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GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
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Telecom Sector Skill Council

Facilitator Guide

Sector
Telecom

Sub-Sector
Network Managed Services

Occupation
Network Operation and Maintenance

Reference ID: **TEL/Q2501**, Version **5.0**
NSQF Level **4**

Surface Mount Technology (SMT)-Telecom Technician

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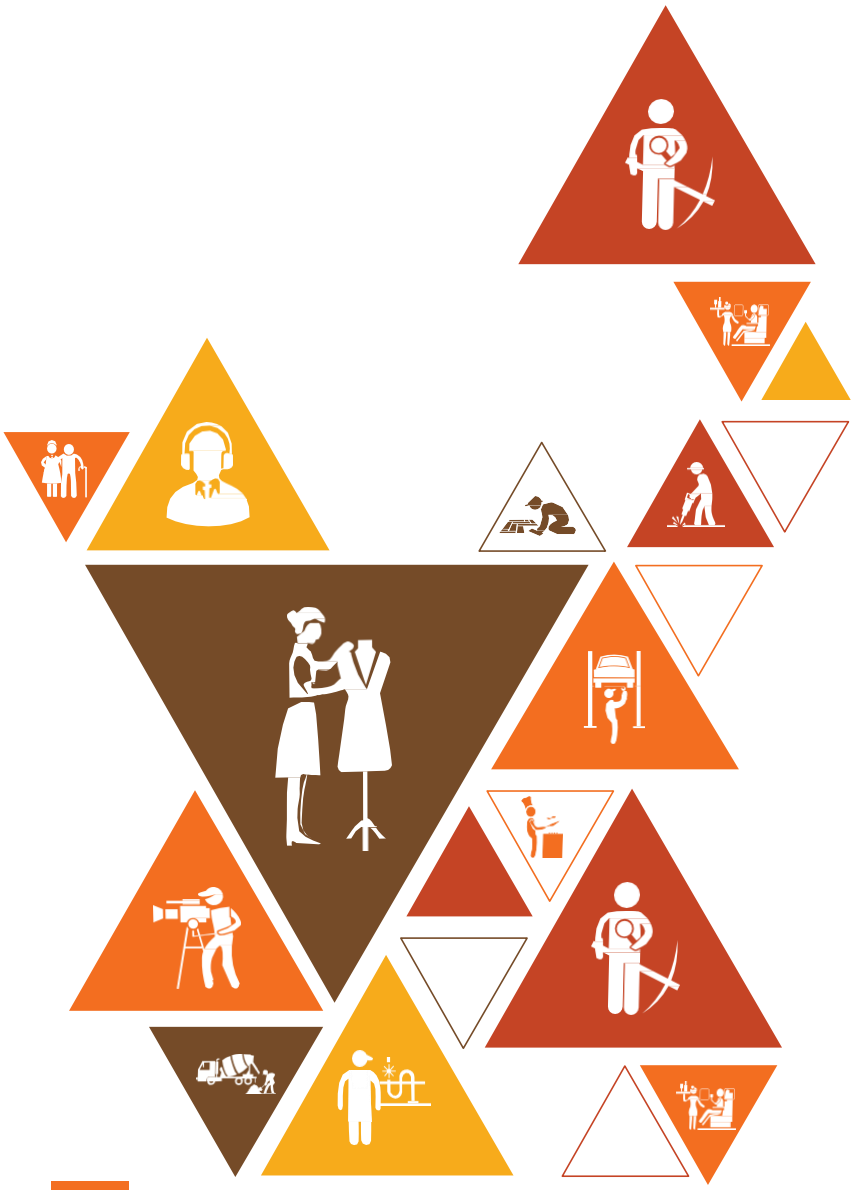
"Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission."

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

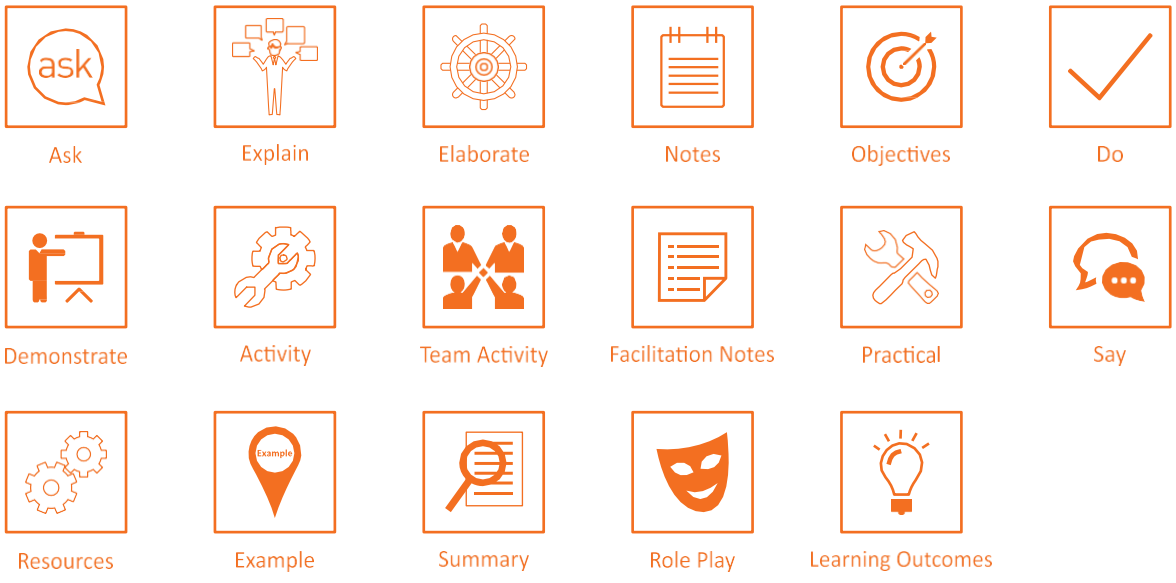
The facilitator guide (FG) for Surface Mount Technology (SMT)- Telecom Technician is primarily designed to facilitate skill development and training of people, who want to become professional Surface Mount Technology (SMT)- Telecom Technician . The facilitator guide is aligned to the Qualification Pack (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/N6208: Undertake Site Acceptance Testing
2. TEL/N6209: Perform Preventive and Corrective Maintenance at Radio Locations
3. TEL/N6210: Perform Change Management at Radio Locations
4. TEL/N6500: Undertake Fault Rectification
5. TEL/N6501: Undertake Configuration Changes, Upgrades and Node Back- up Activities
6. TEL/N9109: Follow sustainable practices in telecom infrastructure management
7. TEL/N9104: Manage Work, Resources and Safety at workplace
8. DGT/VSQ/N0101: Employability Skills (30 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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It is recommended that all trainings include the appropriate Employability skills Module. Content for the same is available here: **https://www.skillindiadigital.gov.in/content/list**

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Unit 1.1 – Fundamentals of Electronics

Unit 1.2 – Basic Functionality of Common Electronic Components

Unit 1.3 – Introduction to Printed Circuit Boards (PCB)

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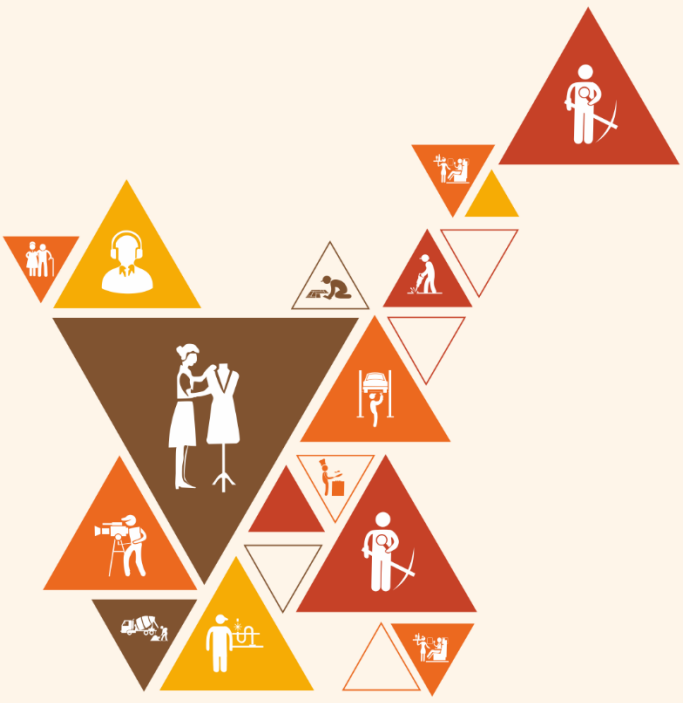


TEL/N2503

Key Learning Outcomes 

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

1. Explain the significance of the telecom sector in daily activities and business operations.
2. Elucidate the key skills and technical expertise required for a Surface Mount Technology (SMT)- Telecom Technician .

