical (4:00)
		Equipment Mount-ing and Inter-con-nections	• Employ suitable techniques to ensure ground connectivity and use of MCB - 48 V DC at the rack for installation. • Demonstrate how to mount the antenna on the tower, connect cables to the tower shelter and check inter-connection of cables. • Apply appropriate methods to avoid damage to cables and connectors at all stages.	TEL/N6320 PC6, PC7, PC8, PC17			7 Theory (3:00) Practical (4:00)
		Equipment Arrange-ment and Configura-tion	• Employ suitable techniques to arrange the equipment properly in the rack. • Demonstrate how to route cables and traffic cable as per architecture and design. • Prepare labels/ stickers/markers for the cables.	TEL/N6320 PC2, PC13, PC14			7 Theory (3:00) Practical (4:00)
		Network Node Installa-tion and Configura-tion	• Implement ways to ensure that feeder and jumper cable are supported by earthing wire, electrical wiring is closed properly, and there is proper power connection.	TEL/N6320 PC15, PC16, PC18, PC19, PC21, PC22			7 Theory (3:00) Practical (4:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			• Perform steps to install gNode inside/ outside of the tower and interconnect microwave equipment. • Demonstrate how to configure equipment and network elements. • Perform steps to install Non Stand Alone (NSA) mode of 5G equipment and configure network equipment.				
		Quality of Service and Network Rollout	• Employ appropriate techniques to measure Quality of Service (QoS) parameters for Operations, Administration and Maintenance (OAM). • Outline network rollout activities and the processes of upgrading software of network nodes, as well as onboarding and validation of enterprise VNF. • Explain the importance of providing a congestion-free network.	TEL/N6320 PC24, PC25, PC27			8 Theory (2:00) Practical (6:00)
		Site Integration and Successful Installation	• Discuss the process of integrating new roll out sites and expand existing sites. • Summarize the factors involved in successful site installation and commissioning such as scientific computation and data acquisition.	TEL/N6320 PC27, PC28			8 Theory (2:00) Practical (6:00)
		Records and Documentation	• Describe the records and documentation pertaining to installation and commissioning.	TEL/N6320 KU7			8 Theory (2:00) Practical (6:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Software Upgradation and Site On-boarding	• Implement steps to upgrade software of network nodes, onboarding and validation of VNF, and other network rollout activities. • Apply suitable methods to integrate new rollout sites and expand existing sites. • Perform steps for successful site installation and commissioning, including scientific computation and data acquisition.	TEL/N6320 PC27, PC28			8 Theory (2:00) Practical (6:00)
5	5G Network Compliance and Quality Verification (TEL/N6321)	Commissioning Requirements and Report Format	• Analyse the commissioning requirements of the site as per the service provider. • Outline the factors of a pre-defined report format to record test results.	TEL/N6321 PC1, PC3	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discussion	White-board and Markers, Chart paper and sketch pens, LCD Projector and Laptop for presentations, passive infrastructure equipment like DG set, PIU panel, earthing systems, transformer, SMPS, air conditioner, battery, list of certifications applicable forsites	8 Theory (3:00) Practical (5:00)
		Testing 5G gNodeBs and Tools	• Summarise the procedure of testing 5G gNodeBs along with the use of testing tools, such as channel and network emulators.	TEL/N6321 PC2, KU3			8 Theory (3:00) Practical (5:00)
		UE Simulators and Debuggers	• Discuss UE simulators like Aeroflex TM500 and Keysight and UE debuggers like QXDM, XCAL, and TEMS.	TEL/N6321 KU5, KU6			8 Theory (3:00) Practical (5:00)
		Issue Identification and Solutions	• Explain the different types of issues/bugs that occur during the test run and explore possible solutions.	TEL/N6321 PC4, PC5			8 Theory (3:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Maintenance and Documentation	• Describe the different processes / tasks / activities to maintain the site in a running condition. • Discuss the importance of maintaining different types of documentation / reports / logs, including compliance report of installation and commissioning of equipment.	TEL/N6321 PC6, PC8, PC9			8 Theory (3:00) Practical (5:00)
		Compliance Closure and Authority Sign-off	• Recall the process of compliance closure for the site after inspection and obtaining sign off on all reports from the concerned authority. • Demonstrate how to get the reports signed off by the concerned authority after inspection.	TEL/N6321 PC10, PC11			8 Theory (3:00) Practical (5:00)
		Test Run and Upgraded Software	• Perform the steps to carry out a test run of all the upgraded software/equipment to identify issues/ bugs.	TEL/N6321 PC2			8 Theory (3:00) Practical (5:00)
		Testing Tools and Traffic Generation	• Demonstrate the use of testing tools IXIA, Spirent for traffic generation and monitoring at the local level.	TEL/N6321 KU4			8 Theory (3:00) Practical (5:00)
		Issue Resolution and Equipment Maintenance	• Employ appropriate techniques to resolve the issues and incorporate necessary changes to maintain equipment running smoothly.	TEL/N6321 PC5			8 Theory (3:00) Practical (5:00)
		Draft Documentation and Reports	• Maintain draft documentation / reports / logs, as per the required format, including status report of the nodes and compliance report.	TEL/N6321 PC8, PC9, KU8			8 Theory (3:00) Practical (5:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
8.	Sustainability in Telecom Infrastructure Management (Theory:10 Practical: 20 hours)	E-Waste and Hazardous Material Management	• Identify, segregate, and categorize e-waste and hazardous waste (PC1) • Dispose of or recycle waste following applicable guidelines (PC2) • Follow safe handling procedures for hazardous materials (PC3) • Maintain logs and records of disposed, recycled, or repurposed waste (PC4) • Know e-waste management rules (2022) applicable to the telecom sector (KU1) • Know CPCB hazardous waste disposal regulations and safety standards for battery handling (KU2, KU3)	TEL/N9109 PC1-PC13, KU1-KU10 TEL/N9109 PC1, PC2, PC3, PC4, KU1, KU2, KU3	Classroom lecture / Hands-on Demonstration (Waste segregation) / Practical Exercise (Log book maintenance) / Safety Procedure Role-Play	Training Kit, Projector, Sample Waste Segregation Bins (Mock setup), Mock Log Sheets/Digital Templates, Reference CPCB/E-waste guidelines, Personal Protective Equipment (PPE) for demonstration.	(Theory: 3:00) (Practical: 7:00)
		Green Energy and Fuel Efficiency	• Optimize power usage through energy-efficient telecom equipment (PC5) • Assist in adopting solar-powered telecom towers and hybrid energy systems (PC6) • Monitor and minimize fuel consumption in Diesel Generators (DG) sets (PC7) • Know techniques for energy optimization (smart cooling, LED lighting, hybrid power systems) (KU5) • Understand the role of solar energy and renewable sources in reducing carbon footprint (KU6) • Know green telecom practices like fuel efficiency in DG sets and power-saving measures (KU7)	TEL/N9109 PC5, PC6, PC7, KU5, KU6, KU7	Classroom lecture / Interactive Case Studies (Solar/Hybrid Systems) / Practical Exercise (DG fuel monitoring and load balancing scenarios) / Group Discussion (Optimization techniques)	Training Kit, Projector, Case Study Materials (Energy Audits), Energy Monitoring Dashboard mock-up, Diagrams of hybrid energy systems.	(Theory: 3:00) (Practical: 7:00)

