Telecom Sector Skill Council

Facilitator Guide

Sector
Telecom

Sub-Sector
Handset

Occupation
Communication Electronics

Reference ID: **TEL/Q2502,** Version **5.0**
NSQF level **3**

Line Assembler – Telecom Products

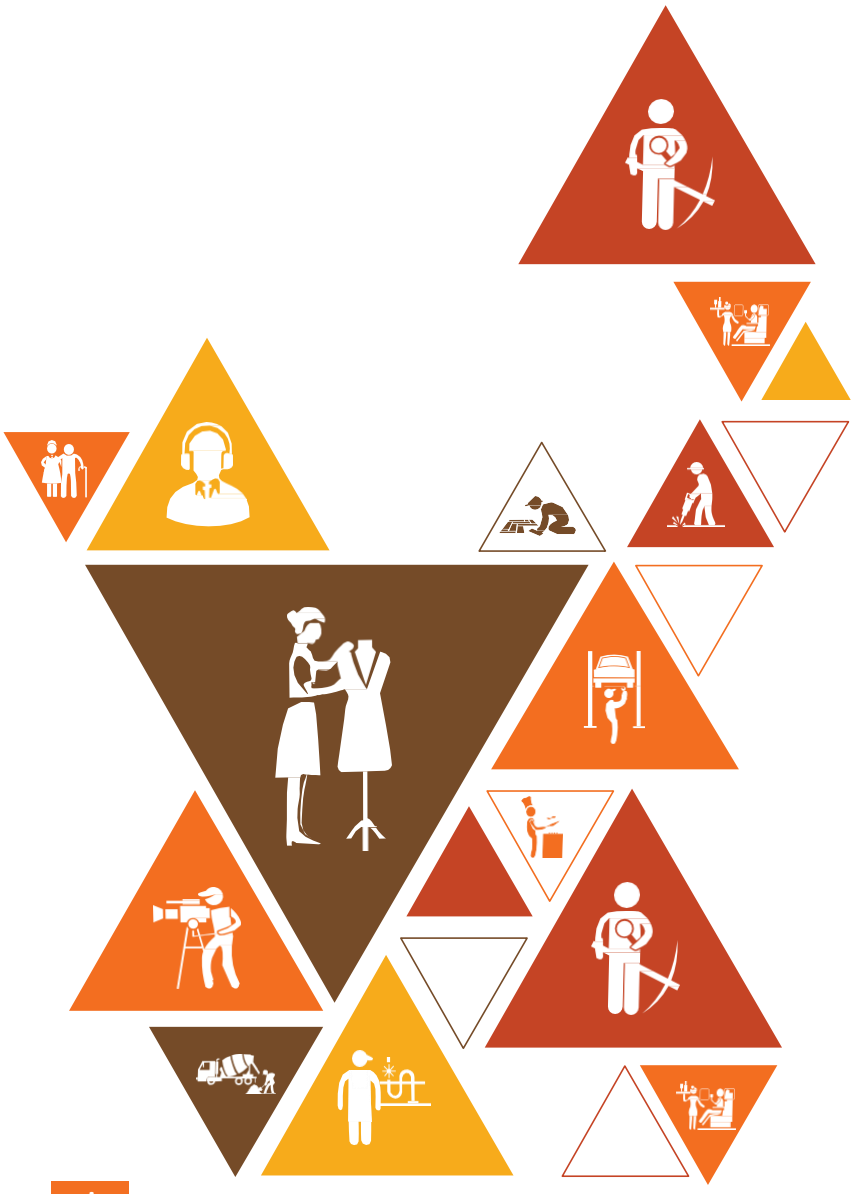
This book is sponsored by
Telecom Sector Skill Council
Estel House,3rd Floor, Plot No: - 126, Sector-44
Gurgaon, Haryana 122003
Phone: 0124-2222222
Email: tssc@tsscindia.com
Website: www.tsscindia.com

Disclaimer

The information contained herein has been obtained from sources reliable to Telecom Sector Skill Council. Telecom Sector Skill Council disclaims all warranties to the accuracy, completeness or adequacy of such information. Telecom Sector Skill Council shall have no liability for errors, omissions, or inadequacies, in the information contained herein, or for interpretations thereof. Every effort has been made to trace the owners of the copyright material included in the book. The publishers would be grateful for any omissions brought to their notice for acknowledgements in future editions of the book. No entity in Telecom Sector Skill Council shall be responsible for any loss whatsoever, sustained by any person who relies on this material. The material in this publication is copyrighted. No parts of this publication may be reproduced, stored or distributed in any form or by any means either on paper or electronic media, unless authorized by the Telecom Sector Skill Council.

"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 Line Assembler - Telecom Products s primarily designed to facilitate skill development and training of people, who want to become professional Line Assembler - Telecom Products. 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/N2506 (Preparing workspace for assembly operations)
2. TEL/N2507 (Assembly operations in production line)
3. TEL/N2510: Assembly of Mobile Phone Accessories
4. TEL/N2508 (ESD safe procedures and practices)
5. TEL/N9107: Follow sustainability practices in telecom production and assembly line processes
6. DGT/VSQ/N0101: Employability Skills (30 Hours)

Post this training, the participants will be able to perform tasks as professional Line Assembler - Telecom Products. 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