UNIT 1.1: Telecom Sector in India

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: Basic Functionality of Common Electronic Components

Unit Objectives

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

1. Evaluate the fundamentals of electronics
2. Demonstrate the basics of electronic circuit

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, Basic electronic components (resistor, capacitor, diode), Simple circuit diagrams, Multimeter

Say

- Today's session introduces the Fundamentals of Electronics, which form the foundation for all telecom and electrical systems.
- You will learn basic electronic concepts and understand how simple electronic circuits work.
- These fundamentals are essential for troubleshooting, maintenance, and understanding telecom equipment behaviour.
- A strong grasp of electronics helps technicians work more confidently and safely with complex systems.

Ask

Ask the participants the following questions:

- Have you seen or worked with any electronic components before?
- What do you think an electronic circuit needs to function properly?
- Why do you think electronics is important in telecom and electrical systems?
- Where do you see electronic circuits used in everyday life?

Elaborate

In this session, we will discuss the following point:

- What is electronics, and how is it different from basic electricity?
- What are the key electronic components and their basic functions?
- How does current flow in a simple electronic circuit?
- What happens when a circuit is open, closed, or shorted?
- Why is understanding circuit basics important before working with telecom equipment?Briefly clarify concepts like voltage, current, resistance, and simple series circuits.

Say

Let us participate in an activity to explore the unit a little more.

Activity

1. **Activity Name:** Basic Circuit Identification
2. **Objective:** Help learners understand simple electronic circuits and components.
3. **Type:** Group
4. **Resources:** Component images, simple circuit diagrams
5. **Duration:** 20–30 minutes
6. **Instructions:**

- Groups identify components shown in diagrams and explain their role in the circuit.
- Learners label current flow direction and basic circuit parts.

7. **Outcome:** Learners gain clarity on electronic fundamentals and circuit basics.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Answer all the queries/doubts raised by the trainees in the class
- Encourage other trainees to answer problems and boost peer learning in the class

Unit 1.3: – Introduction to Printed Circuit Boards (PCB)

Unit Objectives

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

1. Analyze components like diode, transistors and logic gates
2. Diodes, Transistors, and Switches

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, Diode and transistor samples/images, Logic gate diagrams, Simple circuit diagrams, Multimeter

Say

- Today's session focuses on Diodes, Transistors, and Logic Gates, which are essential active components used in electronic and telecom systems.
- You will understand how these components work, how they control current flow, and how logic gates process digital signals.
- These components form the foundation of switching, amplification, and digital decision-making in electronic circuits.
- Understanding them is important for equipment handling, troubleshooting, and system-level awareness.

Ask

Ask the participants the following questions:

- Where have you seen diodes or transistors used in electronic devices?
- What do you think is the role of a switch in an electronic circuit?
- Have you heard terms like AND, OR, or NOT before? Where are they used?
- Why do you think transistors are considered the heart of modern electronics?

Do

- Observe samples or images of diodes, transistors, and logic gate symbols.
- Identify circuit symbols and match them with component names.
- Discuss simple real-life applications of switching and amplification.
- Observe how current direction matters in diode operation (conceptual).

Elaborate

In this session, we will discuss the following point:

- How does a diode allow current to flow in only one direction?
- How does a transistor act as a switch or amplifier in a circuit?
- What is the purpose of switches in electronic and telecom systems?
- How do basic logic gates (AND, OR, NOT) work with digital signals?
- Why is understanding these components important in electronic troubleshooting?

Briefly clarify concepts such as forward bias, reverse bias, switching action, amplification, and logic levels (0 and 1).

Say

Let us participate in an activity to explore the unit a little more.

Activity

1. **Activity Name:** Component Function Matching
2. **Objective:** Help learners understand the function of diodes, transistors, and logic gates.
3. **Type:** Group
4. **Resources:** Component images, circuit symbols, truth tables
5. **Duration:** 20–30 minutes
6. **Instructions:**
   - Groups match components with their functions and applications.
   - Learners identify whether a component is used for switching, amplification, or logic operation.
7. **Outcome:** Learners gain clarity on component behavior and basic circuit usage.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Keep explanations conceptual and application-oriented rather than formula-based.
- Use diagrams, symbols, and real-life analogies for clarity.
- Encourage learners to ask questions, as this unit introduces core concepts.
- Reinforce correct identification of component symbols and terminals.
- Connect learning to telecom equipment components used in later units.

Unit 1.4: PCB Designing Concepts

Unit Objectives

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

1. Evaluate the fundamentals of PCB
2. Analyze the troubleshooting for PCB

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, Sample PCB images/boards, Component solder points images, Multimeter

Say

- In this session, we will study the Fundamentals of PCB, which form the physical base of all electronic and telecom equipment.
- You will understand how components are mounted on PCBs and how signals and power flow through PCB tracks.
- We will also learn basic troubleshooting techniques to identify faults on PCBs.
- This knowledge helps in safe handling, inspection, and preliminary fault diagnosis of electronic boards.

Ask

Ask the participants the following questions:

- Have you seen a PCB inside any electronic device? What did you notice?
- Why do you think PCB design is important for circuit performance?
- What problems can occur if a PCB track or solder joint is damaged?
- Where do you think PCBs are used in telecom equipment?

Do

- Observe sample PCB images/boards and identify tracks, pads, and mounted components.
- Identify visible defects such as burnt marks, loose solder joints, or broken tracks.
- Discuss how visual inspection helps in first-level troubleshooting.
- Use a multimeter (demo) to check continuity on a PCB track.

Elaborate

In this session, we will discuss the following point:

- What is a PCB and why is it used instead of wired circuits?
- What are the basic layers and parts of a PCB?
- What types of faults commonly occur on PCBs?
- How can visual inspection help in identifying PCB issues?
- What are safe and basic steps involved in PCB troubleshooting?

Briefly clarify points such as single-layer vs multi-layer PCBs, soldering quality, and trace continuity.

Say

Let us participate in an activity to explore the unit a little more.

Activity

1. **Activity Name:** PCB Fault Identification Exercise
2. **Objective:** Enable learners to identify common PCB faults and suggest basic checks.
3. **Type:** Group
4. **Resources:** PCB images, fault samples, checklist
5. **Duration:** 20–30 minutes
6. **Instructions:**
   - Groups examine PCB images or samples and identify possible faults.
   - Learners list steps they would take for safe troubleshooting.
7. **Outcome:** Learners understand PCB basics and gain confidence in initial fault analysis.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Focus on visual understanding rather than advanced PCB design concepts.
- Reinforce safety precautions, especially ESD protection.
- Use real-life examples of PCB failures from common devices.
- Encourage learners to ask questions and participate actively.
- Connect PCB knowledge to previous units on components and circuits.

Exercise

Answers to exercises for PHB

Short Answer Questions – Answers

1. The telecom sector consists of network operators, service providers, infrastructure companies, regulatory bodies, and equipment vendors. It is critical because it enables national and global connectivity for communication, business, government, and digital services.
2. Advancements from 2G to 5G, fiber networks, VoIP, and cloud-based systems have made communication faster, more reliable, and capable of supporting high-bandwidth, real-time digital applications.
3. A Surface Mount Technology (SMT)- Telecom Technician manages field installation, maintenance, fault repair, scheduling, resource allocation, and ensures that teams follow standards and timelines.
4. Coordination ensures proper information flow, quick issue resolution, efficient deployment, and high service quality, preventing delays and customer dissatisfaction.
5. Regulatory bodies set rules, allocate spectrum, ensure service quality, enforce safety standards, and protect consumer interests to maintain fairness in the telecom sector.