SL	Module Name	Session Name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		E-Waste and Hazardous Material Management	• Identify, segregate, and categorize e-waste and hazardous waste (PC1) • Dispose of or recycle waste following applicable guidelines (PC2) • Follow safe handling procedures for hazardous materials (PC3) • Maintain logs and records of disposed, recycled, or repurposed waste (PC4) • Know e-waste management rules (2022) applicable to the telecom sector (KU1) • Know CPCB hazardous waste disposal regulations and safety standards for battery handling (KU2, KU3)	TEL/N9109 PC1-PC13, KU1-KU10 TEL/N9109 PC1, PC2, PC3, PC4, KU1, KU2, KU3	Classroom lecture / Hands-on Demonstration (Waste segregation) / Practical Exercise (Log book maintenance) / Safety Procedure Role-Play	Training Kit, Projector, Sample Waste Segregation Bins (Mock setup), Mock Log Sheets/Digital Templates, Reference CPCB/E-waste guidelines, Personal Protective Equipment (PPE) for demonstration.	(Theory: 3:00) (Practical: 7:00)
		Green Energy and Fuel Efficiency	• Optimize power usage through energy-efficient telecom equipment (PC5) • Assist in adopting solar-powered telecom towers and hybrid energy systems (PC6) • Monitor and minimize fuel consumption in Diesel Generators (DG) sets (PC7) • Know techniques for energy optimization (smart cooling, LED lighting, hybrid power systems) (KU5) • Understand the role of solar energy and renewable sources in reducing carbon footprint (KU6) • Know green telecom practices like fuel efficiency in DG sets and power-saving measures (KU7)	TEL/N9109 PC5, PC6, PC7, KU5, KU6, KU7	Classroom lecture / Interactive Case Studies (Solar/Hybrid Systems) / Practical Exercise (DG fuel monitoring and load balancing scenarios) / Group Discussion (Optimization techniques)	Training Kit, Projector, Case Study Materials (Energy Audits), Energy Monitoring Dashboard mock-up, Diagrams of hybrid energy systems.	(Theory: 3:00) (Practical: 7:00)