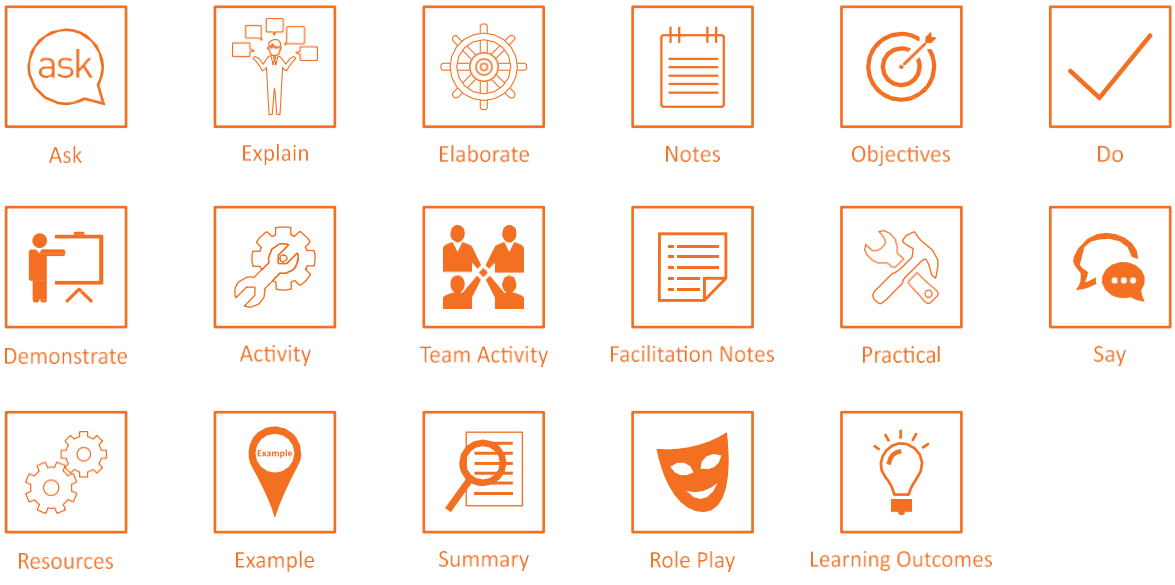
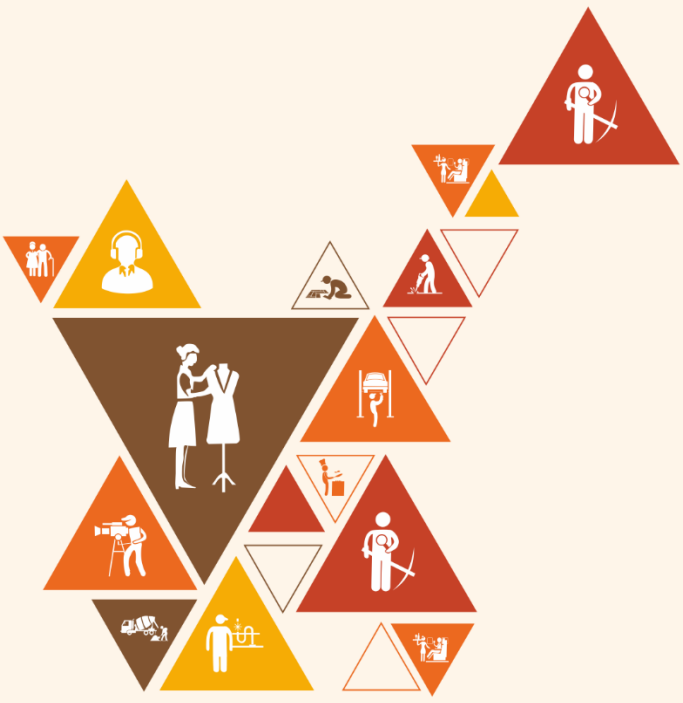


Table of Contents

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**

1. Introduction



Key Learning Outcomes

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

1. Explain the significance of the telecom sector in modern communication and economic development.
2. Elucidate the key skills and technical expertise required for a Fiber-to-the-Home (FTTH/X) Installer.
3. Describe the challenges faced in the installation and maintenance of FTTH/X networks.
4. Determine the impact of fiber optic technology on internet speed and connectivity.
5. Discuss the role and responsibilities of a Line Assembler - Telecom Products.

Unit 1.1: Telecom Industry and its Sub-sectors

Unit Objectives

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

1. Illustrate the size and scope of the Telecom industry and its various sub-sectors in India.
2. Outline the growth of the Indian Telecom Sector

Resources to be Used

Participant Handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer

Note

In this unit, we will discuss the telecom sector in India and its sub-sectors.

Say

Good morning and welcome back to this training program, “Distributor Sales Representative”. Today we shall discuss about the telecom sector in India and its sub-sectors.

Ask

Ask the participants the following questions:

- What do you understand by telecom?

Write down the participants’ answers on a whiteboard/flipchart. Take appropriate cues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following point:

- Introduction to the telecom industry
- Top Mobile handset players in India
- Major subsectors of the Telecom Industry
- Infrastructure
- Equipment
- Mobile Virtual Network Operators (MNVO)
- White Space Spectrum
- 5G
- Telephone service providers and
- Broadband

Say

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

Activity

- This is a group activity
- Divide the class into four groups and provide chart paper and other required items to each group
- Now, ask each group to make a chart paper presentation on major sub-sectors of the Telecom Industry
- Ask them to explain each of the types
- They can use hand-drawn diagrams or pasted pictures
- After the groups complete their work, collect all the chart papers and evaluate them

Activity	Duration	Resources used
Chart paper presentation	60 minutes	Participant handbook, pen, notebook, chart paper, sketch pens, pencils, eraser, ruler, laptop, etc.

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

Activity

1. **Activity Name:** Name Game (Ice Breaker)
2. **Objective:** This activity is focused on breaking the ice between the participants so that they can come up confidently in putting forward their opinion
3. **Type of activity:** Group activity
4. **Resources:** Participant Handbook, Pen, Notebook, Writing Pad, etc.
5. **Duration of the activity:** 60 minutes
6. **Instructions:**
    - Arrange the class in a semi-circle/circle
    - Say your name aloud and start playing the game with your name.
    - Say, “Now, each of you shall continue with the game with your names till the last person in the circle/ semi-circle participates”.
    - Listen to and watch the trainees while they play the game.
    - Ask questions and clarify if you cannot understand or hear a trainee.
    - Discourage any queries related to one’s financial status, gender orientation or religious bias during the game
    - Try recognising each trainee by their name because it is not recommended for a trainer to ask the name of a trainee during every interaction
1. **Outcome:** This activity has focused on breaking the ice between the participants so that they can come up confidently, putting forward their opinion.

Role-play

1. **Activity Name:**
2. **Role Play – Line Assembler (Telecom Products & Accessories)**
3. **Objective:** To help participants understand the roles and responsibilities of a **Line Assembler** through a practical role play activity.
4. **Resources:** Scenario cards, dummy telecom components (optional), timer.
5. **Duration:** 30 minutes
6. **Instructions:** Divide participants into **groups of 3–4**.

- Give each group a role play scenario card related to telecom product assembly.
- Allow 10 minutes for preparation and role assignment (Line Assembler, Quality Inspector, Supervisor).
- Each group performs the role play for 10 minutes, focusing on assembly, quality checks, and safety.
- Conduct a brief feedback discussion after each role play.
- Rotate scenarios so each group gets a different situation.
- End with a short debrief highlighting key duties, teamwork, quality, and safety.

7. **Outcome:**

Participants gain a clear understanding of **Line Assembler responsibilities**, quality standards, and workplace communication through an engaging role play.