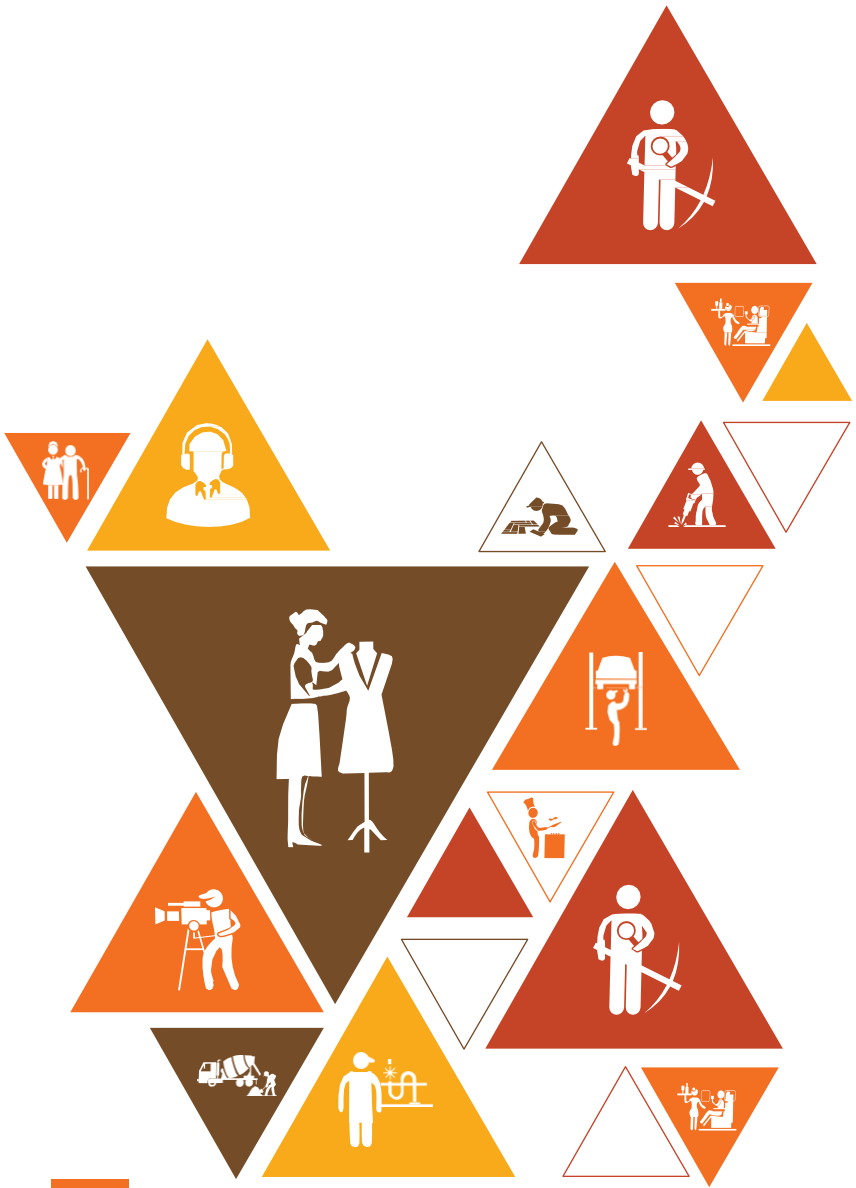
Multiple Choice Question

1. b) Enables global communication and digital connectivity
2. b) Field installation, maintenance, and fault management
3. b) Compliance with standards and fair operations
4. b) Improve operational efficiency and service quality
5. b) Strong technical knowledge and problem-solving abilities

Fill in the Blanks

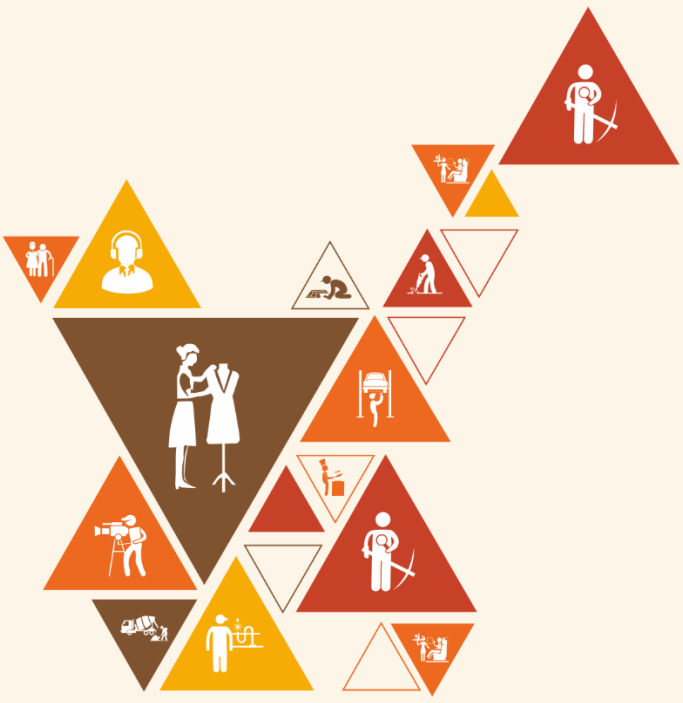
1. Communication
2. Evolution
3. Roles
4. Faults
5. fairness

Notes



2. Screen Printing of Telecom Boards

Unit 2.1 – Screen Printing Process
Unit 2.2 – Pre-baking of Board
Unit 2.3 – Screen-Printing Machines



TEL/N2503

Key Learning Outcomes

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

1. Demonstrate the correct procedure for applying solder paste on a PCB.
2. Identify and list the tools and accessories required for screen printing.
3. Explain the key parameters influencing the screen-printing process.
4. Perform the stencil cleaning process effectively.
5. Analyze the importance of the baking process in PCB assembly.
6. Identify oven specifications and requirements for performing baking operations.
7. List and explain the factors that influence baking time and temperature for effective results.
8. Differentiate between various types of screen-printing machines based on functionality and application.
9. List the key features of equipment used for detecting solder paste printing defects.
10. Differentiate between different inspection methods used in solder paste printing.
11. Analyze the causes of common solder paste print inspection outcomes.
12. List solder paste printing defects along with their acceptance and rejection criteria.

UNIT 2.1: Screen Printing Process

Unit Objectives

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

1. Demonstrate the step-by-step process of applying solder paste accurately on a PCB.
2. Identify and list the essential tools and accessories used in the screen-printing process.
3. Explain the critical parameters that influence the quality and effectiveness of screen printing.
4. Perform the stencil cleaning process using standard procedures to ensure defect-free printing.

Resources to be Used

Participant handbook, laptop with testing software, sample BTS configuration tool, E1 tester, Ethernet tester, VSWR meter, power meter, optical power meter, RJ45/RS232/USB cables, projector, markers, whiteboard, site test sheets, site photos/videos.

Say

Today, we are going to learn one of the most important responsibilities in telecom field operations — Site Acceptance Testing (SAT).

Ask

Ask trainees the following questions:

- Have you ever visited or seen a BTS or telecom site?
- What do you think engineers test before a site goes live?
- Which tools have you heard of — E1 tester, VSWR meter, optical meter?

Write their inputs on the whiteboard and build the discussion around their experiences.

Demonstrate

Now let’s move toward hands-on activities to understand how these tools work in real field situations.

Activity

- **Activity name:** Test Equipment Verification & Laptop Software Check
- **Resources:** E1 tester, Ethernet tester, VSWR meter, optical meter, laptop with software..
- **Time Duration:** 40 minutes
- **Instructions:**
  - Divide into small groups and receive your designated test device and laptop.
  - Inspect the test device. Verify that it powers on, the self-test status is clear, the calibration is current, and the battery status is adequate. Also, visually check the integrity of all cable connection points.
  - On the provided laptop, check and record all installed software versions (e.g., specific configuration tools, drivers).
  - Launch the BTS configuration tools to ensure they open correctly. Then, confirm that both the USB drivers and serial drivers are correctly installed and functioning.
  - As a group, thoroughly document all findings from steps 2, 3, and 4 in your assigned record sheet.

Notes for Facilitation

- Ensure all tools are handled safely.
- Keep reminding trainees to follow grounding and insulation rules.
- Encourage peer learning and group problem-solving.
- Ask trainees to complete related questions in the participant manual.

UNIT 2.2: Pre-baking of Board

Unit Objectives

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

1. Analyze the purpose and importance of the baking process in PCB assembly.
2. Identify the oven specifications and requirements necessary to perform effective baking.
3. List and explain the factors that influence baking time and temperature for achieving reliable results.

Resources to be Used

Participant handbook, laptop with testing software, sample BTS configuration tool, E1 tester, Ethernet tester, VSWR meter, power meter, optical power meter, RJ45/RS232/USB cables, projector, markers, whiteboard, site test sheets, site photos/videos.

Say

Today, we are going to learn one of the most important responsibilities in telecom field operations — Site Acceptance Testing (SAT).

Ask

Ask trainees the following questions:

- Have you ever visited or seen a BTS or telecom site?
- What do you think engineers test before a site goes live?
- Which tools have you heard of — E1 tester, VSWR meter, optical meter?

Write their inputs on the whiteboard and build the discussion around their experiences.

Demonstrate

Now let’s move toward hands-on activities

Activity

1. **Activity Name:** Component Classification Exercise
2. **Objective:** Enable learners to classify and compare electronic components accurately.
3. **Type:** Group
4. **Resources:** Component images/cards, classification chart
5. **Duration:** 20–30 minutes
6. **Instructions:**
   - Each group is given a mixed list of components.
   - Learners classify them as active or passive and explain their use.
7. **Outcome:** Learners clearly understand component types and their differences.

Notes for Facilitation

- Ensure all tools are handled safely.
- Keep reminding trainees to follow grounding and insulation rules.
- Encourage peer learning and group problem-solving.
- Ask trainees to complete related questions in the participant manual.

UNIT 2.3: Screen Printing Machines

Unit Objectives

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

1. Differentiate between the different types of screen-printing machines.

Resources to be Used

Participant handbook, laptop with testing software, sample BTS configuration tool, E1 tester, Ethernet tester, VSWR meter, power meter, optical power meter, RJ45/RS232/USB cables, projector, markers, whiteboard, site test sheets, site photos/videos.