9	Manage Work, Resources and Safety at Work-place	Manage learning and self-di-rection	• List the recent skills and technologies prevalent in the telecom industry. • Describe the importance of conducting team building workshops and trainings • Conduct training of the team such that they are able to adapt latest products/ services in their working environment	TEL/N9104 PC1, PC2, PC3	Classroom lecture / PowerPoint Presentation / Question & Answer / Group Discus-sion	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 extinguish-er and first aid kit	7 Theory (2:00) Practical (5:00)
		Develop critical think-ing and Perform work as per quality standards	• Prepare a time schedule for the tasks to make the team accountable • Discuss some commonly occurring problems and their solutions with the team. • State the importance of keeping the workplace clean, safe and tidy • Outline the organizational structure to assign duties and responsibilities to each team member • Show how to create schedules and rosters for the team to ensure they understand individual work requirements	TEL/N9104 PC4, PC5, PC6, PC7, PC8,.PC9, PC10			7 Theory (2:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
		Maintain safe and secure working environ-ment	• State the procedure to report any breach in the organizational health, safety and security policy and hazards to the authorities • List the types of hazards and the emergency procedures related with them • Discuss the importance of sanitizing and disinfecting one's work area regularly • Describe the significance of conforming to basic hygiene practices such as washing hands, using alcohol-based hand sanitizers • Demonstrate appropriate social and behavioural etiquette (greeting and meeting people, spitting/ coughing/sneezing, etc.). • Illustrate some ways to cope with stress, anxiety etc. with the team members • Discuss the ways of dealing with stress and anxiety during an epidemic or a pandemic	TEL/N9104 PC11, PC12, PC13, PC14,KU9, KU10, KU11			8 Theory (3:00) Practical (5:00)
		Material / energy / electricity conser-vation practices	• Explain the ways to optimize usage of resources. • Evaluate various methods of waste management and its disposal. • Define the concepts of recyclable, nonrecyclable and hazardous waste. • Employ ways for efficient utilization of material and water	TEL/N9104 PC15, PC16, PC17, PC18, PC19, PC20, PC21, KLU12, KU13			8 Theory (3:00) Practical (5:00)

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
			• State the importance of using appropriate colour dustbins for different types of waste. • Examine the common sources of pollution and ways to minimize it. • Discuss different methods of cleaning, disinfection, and sanitization. • Use energy efficient electrical appliances and devices to ensure energy conservation				

Annexure II

Assessment Criteria

CRITERIA FOR ASSESSMENT OF TRAINEES

Assessment Criteria for Project Supervisor – 5G Networks	
Job Role	Project Supervisor – 5G Networks
Qualification Pack	TEL/Q6306 V3.0
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 of aggregate marks.
6	In case of unsuccessful completion, the trainee may seek reassessment on the Qualification File.

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
TEL/N6319. Check Availability of Hardware Equipment at the Site Location	30	50	0	20	100	15
TEL/N6320. Perform Installation and Commissioning of 5G Tower Site	30	50	0	20	100	15
TEL/N6321. Perform Compliance and Quality Checks	30	50	0	20	100	15
TEL/N6322. Carry out Acceptance Testing and Site Monitoring	30	50	0	20	100	20
TEL/N9109. Follow sustainable practices in telecom infrastructure management	30	50	0	20	100	15
TEL/N9104. Manage Work, Resources and Safety at workplace	40	50	-	10	100	10
DGT/VSQ/N0102. Employability Skills (60 Hours)	20	30	-	-	50	10
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Total	**210**	**330**	**-**	**110**	**650**	**100**