Notes for Facilitation

- Encourage active participation and maintain a supportive learning environment.
- Provide opportunities for questions, discussion, and clarification related to assembly tasks.
- Pace the session to ensure understanding and hands-on involvement.
- Emphasize proper handling, storage, and care of telecom components and tools.
- Encourage participants to share real-world experiences or challenges from assembly lines and learn from peers.

Unit 1.2: Fundamentals of Electronics

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: Active and Passive Components

Unit Objectives

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

1. Compare various electronic part
2. Discuss various types of active and passive electronic components

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, Samples/images of electronic components, Simple comparison charts, Multimeter

Say

- In this session, we will learn about Active and Passive Electronic Components, which are the building blocks of electronic and telecom systems.
- You will understand how electronic parts differ in function and how active components differ from passive ones.
- Knowing these components helps in identifying parts inside electronic circuits and understanding their role in system operation.
- This knowledge supports troubleshooting and safe handling of electronic equipment.

Ask

Ask the participants the following questions:

- Have you seen components like resistors, transistors, or capacitors before?
- What do you think makes one electronic component different from another?
- Which components do you think require power to operate and why?
- Where do you commonly find electronic components in daily life?

Do

- Observe samples or images of different electronic components and identify them.
- Group components into active and passive categories based on their function.
- Compare two components (e.g., resistor vs. transistor) and discuss differences.
- Use a multimeter (demonstration level) to observe basic component behaviour.

Elaborate

In this session, we will discuss the following point:

- What are electronic components and why are they used in circuits?
- How are active components different from passive components?
- What are common examples of passive components and their functions?
- What are common active components and where are they used?
- Why is it important to identify and compare electronic components correctly?

Briefly clarify key terms such as active, passive, amplification, resistance, and control.

Say

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

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.

Do

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

Notes for Facilitation

- Use simple language and real examples while explaining component functions.
- Avoid deep technical equations; focus on concepts and comparison.
- Encourage visual identification and hands-on discussion.
- Reinforce safety while handling electronic components and tools.
- Connect component knowledge to later units on circuits and telecom equipment.

Unit 1.4: Understanding of Diodes, Transistors, and Logic Gates

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 1.5: Fundamentals of PCB

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.

Unit 1.6: Fundamentals of Copper Clad Laminates (CCL)

Unit Objectives

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

1. Identify the properties, layout designs and planning of CCL (Copper-Clad Laminates)

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, CCL sample images/sheets, PCB layer diagrams, Multimeter (demo)

Say

- Today's session introduces Copper-Clad Laminates (CCL), which form the base material for Printed Circuit Boards.
- You will learn about the properties of CCL, how it supports circuit layout design, and why proper planning is important.
- Understanding CCL helps in improving PCB reliability, signal flow, and heat management.
- This knowledge supports better understanding of PCB manufacturing and fault prevention.

Ask

Ask the participants the following questions:

- What material do you think is used as the base for making PCBs?
- Why is copper used on laminates for electronic circuits?
- How can poor layout planning affect circuit performance?
- Where do CCLs play a critical role in telecom and electronic devices?

Do

- Observe images or samples of CCL and identify the copper layer and base material.
- Compare different thicknesses or finishes (conceptual) of copper layers.
- Discuss how track layout planning affects signal flow and heat dissipation.
- Relate CCL properties to durability and performance of PCBs.

Elaborate

In this session, we will discuss the following point:

1. What is a Copper-Clad Laminate and why is it used in PCB fabrication?
2. What are the key properties of CCL such as insulation, thermal stability, and conductivity?
3. How does layout design on CCL impact electrical performance?
4. Why is proper planning important before converting CCL into a PCB?
5. What common issues can arise due to low-quality CCL or poor layout design?

Briefly clarify concepts such as base material types, copper thickness, and layout constraints.

Say

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

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.

Do

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

Notes for Facilitation

- Keep concepts simple and qualitative—avoid deep material science.
- Use diagrams and visuals heavily to explain layers and layout.
- Connect CCL understanding to PCB troubleshooting in the previous unit.
- Encourage learners to relate layout planning to real-world electronic products.
- Reinforce terminology such as laminate, copper layer, insulation, and layout.

Exercise

Answers to exercises for PHB

Multiple Choice Questions:

1. b) Semi-conductor
2. c) Printed Circuit Board
3. c) 3 classes
4. a) Never introduce energy to the circuit
5. b) Capacitance
6. b) Volts
7. b) Alternating current
8. b) Center tap
9. b) Lead
10. c) Can measure both of the above