Say

Today, we are going to learn one of the most important responsibilities in telecom field operations — Site Acceptance Testing (SAT).

Ask

Ask trainees the following questions:

- Have you ever visited or seen a BTS or telecom site?
- What do you think engineers test before a site goes live?
- Which tools have you heard of — E1 tester, VSWR meter, optical meter?

Write their inputs on the whiteboard and build the discussion around their experiences.

Demonstrate

Now let’s move toward hands-on activities

Activity

1. **Activity Name:** CCL Properties & Layout Discussion
2. **Objective:** Help learners understand CCL properties and layout planning concepts.
3. **Type:** Group
4. **Resources:** CCL images, PCB layout samples
5. **Duration:** 20–30 minutes
6. **Instructions:**
   • Groups analyze sample CCL and PCB layouts and discuss why certain designs are used.
   • Learners identify how layout planning affects circuit efficiency.
7. **Outcome:** Learners gain clarity on CCL fundamentals and PCB foundation concepts.

Notes for Facilitation

- Ensure all tools are handled safely.
- Keep reminding trainees to follow grounding and insulation rules.
- Encourage peer learning and group problem-solving.
- Ask trainees to complete related questions in the participant manual.

Activity

1. **Activity Name:** CCL Properties & Layout Discussion
2. **Objective:** Help learners understand CCL properties and layout planning concepts.
3. **Type:** Group
4. **Resources:** CCL images, PCB layout samples
5. **Duration:** 20–30 minutes
6. **Instructions:**
   • Groups analyze sample CCL and PCB layouts and discuss why certain designs are used.
   • Learners identify how layout planning affects circuit efficiency.
7. **Outcome:** Learners gain clarity on CCL fundamentals and PCB foundation concepts.

Notes for Facilitation

- Ensure all tools are handled safely.
- Keep reminding trainees to follow grounding and insulation rules.
- Encourage peer learning and group problem-solving.
- Ask trainees to complete related questions in the participant manual.

Exercise

Answers to exercises for PHB

Short Answer Questions – Answers

1. SAT ensures that a telecom site meets all technical, safety, and operational requirements before handover. Key steps include: physical inspection, power and grounding checks, equipment configuration, link testing, performance verification, and documentation of results.
2. E1/Ethernet testers validate transmission links, VSWR meters check antenna line reflection, power meters measure RF output levels, and optical meters verify fiber signal strength and loss—all ensuring site performance meets standards.
3. RJ45 cables support Ethernet configuration and IP testing, RS232 cables are used for serial communication with legacy or CLI-based devices, and Hi-Speed USB cables enable firmware loading, diagnostics, and data transfer.
4. Safety measures prevent electrical faults, equipment damage, and accidents; grounding reduces shock risks, weatherproofing protects outdoor components, and insulation prevents short circuits and fire hazards.
5. Documenting test results captures site performance, confirms compliance, enables troubleshooting, and provides evidence for site acceptance and project closure.

Multiple Choice Question

1. b) Verify that the site meets technical and operational requirements
2. c) Antenna feed line reflection levels
3. c) Ethernet communication and device configuration
4. b) Ensure continuous site operation during power failures
5. b) Network Performance Indicators

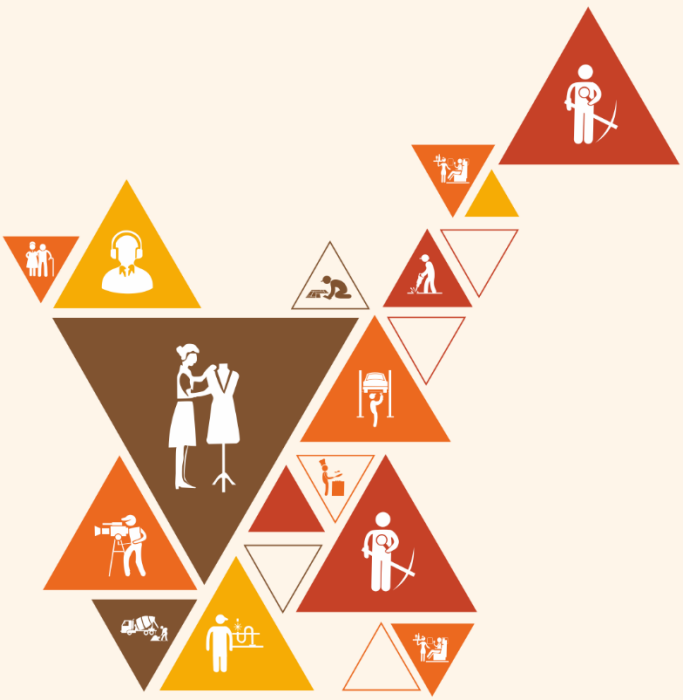
Fill in the Blanks

1. Site Master (or Spectrum Analyzer)
2. bonding
3. antenna
4. test records
5. performance

Notes

3. Component Placement on Telecom Boards

Unit 3.1 – Components Pick and Place Operations
Unit 3.2 – Pick and Place Operations
Unit 3.3 – Loading of Component



TEL/N6209

Unit 2.2: Assembly Tools and Procedures – Faculty Guide Plan

Unit Objectives

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

1. Discuss the use and maintenance of assembly tools and semi-automatic tools.
2. Demonstrate how to collect, check calibration, and test tools and equipment for functionality, compliance, and report malfunctions.
3. Determine the appropriate selection and handling of soldering consumables for different assembly tasks.
4. Show how to interpret and confirm understanding of work and assembly instructions.
5. Demonstrate how to arrange the required assembly parts ergonomically for smooth assembly.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, Manual and semi-automatic assembly tools, Soldering consumables, Tool calibration tags, Work instruction samples, ESD protection items

Say

- This session focuses on Assembly Tools and Procedures, which directly affect product quality and worker safety.
- You will learn how to select, use, and maintain tools correctly, and how calibration ensures accuracy.
- We will also cover soldering consumables, interpretation of work instructions, and ergonomic arrangement of parts.
- Proper tool usage and workplace setup help reduce defects, rework, and fatigue.

Ask

- Why is tool calibration important in assembly operations?
- What problems can occur when incorrect soldering consumables are used?
- How do clear work instructions help in reducing assembly errors?
- What benefits do you see in arranging tools and parts ergonomically?

Do

- Identify different assembly tools and discuss their functions.
- Check calibration tags and tool condition during a demonstration.
- Review a sample work instruction and identify key steps.
- Arrange sample assembly parts in an ergonomic sequence.

Elaborate

Use the following guiding questions to deepen understanding:

1. What are common assembly tools and semi-automatic tools used in operations?
2. How does tool calibration affect quality and compliance?
3. What factors influence the selection of soldering consumables?
4. How should work instructions be read and confirmed before starting assembly?
5. Why is ergonomic arrangement important for productivity and safety?

Clarify points such as tool care, consumable storage, instructions interpretation, and workstation setup.

Demonstrate

- Demonstrate proper handling and basic maintenance of assembly tools.
- Show how to collect tools, check calibration status, and test for functionality.
- Demonstrate correct selection and handling of solder wire, flux, and tips.
- Show correct method to read and confirm understanding of assembly instructions.
- Demonstrate ergonomically arranging tools and components at the workstation.

Activity

1. **Activity Name:** Tool Handling and Workstation Setup Exercise
2. **Objective:** Enable learners to practice tool verification and ergonomic setup.
3. **Type:** Group
4. **Resources:** Tools, consumables, work instructions, calibration labels
5. **Duration:** 30 minutes
6. **Instructions**:
   - Groups collect tools, verify calibration, and set up a workstation as per instructions.
   - Learners identify incorrect arrangements or non-compliances.
7. **Outcome:** Learners gain hands-on experience in tool handling, verification, and efficient workstation layout.

Notes for Facilitation

- Stress the importance of safety, calibration, and tool care at all times.
- Keep demonstrations simple and aligned to shop-floor realities.
- Encourage learners to ask clarifying questions on work instructions.
- Reinforce ergonomic practices to avoid fatigue and injuries.
- Link tool usage to quality and productivity outcomes.

Unit 2.3: Advanced Assembly Technologies and Safety

Unit Objectives

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

1. Elucidate the handling and assembly procedures for 5G-specific hardware components.
2. Demonstrate how to identify and segregate 5G-specific hardware for assembly tasks.
3. Describe the use of ERP systems for inventory and production tracking in an assembly setup.
4. Show how to update inventory records using the ERP system to ensure material availability.
5. Discuss the role of IoT-enabled tools in compliance monitoring during assembly processes.
6. Show how to use IoT-enabled tools to monitor tool compliance and performance.
7. Explain the applications of 3D printing in assembly and prototyping.
8. Demonstrate how to set up and calibrate 3D printing workstations for prototyping, small-batch production, and ensure printed parts meet specifications.
9. Explain the safety and environmental standards that must be followed in assembly operations.