Annexure-III

QR Codes –Video Links

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
1. Introduction to the Role of a Project Engineer – 5G Networks	1.1: Introduction to the Telecom Sector	1.1.1 Telecom Sector in India	https://www.youtube.com/watch?v=tha-DJhkih8	Telecom Sector in India
		1.1.3 Standard Operating Procedures (SOP)	https://www.youtube.com/watch?v=jh0ClNo1qSA	Standard Operating Procedure (SOP)
	1.2: Roles and Responsibilities of Project Engineer - 5G Network	1.2.1 Who is a Project Engineer - 5G Network?	https://www.youtube.com/watch?v=-e0MCueeB3o	How to become a Project Engineer?
2. Install Hardware Equipment at the Site	2.1: Install 5G NR Site Hardware Equipment	2.1.1 Radio Access Technology (4G/5G) and 5G Access Domain	https://www.youtube.com/watch?v=Ma-NBj_1e-0	What is Open Radio Access Network (Open RAN)
		2.1.3 Advanced Telecommunication Technologies	https://www.youtube.com/watch?v=kuWFQLBxjWA	The Future Of Telecommunication Technology

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
	2.2: Implement STEPs to Prepare Site for 5G Implementation	2.2.1 3GPP Specs/Standards, Budget, Architectural	https://www.youtube.com/watch?v=S8aB417CYqE	A Quick Introduction to 3GPP
		2.2.2 Message Flows and Parameters Used in Messages for 5G Proce- dures	https://www.youtube.com/watch?v=Tcb_m7EG5jw	IMS Registration Procedure in 5G
3. Install and Commission 5G Tower Site	3.1: Perform Pre-Installation Activities	3.1.6 Mount Antenna and Connect Cables to Tower Shelter	https://www.youtube.com/watch?v=MRjXc5wRTtY	5 Antenna Jumber Installation
		3.1.10 Feeder and Jumper Cable	https://www.youtube.com/watch?v=9iruTcSRwHo	1/2 Inch Super Flexiable Coaxial Jumper Cable with N Connector
		3.1.12 Kubernetes/Dockers, continuous integration (CI)/ continu- ous delivery (CD) (Ansible, Jenkins's pipeline)	https://www.youtube.com/watch?v=XE_mAhxZpwU	CICD Pipeline To Deploy To Kubernetes Cluster Using Jenkins

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
		3.1.13 Basic Python in Software Upgradation	https://www.youtube.com/watch?v=RAAwSmjlGoQ	Python in Excel
	4.1: Install and Commis- sion gNodeB	4.1.4 Quality of Service (QoS)	https://www.youtube.com/watch?v=-cGMmSx9Ag0	Communication Networks Quality Of Service (QOS)
4. Perform Installation and Commissioning Checks	4.1: Perform Quality Checks Pertaining to Installation and Commissioning	4.1.1 Analyse Specific Commissioning Requirements of the Site	https://www.youtube.com/watch?v=ohKrEtXYn98	Testing & Commissioning Requirements
		4.1.3 UE Simulators and UE Debuggers	https://www.youtube.com/watch?v=uS9eWXcuYOk	Program Debugging
	4.2: Prepare Compliance Reports	4.2.2 Maintaining Different Types of Documentation, Reports, and Logs	https://www.youtube.com/watch?v=jcasT8w9D8c	Maintenance Checklist in Excel

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
5. Communication and Interpersonal Skills	5.1: Personal Hygiene and Dress Code	5.1.1 Personal Hygiene and Grooming	https://www.youtube.com/watch?v=3Zlcmzp9oTI	Disease Transmission
	5.2: Importance of Effective Communication and Interpersonal skills	5.2.1 What is Communication?	https://www.youtube.com/watch?v=RkebtEk2zU0	What is Communication?
		5.2.2 Importance of Effective Communication	https://www.youtube.com/watch?v=I6IAhXM-vps	CICD Pipeline To Deploy To Kubernetes Cluster Using Jenkins
	5.3: Gender and PwD Sensitisation	5.4.1 Guidelines for Gender Neutral Behavior at Workplace	https://www.youtube.com/watch?v=zAnOC7cfrUw	Gender equality in the workplace
6. Manage Work, Resources and Safety at Workplace	6.1: Workplace Hygiene and Safety	6.1.1 Organisational Hazards	https://www.youtube.com/watch?v=2B823bEBKGU	Understanding Disasters, Hazards,Risk and Vulnerability

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
		6.1.5 Sanitising and Disinfact-ing Work Area	https://www.youtube.com/watch?v=3Zlcmzp9oTI	Disease Transmission
	6.4: Waste Manage-ment	6.4.9 Source of Pollution	https://www.youtube.com/watch?v=qS8mfAX1tAk	Environment Pollution
Employability Skills			https://www.skillindiadigital.gov.in/content/list	

NCVET
कौशल गुणवत्ता प्रगति

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
RE IMAGINE FUTURE

Telecom Sector Skill Council

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