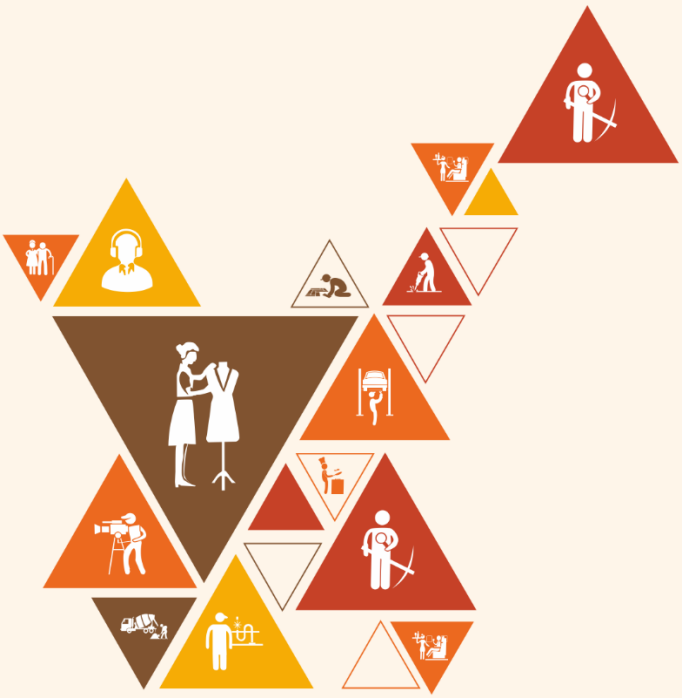
Notes

2. Preparing Workspace for Assembly Operations

Unit 2.1 - Component Handling and Verification

Unit 2.2 - Assembly Tools and Procedures

Unit 2.3 - Advanced Assembly Technologies and Safety



TEL/N2506

Key Learning Outcomes

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

1. Explain the types and specifications of electronic components used in assembly operations.
2. Describe the safe handling procedures for electronic components to prevent damage or defects.
3. Demonstrate how to retrieve assembled electronic PCB boards, enclosures, accessories, and hardware components from stores and verify them against inventory records.
4. Show how to check all assembly parts, including electronic PCB boards, metal enclosures, and hardware items, for defects, mismatches, or non-conformance, and report identified issues.
5. Elucidate the types of mechanical fasteners and their applications in assembly.
6. Discuss the use and maintenance of assembly tools and semi-automatic tools.
7. Demonstrate how to collect, check calibration, and test tools and equipment for functionality, compliance, and report malfunctions.
8. Determine the appropriate selection and handling of soldering consumables for different assembly tasks.
9. Elucidate the handling and assembly procedures for 5G-specific hardware components.
10. Demonstrate how to identify and segregate 5G-specific hardware for assembly tasks.
11. Describe the use of ERP systems for inventory and production tracking in an assembly setup.
12. Show how to update inventory records using the ERP system to ensure material availability.
13. Show how to interpret and confirm understanding of work and assembly instructions.
14. Demonstrate how to arrange the required assembly parts ergonomically for smooth assembly.
15. Discuss the role of IoT-enabled tools in compliance monitoring during assembly processes.
16. Show how to use IoT-enabled tools to monitor tool compliance and performance.
17. Explain the applications of 3D printing in assembly and prototyping.
18. Demonstrate how to set up and calibrate 3D printing workstations for prototyping, small-batch production, and ensure printed parts meet specifications.
19. Explain the safety and environmental standards that must be followed in assembly operations.

Unit 2.1: Component Handling and Verification

Unit Objectives

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

1. Explain the types and specifications of electronic components used in assembly operations.
2. Describe the safe handling procedures for electronic components to prevent damage or defects.
3. Demonstrate how to retrieve assembled electronic PCB boards, enclosures, accessories, and hardware components from stores and verify them against inventory records.
4. Show how to check all assembly parts, including electronic PCB boards, metal enclosures, and hardware items, for defects, mismatches, or non-conformance, and report identified issues.
5. Elucidate the types of mechanical fasteners and their applications in assembly.

Resources to be Used

Participant handbook, Presentation slides, Whiteboard or flipchart, Markers, Handouts or reference materials on pre-construction surveys, Samples or visuals of key equipment (blowing equipment, cable pulling tools, etc.), Safety equipment (gloves, goggles, etc.), OTDR (Optical Time Domain Reflectometer) for demonstration and pre-testing activity.

Say

- This session focuses on Component Handling and Verification, a critical step in ensuring quality and reliability during assembly operations.
- You will learn to identify different electronic components, understand their specifications, and handle them safely to prevent damage.
- We will also cover how to retrieve components from stores, verify them with records, and inspect them for defects.
- Understanding fasteners and proper handling practices helps maintain assembly accuracy and reduces rework.

Ask

- Why is correct handling of electronic components important during assembly?
- What types of damages can occur if components are not handled properly?
- How do you think inventory verification helps in maintaining assembly quality?
- What defects should be checked before assembling PCB boards or enclosures?

Do

- Observe different electronic components and discuss their basic specifications.
- Review a sample inventory checklist and match items with provided components.
- Inspect sample PCB boards and enclosures to identify visible defects.
- Identify different mechanical fasteners and discuss their uses.

Elaborate

Use the following guiding questions to deepen understanding:

1. What types of electronic components are commonly used in assembly operations?
2. What safe handling practices prevent ESD and physical damage?
3. How does proper retrieval and verification reduce assembly errors?
4. What common defects occur in PCB boards, enclosures, and hardware parts?
5. Why is it important to select the right fastener for an assembly task?

Briefly clarify concepts such as component ratings, ESD protection, visual inspection, and fastener selection.

Demonstrate

- Demonstrate safe handling of electronic components using ESD precautions.
- Show how to retrieve components from a store and verify them against inventory records.
- Demonstrate inspection of PCB boards, enclosures, and hardware for defects or mismatches.
- Show identification and correct use of different mechanical fasteners.

Activity

1. **Activity Name:** Component Verification Exercise
2. **Objective:** Enable learners to practice component retrieval, verification, and inspection.
3. **Type:** Group
4. **Resources:** Sample inventory lists, components, PCB boards, fasteners
5. **Duration:** 30 minutes
6. **Instructions:**
   - Groups retrieve items based on an inventory list and verify quantities and specifications.
   - Learners inspect the items for defects and report any non-conformance.
7. **Outcome:** Learners gain hands-on experience in component handling, verification, and quality checks.

Notes for Facilitation

- Emphasize the importance of ESD safety and careful handling.
- Encourage learners to follow standard verification and inspection steps.
- Use real-life examples of assembly defects caused by improper handling.
- Reinforce documentation and reporting of non-conformance.
- Promote teamwork during the activity for effective learning.

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

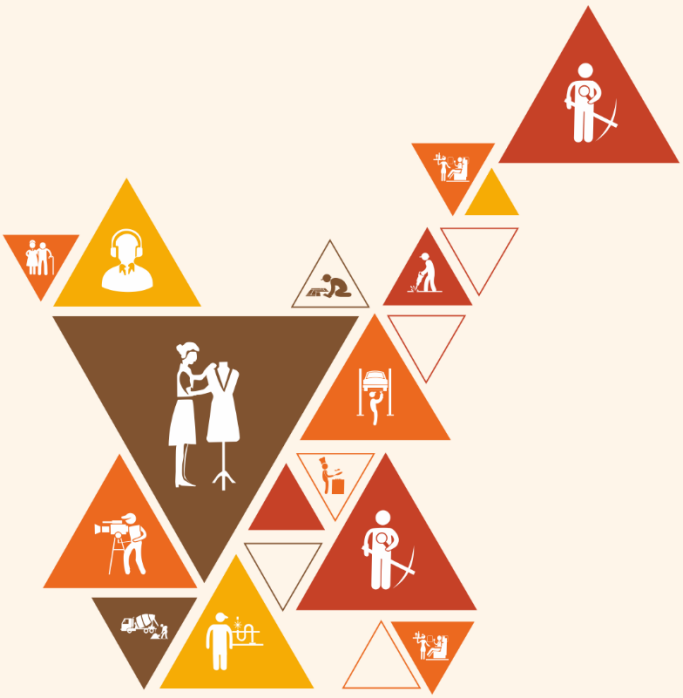
- Use practical examples rather than deep technical system configurations.
- Emphasize traceability, compliance, and safety at every step.
- Clarify that ERP and IoT demonstrations may be conceptual where live systems are unavailable
- Reinforce environmental responsibility and safe disposal practices.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

Notes

3. Assembly Operations in Production Line

Unit 3.1 - Performing Assembly Operations in Telecom Production

Unit 3.2 - Managing Production and Post-Assembly Activities



TEL/N2507

Key Learning Outcomes

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

1. Explain the process of assembling telecom devices/products in a production line.
2. Discuss how automation and smart manufacturing methods improve efficiency in telecom device assembly.
3. Describe the use of digital tools for inventory and production management in telecom manufacturing.
4. Elucidate the key post-assembly activities required to ensure product quality and compliance.