Resources to be Used

Participant handbook, Presentation slides, Whiteboard or flipchart, Markers, Samples or visuals of various types of optical fiber cable constructs, Handouts or reference materials on deployment suitability, , Safety equipment (gloves, goggles, etc.), Samples or visuals of proper trenching, ducting, and aerial supports, Demonstrative tools or props (e.g., bend radius gauge)

Say

- This unit introduces advanced assembly technologies used in modern telecom manufacturing.
- You will learn how 5G-specific hardware is handled, identified, and segregated during assembly.
- We will explore how ERP systems and IoT-enabled tools support inventory control, compliance, and performance tracking.
- You will also understand the role of 3D printing in rapid prototyping and the importance of safety and environmental standards in advanced assembly setups.

Ask

- Why do you think 5G hardware requires special handling during assembly?
- How can ERP systems prevent material shortages in production?
- What advantages do IoT-enabled tools provide in compliance monitoring?
- Where do you see the practical use of 3D printing in assembly operations?

Do

- Observe sample 5G hardware components and discuss handling requirements.
- Review ERP screen samples to identify key inventory and production fields.
- Examine IoT tool dashboards to understand compliance indicators.
- Discuss basic safety requirements applicable to advanced assembly stations.

Elaborate

Use the following guiding questions to deepen understanding:

1. What makes 5G-specific hardware different from conventional components?
2. How do ERP systems support real-time inventory and production tracking?
3. What compliance parameters can be monitored using IoT-enabled tools?
4. How does 3D printing support prototyping and small-batch production?
5. Why are safety and environmental standards critical in advanced assembly operations?

Relate concepts to quality, traceability, and workplace safety.

Demonstrate

- Demonstrate identification and segregation of 5G-specific hardware components.
- Show how inventory updates are done in an ERP system (demo or walkthrough).
- Demonstrate monitoring of tool compliance and performance using IoT-enabled tools.
- Explain setup and calibration steps of a 3D printing workstation using visuals.
- Demonstrate safe working practices and compliance with environmental norms.

Activity

1. **Activity Name:** Advanced Assembly Technology Mapping
2. **Objective:** Enable learners to correlate advanced tools, systems, and safety practices in assembly.
3. **Type:** Group
4. **Resources:** ERP screenshots, 5G hardware samples, IoT dashboard images, 3D printing visuals
5. **Duration:** 30 minutes
6. **Instructions:**
   • Groups map assembly tasks with appropriate technology (ERP, IoT, 3D printing).
   • Learners identify safety and compliance checks for each task.
7. **Outcome:** Learners understand how advanced technologies integrate into safe and efficient assembly processes.

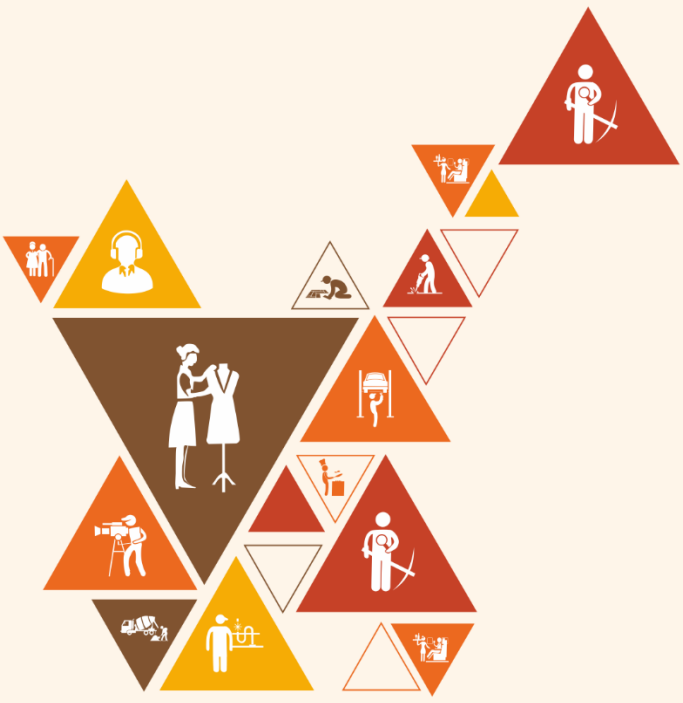
Notes for Facilitation

- Use practical examples rather than deep technical system configurations.
- Emphasize traceability, compliance, and safety at every step.
- Clarify that ERP and IoT demonstrations may be conceptual where live systems are unavailable
- Reinforce environmental responsibility and safe disposal practices.
- Encourage discussion on future trends in telecom assembly technologies.

Notes

4. Reflow Soldering on Telecom Boards

Unit 4.1 – Reflow Soldering
Unit 4.2 – Operation of Reflow Machine



TEL/N6210

Key Learning Outcomes

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

1. List the factors that determine an effective reflow soldering process.
2. Identify the factors that influence the reflow profile.
3. Define the concept of footprint design.
4. List the different types of reflow soldering ovens.
5. Describe the stages of the reflow soldering process.
6. Identify the alarm messages generated during reflow soldering.
7. Analyse the significance of the N_2 conservation mode.
8. Identify common defects occurring in the reflow soldering process.

UNIT 4.1: Reflow Soldering

Unit Objectives

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

1. List the key factors of an effective reflow soldering process.
2. Identify the factors that affect the reflow profile.
3. Define footprint design in the context of PCB assembly.
4. List the different types of reflow soldering ovens.

Resources to be Used

Participant handbook, whiteboard, markers, projector, laptop, sample change request templates (CR forms), inventory sheets, sample work plans, diagnostic tools demonstration videos.

Say

Today we're going to learn how telecom companies manage network changes in a structured and safe manner. Whether it's upgrading a router, replacing fibers, or updating software — every change must be controlled to protect network stability.

Ask

- Have you ever seen a network outage caused by a misconfigured change or improper installation?
- Why do you think telecom companies follow strict change management processes?

Demonstrate

Let's now engage in a structured activity to reinforce these concepts by creating a practical work plan.

Activity

- Activity name: Change Request Validation Simulation
- Objective of the Activity: To help participants practice evaluating a change request by reviewing criticality, dependencies, risks, and required approvals.
- Resources: Participant handbook, mock CR forms, pens, projector.
- Time Duration: 30 minutes
- Instructions:
  1. Divide participants into small groups.
  2. Give each group a hypothetical change request (e.g., "Upgrade OLT firmware", "Replace fiber patch panel", "Expand switch capacity").
  3. Ask groups to validate the CR by identifying:
     - Risks
     - Dependencies
     - Impact on customers
     - Required approvals
     - Rollback plan
  4. Each group presents their analysis to the class.
  5. Facilitate a discussion on what was accurate, missing, or could be improved.
- Outcome: Participants will learn how to analyze and validate real-world change requests effectively and understand the importance of structured planning before upgrades.

Notes for Facilitation

- Encourage participants to share insights from their own experiences and consider real-world challenges.
- 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.

UNIT 4.2: Operation of Reflow Machine

Unit Objectives

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

1. List and describe the four stages of a typical reflow soldering profile.
2. Identify common alarm messages that may be received during the reflow soldering process.
3. Explain the significance of the nitrogen (N2) conservation mode in reflow ovens.
4. Recognize common defects that occur during reflow soldering and their causes.

Resources to be Used

Participant handbook, change management workflow charts, KPI dashboards (live or demo), laptop, projector, sample maintenance logs, alarm monitoring screenshots, escalation matrix, whiteboard, markers.

Say

In this session, we'll explore how change management works in telecom operations, and why following approved procedures is crucial for minimizing network disruptions and maintaining customer satisfaction.

Ask

- Why do you think telecom operators use strict workflows for network modifications?
- What might happen if KPIs are not monitored during a change?

Activity

- Activity name: Change Execution and KPI Monitoring Simulation
- Objective of the Activity: To engage participants in creating a comprehensive pre-installation checklist
- Resources: KPI dashboard screenshots, sample alarms, escalation matrix, role cards.
- Time Duration: 40 minutes
- Instructions:
  1. Divide trainees into groups.
  2. Provide each group a scenario such as fiber rerouting, CPE upgrade, or link reconfiguration.
  3. Ask them to execute the "change" using the given work plan.
  4. Show them simulated KPIs before and after the change.
  5. Ask them to decide:
     - Is performance acceptable?
     - Should they escalate?
     - Should rollback be triggered?
  6. Each group presents its findings.

Notes for Facilitation

- Promote teamwork and communication during simulations.
- Reinforce that documentation is as important as the technical task itself.
- Ask trainees to discuss real-life challenges faced during changes.
- Guide them to complete all unit-related questions in the participant manual.