Unit 3.1: Performing Assembly Operations in Telecom Production

Unit Objectives

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

1. Explain the applicable quality standards, compliance requirements, and health and safety policies in telecom assembly operations.
2. Demonstrate the process of conducting pre-assembly safety compliance checks before starting operations.
3. Describe the roles, responsibilities, and reporting structures in the assembly line.
4. Discuss the handling and assembly of various electronic and mechanical parts in telecom devices.
5. Elucidate the different electronic components used in mobile phones and their functions.
6. Determine the importance of polarity in electronic components and its impact on device functionality, along with the mechanical items used in the assembly process.
7. Show how to handle components carefully and ensure proper fitment using appropriate tools.
8. Demonstrate the correct procedures and sequences for assembling components such as RFID tags, Wi-Fi, and Bluetooth modules.
9. Describe the safe and correct usage of assembly tools such as screwdrivers, pliers, and tweezers.
10. Explain the working principles and applications of semi-automatic and automated assembly tools.
11. Show how to ensure all required tools and equipment are operational and properly calibrated before assembly.
12. Discuss the proper handling and storage of PCBs, including baking and flux application.
13. Elucidate basic soldering techniques, defect identification, and rework procedures.
14. Demonstrate how to check the availability of all required parts, tools, and components as per assembly specifications.
15. Show how to arrange parts and sub-assemblies in the correct sequence for an efficient workflow.
16. Demonstrate how to interpret technical diagrams, specifications, and schematics accurately for assembly.
17. Show how to perform basic quality checks to verify correct assembly before moving to the next stage.
18. Demonstrate the use of IoT sensors to track assembly items and ensure placement accuracy and efficiency.
19. Show how to operate Robotic Process Automation (RPA) tools for automated pick-and-place assembly.
20. Demonstrate how to use machine vision systems for real-time quality inspection and defect detection.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, Sample telecom components (PCBs, modules, connectors), Manual & semi-automatic assembly tools, Soldering station & consumables, IoT sensor demo/images, RPA & machine vision demo videos, Calibration tags, PPE

Say

- This unit covers end-to-end assembly operations used in telecom production environments.
- You will learn how quality, safety, correct sequencing, and tool usage ensure defect-free assembly.
- We will discuss manual, semi-automatic, and automated assembly technologies.
- This unit also introduces advanced tools like IoT sensors, robotic pick-and-place, and machine vision systems.

Ask

- Why are quality and safety checks important before starting assembly?
- What issues can occur due to incorrect polarity or improper fitment?
- How do automated tools improve assembly accuracy and productivity?
- What quality checks should be done before moving to the next assembly stage?

Do

- Identify electronic and mechanical components used in telecom devices.
- Review assembly tools and discuss safe usage practices.
- Arrange parts in proper assembly sequence at a workstation.
- Observe sample IoT, RPA, and machine vision applications through demos.

Elaborate

Use the following guiding questions to deepen understanding:

1. What quality standards and safety policies apply to telecom assembly operations?
2. Why are pre-assembly safety and calibration checks mandatory?
3. How does correct sequencing and polarity impact final product performance?
4. What role do semi-automatic and automated tools play in large-scale production?
5. How do IoT sensors, RPA, and machine vision enhance quality and traceability?

Reinforce links between safety, quality, productivity, and automation.

Demonstrate

- Demonstrate pre-assembly safety compliance and tool readiness checks.
- Show correct handling, polarity identification, and fitting of components.
- Demonstrate basic soldering techniques and identification of soldering defects.
- Show interpretation of technical drawings and assembly schematics.
- Demonstrate quality checks before stage handover.
- Demonstrate (conceptually or via video) IoT-based tracking, robotic pick-and-place, and machine vision inspection.

Activity

1. **Activity Name:** End-to-End Assembly Workflow Simulation
2. **Objective:** Enable learners to practice sequencing, tool usage, and quality checks.
3. **Type:** Group
4. **Resources:** Assembly kits, tools, setup checklist, quality checklist
5. **Duration:** 30–40 minutes
6. **Instructions:**
   • Groups simulate an assembly process from part verification to final inspection.
   • Learners identify errors, safety gaps, and quality issues.
7. **Outcome:** Learners gain practical understanding of telecom assembly workflow and quality controls.

Notes for Facilitation

- Emphasize safety, quality, and standard operating procedures at every step.
- Keep advanced automation concepts demonstrative, not deeply technical.
- Use real telecom production examples to improve relevance.
- Encourage teamwork and role-based understanding of assembly lines.
- Reinforce documentation, traceability, and compliance importance.

Unit 3.2: Managing Production and Post-Assembly Activities

Unit Objectives

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

1. Explain the fundamentals of voltage, current, resistance, and power measurement in telecom equipment.
2. Describe the interpretation of electronic circuit diagrams, schematics, and assembly drawings.
3. Discuss the assembly and testing of telecom RF circuits, power supplies, and multiplexers.
4. Determine the identification, pin configuration, and specifications of connectors, cables, and wires used in telecom manufacturing.
5. Elucidate the role of IoT, RPA, and SMT in modern assembly lines for enhanced efficiency and accuracy.
6. Explain the application of AR-based interactive tools for assembly training and troubleshooting.
7. Discuss the implementation of machine vision for defect detection and process validation in telecom production.
8. Describe the waste management and disposal protocols for hazardous materials in telecom manufacturing.
9. Demonstrate the safe disposal of hazardous and non-hazardous waste in designated areas.
10. Demonstrate how to use ERP systems to track materials and schedule production efficiently.
11. Show how to log component usage accurately to maintain proper stock levels.
12. Demonstrate the process of coordinating inventory management with production teams.
13. Show how to conduct intermediate and final compliance checks for assembly verification.
14. Demonstrate how to secure the workstation by removing loose components and consumables post-assembly.
15. Show how to reconcile used components with issued inventory and document discrepancies.
16. Demonstrate the correct store procedures for returning unused components and tools.
17. Show how to maintain proper documentation of completed work and inventory usage.
18. Show how to align assembly processes with ISO/IEC 9001 quality management and 27001 information security standards.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, Multimeter, Circuit diagrams & schematics, Sample RF modules/connectors/cables, ERP screenshots or demo access, AR/SMT/machine vision videos, Waste segregation bins, Inventory and compliance checklists

Say

- This unit focuses on production management and post-assembly activities in telecom manufacturing.
- You will learn how measurements, drawings, and component identification support accurate assembly and testing.
- We will explore how advanced technologies like IoT, RPA, SMT, AR, and machine vision improve efficiency.
- The unit also covers inventory control, waste management, compliance verification, and documentation.