Notes

5. Cleaning and Inspection of Telecom Boards

Unit 5.1 – Cleaning of PCBs

Unit 5.2 – Inspection of PCBs

TEL/N2502

Key Learning Outcomes

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

1. Identify the different types and sources of contamination in PCBs.
2. Describe various methods of PCB cleaning and their applications.
3. Explain the causes and impact of white residue on PCB performance and reliability.
4. Demonstrate correct procedures for storing and handling PCBs after cleaning.
5. List and explain key points of importance in visual inspection of PCBs.
6. Identify the attributes, capabilities, and limitations of Automated Optical Inspection (AOI).
7. List the applications and advantages of Automated X-ray Inspection (AXI).
8. Apply in-circuit testing (ICT) methods to verify assembly integrity.
9. Compare different types of visual inspection systems and their suitability for specific applications.

UNIT 5.1: Cleaning of PCBs

Unit Objectives

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

1. Identify different types and sources of contamination in PCBs.
2. List the common methods used for PCB cleaning.
3. Explain the impact of white residue on PCB quality and reliability.
4. Demonstrate correct methods for storage and handling of PCBs after cleaning.

Resources to be Used

Participant handbook, sample PCBs (contaminated and cleaned), magnifying glass or microscope, lint-free wipes, cleaning solvents (IPA), PCB cleaning station (if available), ESD mats, gloves, projector, whiteboard.

Note

This unit focuses on the importance of maintaining PCB cleanliness to ensure long-term reliability, prevent failures, and support high-quality repair and manufacturing practices.

Say

Good Morning everyone!
Today we are going to learn something very important for technicians — PCB contamination and proper cleaning methods. A tiny residue on a PCB can cause corrosion, overheating, intermittent faults, or complete board failure. Understanding this will help you maintain high repair standards and deliver reliable service.

Ask

Ask the participants the following questions:

- Have you ever seen dust, fingerprints, or white residue on a circuit board?
- What problems do you think contamination can create?
- Which tools or materials do you currently use for cleaning PCBs?

Write their responses on the whiteboard.

Elaborate

In this session, we will discuss the following point:

- PCB Cleaning and Flux Residue
- Waste IPC Standards of Soldering
- Types of Contamination in PCBs
- Types of Cleaning Solvents
- Board Cleaning Methods
- White Residues on PCBs
- Storage and Handling of PCBs after Cleaning

Say

Now let's move to a hands-on activity where you will inspect, clean, and correctly store PCBs following proper procedures.

Activity

- **Duration**: 40 minutes
- **Resources**: Sample contaminated PCBs, IPA, brushes, wipes, ESD mat, gloves.
- **Steps**:
  1. Divide the trainees into pairs.
  2. Provide each pair with a contaminated PCB.
  3. Ask them to inspect the contaminants and list what they observe.
  4. Demonstrate proper IPA-based PCB cleaning.
  5. Allow trainees to clean their assigned PCB.
  6. Show them how to dry, inspect, and store the PCB.
  7. Each pair documents the contamination type and cleaning method used.

Do

- Demonstrate correct use of IPA, brushes, and lint-free wipes.
- Guide trainees to avoid damage to components or tracks.
- Check that PCBs are dried and stored in ESD-safe packaging.
- Ensure all trainees practice contamination identification and post-cleaning handling.

Notes for Facilitation

- Reinforce ESD precautions throughout the session.
- Highlight real-world failures caused by improper cleaning.
- Encourage trainees to speak about mistakes they made previously and how to avoid them now.
- Ask trainees to update their workbooks with cleaning procedures.

UNIT 5.2: Inspection of PCBs

Unit Objectives

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

1. Explain the importance and key requirements of visual inspection in PCB assembly.
2. Identify the features and capabilities of Automated Optical Inspection (AOI) systems.
3. Describe the applications and benefits of Automated X-ray Inspection (AXI) methods.
4. Perform in-circuit testing to verify electrical functionality.
5. Compare the working principles, advantages, and limitations of different visual inspection machines.

Resources to be Used

Participant handbook, sample PCBs (good and defective), magnifying lamps, microscopes, AOI/AXI demo videos, multimeter, ICT jig (if available), laptop, projector, whiteboard, markers.

Note

This unit helps trainees understand how visual inspection and automated test systems ensure quality, detect defects early, and avoid costly failures in electronic manufacturing and repair workflows.

Say

Good Morning everyone!
In this session, we are going to explore how PCBs are inspected, tested, and verified before they are delivered to customers or integrated into devices. Visual inspection—whether manual or automated—plays a critical role in finding soldering issues, missing components, polarity mistakes, and hidden structural defects.

Ask

Ask the participants the following questions:

- Have you ever used a magnifying lamp or microscope to inspect a PCB?
- What kind of defects have you commonly noticed on circuit boards?

Write their responses on the whiteboard.

Elaborate

In this session, we will discuss the following point:

- Visual Inspection
- Automated Optical Inspection (AOI)
- Automated X-ray Inspection (AXI)
- In-Circuit Testing (ICT)
- Comparison between Visual Inspection Machines

Say

Now let's move to a small activity where you will inspect PCBs manually and compare your findings with an AOI sample result.

Activity

- **Duration**: 60 minutes
- **Resources**: Magnifying lamp, microscope, sample PCBs, multimeter.
- **Steps**:
  1. Divide the class into small groups.
  2. Provide each group with a PCB containing known defects.
  3. Ask them to identify as many defects as possible using visual tools.
  4. Show an AOI/AXI sample report and compare results.
  5. Demonstrate basic ICT using a multimeter or test jig.
  6. Ask trainees to note whether the board passes or fails the tests.

Do

- Guide trainees on how to classify defects (critical/major/minor).
- Encourage them to discuss what defects they detected or missed.
- Reinforce the habit of documenting each defect correctly.
- Ensure safe handling of PCBs and ESD precautions.

Notes for Facilitation

- Encourage peer learning—ask trainees to cross-check each other's inspection observations.
- Use real-world examples of failures caused by poor inspection.
- Ask them to complete questions and exercises from the participant manual.

Exercise

Answers to exercises for PHB

Ax Multiple Choice Questions (MCQs):

1. b) Prevent electromigration and improve reliability
2. c) IPC J-STD-001
3. b) Flux chemistry and improper cleaning processes
4. b) Ultrasonic cleaning
5. b) Inspecting hidden solder joints like BGAs and CSPs
6. b) A structural electrical test for verifying assembly integrity

7. Fill in the Blanks:

a) Ionic contamination includes salts and flux activators, while non-ionic contamination includes oils, greases, and solder balls.
b) The IPC standard IPC J-STD-001 covers requirements for soldered electrical and electronic assemblies.
c) White residues on PCBs are complex mixtures of flux residues, metallic salts, and other materials.
d) In ultrasonic cleaning, contaminants are removed through a process called cavitation.
e) AOI inspection uses high-resolution cameras and image-processing algorithms to detect surface defects on PCBs.
f) The two common ICT methods are Bed-of-Nails tester and Flying Probe tester.

8. Short Answer Questions (Shortened)

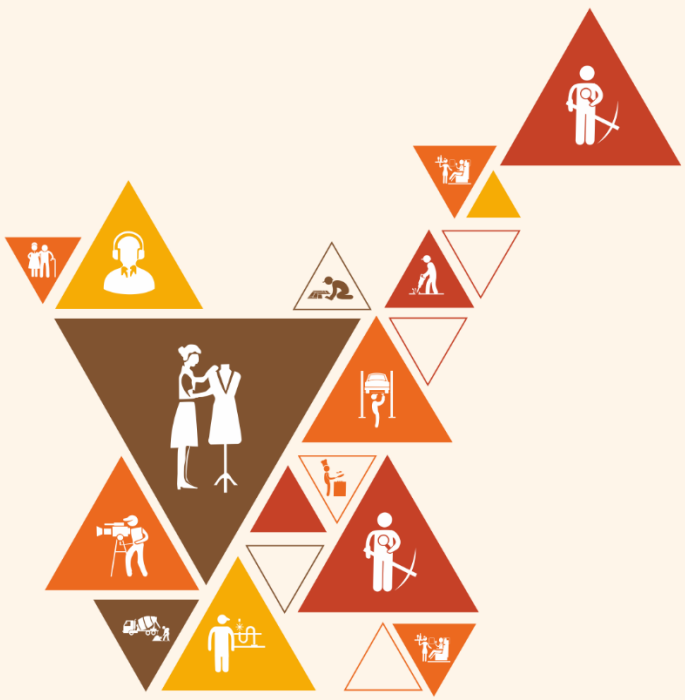
a) Electromigration occurs when ionic contaminants move under electrical stress and create conductive paths. Cleaning removes these contaminants and prevents failures.
b) Three benefits of IPC standards: Improve soldering quality, Reduce defects, and rework Ensure consistent and reliable manufacturing
c) Aqueous: Water-based, eco-friendly, needs rinsing. Semi-aqueous: Solvent-based, removes tougher residues, then rinsed with water.
d) White residues are flux salts or reaction byproducts left after poor cleaning. They can cause corrosion, leakage, and reliability issues.
e) AOI: + Fast surface inspection; – cannot check hidden joints. AXI: + Inspects hidden joints; – expensive. ICT: + Accurate electrical testing; – fixtures can be costly.
f) Bed-of-Nails: Fast and good for mass production; expensive fixtures. Flying Probe: Flexible and low-cost for small batches; slower.

Notes

6. Sustainability Practices in Telecom Production and Assembly Line Processes

Unit 6.1 - Environmental Compliance and Sustainable Practices

Unit 6.2 - Waste Management, Disposal, and Environmental Audit Compliance



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Key Learning Outcomes

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

1. Explain the organization's sustainability policies and goals.
2. Demonstrate the use of energy-efficient equipment, tools, and automated systems to reduce carbon footprint and optimize material, water, and electricity consumption.
3. Elucidate the key aspects of EPR guidelines, ISO 14001, and e-waste disposal laws.
4. Demonstrate how to inspect, categorize, and store telecom components such as PCBs, cables, batteries, and plastic casings for appropriate processing, ensuring compliance with EPR guidelines.
5. Discuss the methods for identifying recyclable and hazardous components in telecom production.
6. Show how to maintain an inventory of recyclable and hazardous materials while tracking waste management and reporting improper disposal practices.
7. Describe green manufacturing practices, including energy-efficient tools, lead-free soldering, and automation.
8. Show how to follow low-emission soldering and lead-free assembly processes while ensuring compliance with ISO 14001 (Environmental Management System).
9. Explain the proper handling, storage, and disposal methods for e-waste.
10. Demonstrate how to properly dispose of hazardous waste (e.g., lithium batteries, chemical residues) and deposit non-hazardous recyclable materials (e.g., plastics, aluminum, copper) in designated collection areas.
11. Determine techniques for reducing material wastage without impacting production quality.
12. Demonstrate the process of maintaining and calibrating energy-efficient machinery to ensure optimal performance and minimize environmental impact.
13. Discuss the safe and responsible handling of hazardous and non-hazardous materials in telecom manufacturing.
14. Demonstrate how to coordinate with authorized e-waste recyclers to ensure proper processing and disposal of materials.
15. Describe environmental impact assessment techniques for telecom production.
16. Demonstrate how to follow national and international environmental laws, participate in sustainability audits, check for adherence to guidelines, and implement corrective actions based on assessments.
17. Explain the documentation requirements for sustainability audits and compliance tracking.
18. Demonstrate how to maintain documentation for waste disposal, conduct periodic waste audits, and identify opportunities for further waste reduction.

Unit 6.1: Sustainability Practices in Telecom Infrastructure Management

Unit Objectives

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

1. Explain the organization's sustainability policies and goals.
2. Demonstrate the use of energy-efficient equipment, tools, and automated systems to reduce carbon footprint and optimize material, water, and electricity consumption.
3. Elucidate the key aspects of EPR guidelines, ISO 14001, and e-waste disposal laws.
4. Demonstrate how to inspect, categorize, and store telecom components such as PCBs, cables, batteries, and plastic casings for appropriate processing, ensuring compliance with EPR guidelines.
5. Discuss the methods for identifying recyclable and hazardous components in telecom production.
6. Show how to maintain an inventory of recyclable and hazardous materials while tracking waste management and reporting improper disposal practices.
7. Describe green manufacturing practices, including energy-efficient tools, lead-free soldering, and automation.
8. Show how to follow low-emission soldering and lead-free assembly processes while ensuring compliance with ISO 14001 (Environmental Management System).
9. Explain the proper handling, storage, and disposal methods for e-waste.
10. Demonstrate how to properly dispose of hazardous waste (e.g., lithium batteries, chemical residues) and deposit non-hazardous recyclable materials (e.g., plastics, aluminum, copper) in designated collection areas.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, E-waste bins (color-coded), Sample PCBs, cables, batteries, plastic casings, ISO 14001 overview slides, EPR guideline handouts, Inventory register/format, PPE

Say

- Environmental compliance is critical for sustainable telecom manufacturing and legal adherence.
- This unit focuses on responsible use of resources, waste segregation, and regulatory compliance.
- You will learn how EPR, ISO 14001, and e-waste laws guide daily shop-floor practices.
- Proper identification and disposal of waste protects the environment and organizational credibility.

Ask

- Why is environmental compliance important in electronics and telecom production?
- What risks arise from improper disposal of batteries or PCBs?
- How does ISO 14001 support sustainable manufacturing?
- What is the role of workers in meeting EPR requirements?

Do

- Observe samples of telecom components and classify them as recyclable or hazardous.
- Review a simple waste inventory format and reporting mechanism.
- Identify energy-efficient tools and practices used in the workshop.
- Discuss examples of improper disposal and corrective actions.

Elaborate

Use the following key questions for discussion:

1. What are the main goals of organizational sustainability policies?
2. How do EPR guidelines impact handling of telecom components?
3. What practices help reduce energy, water, and material consumption?
4. How does ISO 14001 ensure environmental compliance at the site?
5. Why is proper segregation and documentation of waste important?

Link environmental practices to legal compliance and cost optimization.

Demonstrate

- Demonstrate segregation of PCBs, cables, batteries, and plastic casings.
- Show proper storage and labeling of hazardous and recyclable waste.
- Demonstrate how to record recyclable and hazardous material movement in inventory logs.
- Demonstrate lead-free soldering and low-emission assembly practices.
- Show correct disposal of hazardous and non-hazardous waste in designated bins.

Activity

1. **Activity Name:** Waste Segregation and Environmental Compliance Drill
2. **Objective:** Build hands-on understanding of sustainable practices and compliance.
3. **Type:** Group Activity
4. **Resources:** Sample components, waste bins, inventory sheets
5. **Duration:** 30 minutes
6. **Instructions:**
   - Groups classify provided components into recyclable and hazardous categories.
   - Learners store them in appropriate bins and update inventory records.
   - Groups identify one non-compliance scenario and propose corrective action.
7. **Outcome:** Learners confidently apply environmental compliance and waste management practices.

Notes for Facilitation

- Keep explanations practical and linked to shop-floor activities.
- Emphasize compliance as a shared responsibility.
- Reinforce correct labeling, documentation, and segregation habits.
- Encourage adherence to ISO 14001 principles in daily work.
- Promote sustainability as both an environmental and operational priority.

Unit 6.2: Sustainability Practices in Telecom Infrastructure Management

Unit Objectives

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

1. Determine techniques for reducing material wastage without impacting production quality.
2. Demonstrate the process of maintaining and calibrating energy-efficient machinery to ensure optimal performance and minimize environmental impact.
3. Discuss the safe and responsible handling of hazardous and non-hazardous materials in telecom manufacturing.
4. Demonstrate how to coordinate with authorized e-waste recyclers to ensure proper processing and disposal of materials.
5. Describe environmental impact assessment techniques for telecom production.
6. Demonstrate how to follow national and international environmental laws, participate in sustainability audits, check for adherence to guidelines, and implement corrective actions based on assessments.
7. Explain the documentation requirements for sustainability audits and compliance tracking.
8. Demonstrate how to maintain documentation for waste disposal, conduct periodic waste audits, and identify opportunities for further waste reduction.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, Sample waste audit checklist, Energy-efficient equipment (demo/visual), Waste segregation bins, Sample documentation formats, PPE, Calibration sticker samples

Say

- Waste management is critical to sustainable telecom manufacturing and regulatory compliance.
- Reducing material wastage directly improves cost efficiency and environmental performance.
- Proper calibration and maintenance of machinery minimizes energy loss and emissions.
- Environmental audits help identify risks, gaps, and opportunities for continuous improvement.

Ask

- How can material wastage be reduced without affecting product quality?
- Why is calibration of machines important from an environmental point of view?
- What risks are involved in poor handling of hazardous waste?
- How do environmental audits help an organization stay compliant?

Do

- Review examples of hazardous and non-hazardous waste used in telecom production.
- Observe a sample calibration label and audit checklist.
- Identify possible waste reduction opportunities in a given production scenario.
- Discuss roles of authorized recyclers in e-waste disposal.

Elaborate

Discuss using the following key questions:

1. What techniques help reduce material wastage while maintaining quality?
2. How does preventive maintenance of machinery contribute to sustainability?
3. What are the regulatory requirements for handling hazardous waste?
4. How are environmental impact assessments conducted in telecom manufacturing?
5. Why is proper documentation essential during sustainability audits?

Connect audit outcomes to corrective actions and continuous improvement.

Demonstrate

- Demonstrate safe segregation and storage of hazardous and non-hazardous waste.
- Show how calibration status of energy-efficient machinery is checked and recorded.
- Demonstrate coordination steps with authorized e-waste recyclers (process flow).
- Show how to fill waste disposal records and audit checklists.
- Demonstrate identifying non-compliance findings and suggesting corrective actions.