Ask

- Why are correct measurements critical before and after assembly?
- How do ERP systems help balance production and inventory?
- What risks arise if waste is not disposed of as per guidelines?
- Why are post-assembly compliance and reconciliation important?

Do

- Observe measurement of voltage and resistance using a multimeter (demo).
- Review circuit diagrams and identify major components.
- Examine connectors and cables and discuss pin configuration.
- Review waste segregation categories and documentation formats.

Elaborate

Use the following guiding questions to deepen understanding:

1. How do electrical measurements support assembly validation and fault detection?
2. Why are schematics and drawings essential for correct assembly?
3. How do IoT, RPA, SMT, AR, and machine vision improve production accuracy?
4. What steps ensure effective post-assembly inventory reconciliation?
5. Why are ISO/IEC 9001 and 27001 important for telecom production processes?

Link production efficiency with compliance, safety, and quality outcomes.

Demonstrate

- Demonstrate basic electrical measurements on telecom equipment.
- Show interpretation of circuit diagrams and assembly drawings.
- Demonstrate ERP-based tracking of materials and component usage.
- Demonstrate safe segregation and disposal of hazardous/non-hazardous waste.
- Show intermediate and final compliance checks for assembled items.
- Demonstrate workstation closure and secure storage of unused materials.
- Demonstrate reconciliation of issued vs. used components and discrepancy reporting.

Activity

1. **Activity Name:** Production & Post-Assembly Compliance Simulation
2. **Objective:** Practice production coordination, compliance checks, and documentation.
3. **Type:** Group
4. **Resources:** ERP sheets, compliance checklists, waste bins, inventory logs
5. **Duration:** 30–40 minutes
6. **Instructions:**
   • Groups simulate post-assembly steps including waste disposal, ERP updates, and reconciliation.
   • Learners identify gaps and suggest corrective actions.
7. **Outcome:** Learners understand end-to-end production control and post-assembly responsibilities.

Notes for Facilitation

- Keep advanced technologies conceptual if live systems are unavailable.
- Emphasize traceability, documentation, and standard compliance.
- Reinforce correct waste handling and environmental responsibility.
- Encourage discipline in workstation cleanliness and inventory reconciliation.
- Continuously connect activities to ISO/IEC quality and security requirements.

Exercise

Answers to exercises for PHB

A. Multiple Choice Questions (Answers only)

1. c) Volts
2. b) Assembly drawing
3. c) SMT
4. b) Automatic deduction of materials from inventory after product completion
5. c) ISO 27001

B. Short Answer Questions (Short answers)

1. A voltmeter measures voltage and is connected in parallel, while an ammeter measures current and is connected in series.
2. Torque checking ensures proper tightening of components to avoid damage or loose connections, e.g., tightening terminal screws on PCB assemblies.
3. Machine vision detects missing, misaligned, or defective components automatically during PCB production.

C. True or False (Answers only)

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

D. Fill in the Blanks (Answers only)

1. Watt
2. Circuit / Schematic
3. Sustain
4. SMT (Surface Mount Technology)

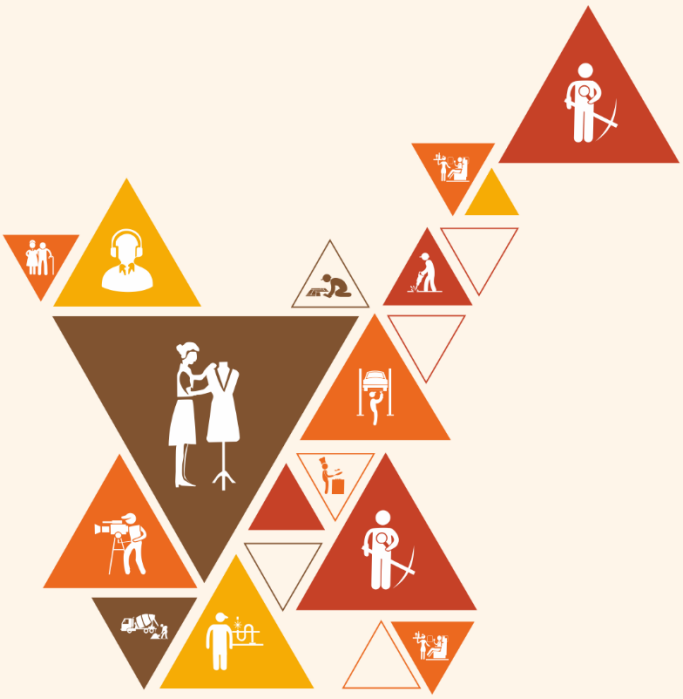
Notes

4. Assembly & Testing of Mobile Phone Accessories

Unit 4.1 - Mobile Accessories and Electronic Concepts

Unit 4.2 - Safety Measures, Tool Handling, and Quality Assurance

Unit 4.3 - Troubleshooting, Documentation, and Digital Production Systems



TEL/N2510

Key Learning Outcomes

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

1. Explain the process of assembling mobile phone accessories while ensuring compliance with industry standards.
2. Discuss the key quality inspection and testing methods used in mobile phone accessory manufacturing.
3. Describe the essential post-assembly activities required for packaging and finalizing mobile phone accessories.

Unit 4.1: Mobile Accessories and Electronic Concepts

Unit Objectives

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

1. Explain the types, functions, and basic specifications of mobile phone accessories such as chargers, cables, batteries, and audio devices, along with their key components.
2. Elucidate the fundamental concepts of electronic circuits, including voltage, current, and resistance, and their role in the functionality of mobile accessories.
3. Describe the relevant industry standards and basic regulatory guidelines, such as BIS certification.
4. Demonstrate the process of assembling mobile phone accessories according to technical diagrams and process specifications.
5. Show how to ensure correct positioning and secure connection of electronic and mechanical parts during assembly.
6. Describe the basic working principles and safe operation of specialized tools such as crimping tools, ultrasonic welders, and semi-automated/automated assembly systems.
7. Demonstrate the use of appropriate tools such as screwdrivers, crimping tools, ultrasonic welders, and automated assembly machines.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, Sample mobile accessories (charger, cable, battery), Circuit diagrams, Manual & semi-automatic tools, Crimping tool, Ultrasonic welding visuals/demo, Automated assembly system videos, PPE

Say

- This session introduces mobile accessories and the electronic concepts behind their operation.
- You will learn how basic electrical principles influence the performance of chargers, cables, and batteries.
- We will cover assembly procedures, industry standards, and safe tool usage.
- Practical handling and correct tool selection ensure product quality and user safety.

Ask

- Why are standards like BIS important for mobile accessories?
- How do voltage and current affect charger and battery performance?
- What risks arise from improper assembly or unsafe tool handling?
- Where are automated tools commonly used in accessory manufacturing?

Do

- Identify components inside sample mobile accessories.
- Observe simple circuit diagrams related to chargers and cables.
- Practice arranging accessory parts as per assembly sequence.
- Observe demonstrations/videos of crimping and ultrasonic welding processes.

Elaborate

Use the following guiding questions to deepen understanding:

1. How do electronics fundamentals apply to mobile accessories?
2. What are the key components of common accessories and their functions?
3. Which standards and certifications ensure accessory safety and quality?
4. Why is correct positioning and secure connection critical during assembly?
5. What safety precautions must be followed when using specialized tools?

Reinforce links between electronics concepts, assembly accuracy, and consumer safety.

Demonstrate

- Demonstrate identification of key components in a charger, cable, and battery.
- Show correct assembly steps using technical diagrams.
- Demonstrate secure fitting and connection of electronic and mechanical parts.
- Demonstrate safe and correct use of screwdrivers and crimping tools.
- Demonstrate (conceptually or via video) ultrasonic welding and automated assembly operations.

Activity

1. **Activity Name:** Mobile Accessory Assembly Exercise
2. **Objective:** Enable learners to practice assembly and tool handling for mobile accessories.
3. **Type:** Group
4. **Resources:** Accessory assembly kits, tools, diagrams, quality checklist
5. **Duration:** 30 minutes
6. **Instructions:**
   • Groups assemble a basic mobile accessory following diagrams and tool guidelines.
   • Learners verify secure fitment and identify common errors.
7. **Outcome:** Learners gain hands-on experience in accessory assembly and safe tool usage.

Notes for Facilitation

- Keep electronic concepts simple and application-oriented.
- Emphasize safety and tool handling best practices.
- Use real accessory samples to improve understanding.• Encourage learners to follow diagrams and process flow strictly.
- Reinforce the importance of standards and certifications.

Unit 4.2: Safety Measures, Tool Handling, and Quality Assurance

Unit Objectives

1. Determine the importance of electrostatic discharge (ESD) safety measures and proper grounding techniques for the safe handling of sensitive electronic components.
2. Explain the key quality parameters and fundamental methods for real-time defect detection and basic automated testing of assembled accessories.
3. Elucidate the importance of proper waste disposal and safe handling of defective components.
4. Demonstrate the application of automation and smart manufacturing techniques such as robotic assembly and AI-assisted quality checks.
5. Show how to follow ESD-safe handling procedures to prevent static discharge damage to sensitive components.
6. Demonstrate how to test assembled accessories for electrical functionality, durability, and compliance with applicable quality standards.
7. Show how to dispose of defective or rejected components following applicable guidelines.
8. Demonstrate adherence to workplace safety and cleanliness guidelines throughout the process.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, ESD kits (wrist strap, mat), Multimeter, Accessory testing samples, Automated test setup videos, Robotic/AI inspection visuals, Waste segregation bins, PPE

Say

- This unit focuses on safety, quality assurance, and defect prevention in mobile accessory manufacturing.
- You will learn how ESD safety protects sensitive components and how quality checks ensure reliable products.
- We will discuss testing methods, automation, waste disposal, and workplace cleanliness.• Following these practices reduces failures, improves safety, and ensures compliance.

Do

- Observe ESD-safe workstation setup and grounding practices.
- Identify quality defects using sample accessory units.
- Practice segregating defective and non-defective components.
- Review demonstration videos of automated and AI-based quality inspection systems.

Ask

- What damage can static electricity cause to electronic components?
- Why are quality checks important even after assembly is completed?
- How does automation support consistency in quality inspection?
- What risks arise from improper disposal of defective components?

Elaborate

Use the following guiding questions to deepen understanding:

- Why are ESD precautions mandatory in electronics manufacturing?
- What quality parameters must be checked in assembled accessories?
- How do automation and AI improve defect detection?
- What guidelines govern safe disposal of electronic waste?
- How does workplace cleanliness impact safety and product quality?

Connect quality assurance with safety, compliance, and customer satisfaction.

Demonstrate

- Demonstrate correct use of ESD wrist straps and mats.
- Show electrical testing of accessories using basic test instruments.
- Demonstrate visual and functional quality checks.
- Explain (or show via video) robotic assembly inspection and AI-assisted quality checks.
- Demonstrate proper waste segregation and disposal practices.
- Demonstrate maintaining a clean and safe workstation.

Activity

1. **Activity Name:** ESD Safety and Quality Inspection Exercise
2. **Objective:** Enable learners to practice ESD handling, testing, and waste disposal.
3. **Type:** Group
4. **Resources:** ESD kits, test instruments, defective samples, waste bins
5. **Duration:** 30 minutes
6. **Instructions:**
   - Groups set up an ESD-safe station, test an accessory, and identify defects.
   - Learners dispose of rejected components as per guidelines.
7. **Outcome:** Learners gain hands-on experience in safety compliance and quality assurance.

Notes for Facilitation

- Reinforce ESD awareness throughout the session.
- Keep automation concepts practical and relatable.
- Emphasize proper disposal and environmental responsibility.
- Encourage consistent cleanliness and safety discipline.
- Link failures and defects to real-world customer impact.