Activity

1. **Activity Name:** Waste Audit and Compliance Exercise
2. **Objective:** Develop practical understanding of waste audits and environmental compliance.
3. **Type:** Group Activity
4. **Resources:** Waste audit checklist, sample records, waste bins
5. **Duration:** 30 minutes
6. **Instructions:**
   - Learners review a mock telecom production scenario.
   - Identify types of waste generated and proper disposal methods.
   - Complete a basic waste audit checklist.
   - Suggest two corrective or improvement actions to reduce waste.
7. **Outcome:** Learners gain confidence in waste management, audit participation, and compliance practices.

Notes for Facilitation

- Use real-life examples from telecom or electronics production environments.
- Emphasize compliance as part of daily operational responsibility.
- Reinforce correct documentation and record-keeping habits.
- Encourage learners to think in terms of continuous improvement.
- Highlight coordination with authorized agencies as mandatory, not optional.

Exercise

Answers to exercises for PHB

A. Multiple Choice Questions – Answers only

1. b) Accurate measurement
2. b) Lockout/Tagout
3. c) Hazardous materials
4. b) Authorized e-waste recycler
5. b) ISO 14001

B. Short Answer Questions

1. Accurate measurement before cutting, use of cutting jigs/templates, reuse of leftover cables where permitted.
2. Calibration ensures machines operate efficiently, reduce energy loss, maintain product quality, and prevent wastage.
3. Use PPE while handling, proper labeling and storage, and follow approved disposal procedures.

C. True or False – Answers

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

D. Fill in the Blanks

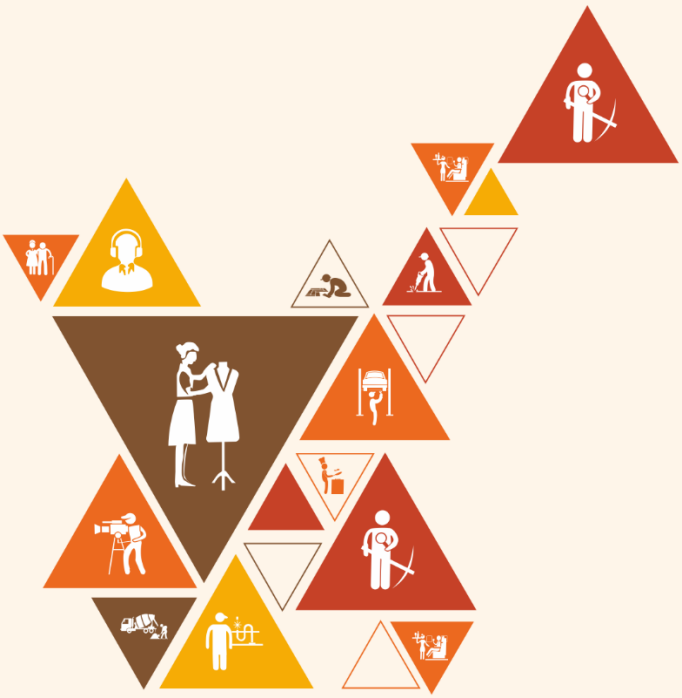
1. Fixtures
2. Lockout/Tagout
3. Environmental Impact
4. quantity

Notes

Telecom Sector Skill Council

7. Employability Skills (30 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



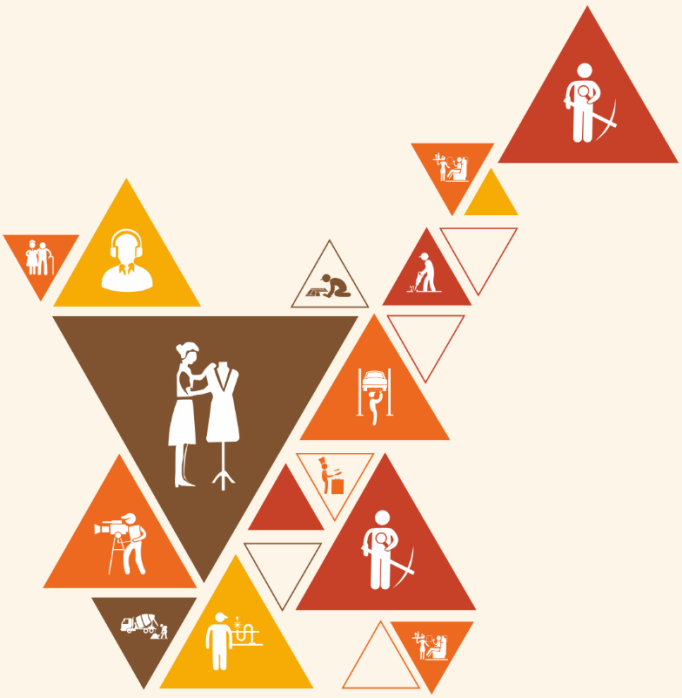
DGT/VSQ/N0102

8. 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:	Surface Mount Technology (SMT)- Telecom Technician		
Qualification Pack Name & Ref. ID	Surface Mount Technology (SMT)- Telecom Technician, TEL/Q2501		
Version No.	5.0	**Version Update Date**	08/05/2025
Pre-requisites to Training (if any)	Not Applicable		
Training Outcomes	• Explain the process of screen printing on PCBs and its significance in circuit assembly. • Describe the key considerations for accurate component placement on PCBs. • Discuss the role of re-flow soldering in PCB manufacturing and its impact on circuit reliability. • Elucidate the importance of cleaning and inspection in ensuring the quality of PCBs. • Determine the key sustainability practices that must be followed in telecom production and assembly line processes.		

SL	Module Name	Session name	Session Objectives	NOS	Methodology	Training Tools/Aids	Duration (hours)
1	Introduction to the sector and the job role of a Surface Mount Technology (SMT)-Telecom Technician (Theory-05:00 Practical-00:00)	Introduction to the sector & the job role of a Surface Mount Technology (SMT)-Telecom Technician	• Describe the structure and significance of the telecom sector, highlighting its role in global and national connectivity. • Discuss the evolution of telecom technologies and their impact on communication infrastructure. • Describe the primary responsibilities of a Surface Mount Technology (SMT)-Telecom Technician , including installation, maintenance, and fault management. • Explain the key skills and competencies required for effective performance as a Surface Mount Technology (SMT)-Telecom Technician .	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	5 Theory (5:00) 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)
7.	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: 2:30) (Practical: 5:00)
		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: 2:30) (Practical: 5:00)

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: 2:30) (Practical: 5:00)
		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: 2:30) (Practical: 5:00)

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	(Theory: 2:30) (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			(Theory: 2:30) (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			(Theory: 2:30) (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			(Theory: 2:30) (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 70% of aggregate marks.
6	In case of unsuccessful completion, the trainee may seek reassessment on the Qualification File.

National Occupational Standards	NOS Code & Version	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
Screen Printing of PCBs	TEL/N2503, v4.0	30	50	-	20	100	20
Component Placement on PCBs	TEL/N2504, v4.0	30	50	-	20	100	20
Re-flow soldering on PCBs	TEL/N2505, v4.0	30	50	-	20	100	20
Cleaning and Inspection of PCBs	TEL/N2502, v5.0	30	50	-	20	100	15
Follow sustainability practices in telecom production and assembly line processes	TEL/N9107, v1.0	30	50	-	20	100	15
Employability Skills (30 Hours)	DGT/VSQ/N0101, v1.0	20	30	-	-	50	10
Total		**170**	**280**	**-**	**100**	**550**	**100**

Annexure-III

QR Codes –Video Links

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
1. Role and Responsibilities of a Telecom Surface Mount Technology (SMT) Technician	UNIT 1.1: Fundamentals of Electronics	Intro- duc-tion to the Telecom Sec-tor in India	https://youtu.be/Cag-bc-bivtM	Introduction to the Telecom Sector in India
		Fundamentals of Electronics in Telecom Boards	https://www.youtube.com/watch?v=4sBgu_tUpiI	Basic electronics Guide to components
2. Screen Printing of Telecom Boards (TEL/N2503)	UNIT 2.1: Screen Printing Process	Selection of Soldering Materials and Tools	https://www.youtube.com/watch?v=KElnqQ85ZdQ	Soldering and Soldering Process
		Safety, ESD Protection, and Documentation	https://www.youtube.com/watch?v=xay2p514iS8	Electrostatic Discharge
	UNIT 2.2: Pre-baking of Board	Solder Paste Types and Handling	https://www.youtube.com/watch?v=bq4-k6LSWjo	Solder Paste Handling

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
4. Reflow Soldering on Telecom Boards (TEL/N2505)	UNIT 4.1: Reflow Soldering	Soldering Defects and Rework Standards	https://www.youtube.com/watch?v=e-HsloQKwEU	Soldering defects and their remedies
	UNIT 4.2: Operation of Reflow Machine	De-soldering and Selective Soldering Techniques	https://www.youtube.com/watch?v=bG7yW9FigJA	Desoldering
5. Cleaning and Inspection of Telecom Boards (TEL/N2502)	UNIT 5.1 Cleaning of PCBs	PCB Cleaning and Flux Residue	https://www.youtube.com/watch?v=Ji5aF0RkIlM	Cleaning of PCBs

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
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