Unit 4.3: Troubleshooting, Documentation, and Digital Production Systems

Unit Objectives

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

1. Discuss common assembly defects, their causes, and basic troubleshooting techniques using visual inspection and simple testing tools.
2. Discuss the standard procedures for assembling different types of mobile accessories, including handling sequence, safety protocols, and quality considerations.
3. Discuss the role of digital production records and basic ERP system usage for tracking components and production progress.
4. Show how to conduct basic visual inspections as per the quality checklist for defects such as misalignment, loose connections, or surface damage.
5. Demonstrate the use of appropriate measuring tools such as calipers, multimeters, or gauges to verify dimensions and electrical properties.
6. Demonstrate how to identify and rectify minor assembly errors, escalating critical issues to the supervisor.
7. Demonstrate the appropriate quality checks on assembled accessories to ensure compliance with industry standards.
8. Show how to follow standard procedures for packaging, labeling, and storing finished accessories to prevent damage.
9. Demonstrate how to document and report production outputs, quality issues, and inventory usage using digital tracking tools.
10. Show how to use digital tools and ERP systems to track component usage and production progress.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, Sample assembled accessories (good & defective), Quality checklist formats, Measuring tools (multimeter, caliper/gauge), ERP screenshots or demo access, Packaging samples, PPE

Say

- This unit focuses on *troubleshooting, quality documentation, and digital production tracking*.
- You will learn how to identify assembly defects, correct minor issues, and report critical problems.
- We will also cover packaging, labeling, and digital documentation using ERP systems.
- Correct troubleshooting and documentation improve quality, traceability, and productivity.

Ask

- What common defects have you seen in assembled accessories?
- Why is visual inspection important before final packing?
- How do digital production records help manufacturing teams?
- When should an issue be escalated instead of fixed locally?

Do

- Observe sample accessories and identify visible defects using a checklist.
- Practice using basic measuring tools to verify dimensions and continuity.
- Review sample digital production records and ERP screens.
- Observe correct packaging and labeling samples.

Elaborate

Use the following guiding questions to deepen understanding:

1. What common defects occur during mobile accessory assembly and why?
2. How do visual checks and simple tools support effective troubleshooting?
3. Why are digital production records important for traceability?
4. What quality checks must be completed before packaging?
5. When and how should issues be escalated to supervisors?

Link troubleshooting with documentation, quality assurance, and accountability.

Demonstrate

- Demonstrate visual inspection using quality checklists.
- Show use of multimeter and calipers/gauges for basic checks.
- Demonstrate correction of minor assembly issues safely.
- Explain escalation process for critical defects.
- Demonstrate packaging, labeling, and storage procedures.
- Demonstrate recording production output and inventory usage in ERP systems.

Activity

1. **Activity Name:** Defect Identification & Digital Reporting Exercise
2. **Objective:** Enable learners to practice troubleshooting, inspection, and documentation.
3. **Type:** Group
4. **Resources:** Defective samples, checklists, measuring tools, ERP formats
5. **Duration:** 30 minutes
6. **Instructions:**
   - Groups inspect accessories, identify defects, and decide corrective or escalation actions.
   - Learners complete digital or mock ERP records for production and quality issues.
7. **Outcome:** Learners gain hands-on experience in troubleshooting, quality assurance, and digital documentation.

Notes for Facilitation

- Keep troubleshooting focused on first-level corrections only.
- Reinforce strict adherence to checklists and procedures.
- Highlight the importance of accurate digital entries.
- Encourage safe handling and escalation culture.
- Relate documentation to audit, traceability, and quality improvement.

Exercise

Answers to exercises for PHB

A. Multiple Choice Questions (Answers only)

1. c) Multimeter
2. c) To test small parts before final assembly
3. c) Burnt or damaged PCB

Fill in the Blanks (Answers only)

1. Cold
2. FIFO
3. Wire gauge
4. Visual
5. Quality / Quality Management

Short Answer Questions (Short answers)

1. Loose connections, cold solder joints, damaged wires, missing components, faulty connectors.
2. They help track production, reduce errors, improve efficiency, and maintain records.
3. Inspection, proper placement in packaging, labeling, sealing, and final dispatch check.

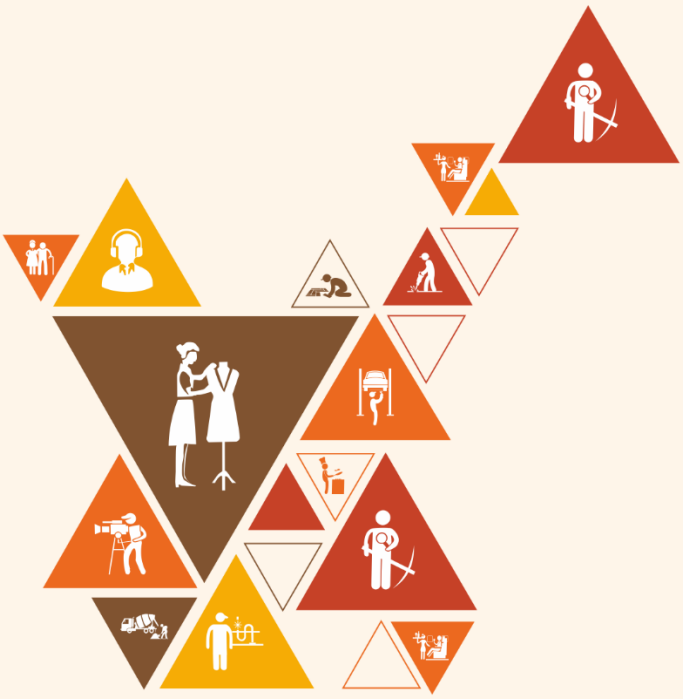
True or False (Answers only)

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

Notes

5. ESD Safe Procedures and Practices

Unit 5.1 - ESD and Its Effects on Electronic Components
Unit 5.2 - Classification of ESD Materials
Unit 5.3 - ESD Safety Procedures
Unit 5.4 - Levels of Electrostatic Voltage Generation
Unit 5.5 - Grounding
Unit 5.6 - ESD Audit



TEL/N2508

Key Learning Outcomes

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

1. Elucidate the basics of Electrostatic Discharge (ESD), its sources in the workplace, and its impact on electronic components and product performance.
2. Explain the necessity of following ESD policies, procedures, and safety guidelines to protect electronic components and ensure product quality.
3. Demonstrate how to follow safe work practices as per the ESD process and protocol.
4. Describe the classification and properties of ESD-safe materials, appropriate PPEs, and the use of storage/packaging solutions like trays and bags.
5. Demonstrate the correct use of ESD tools/equipment such as static voltage checkers, wrist straps, shoe grounders, air ionizers, and ionized air guns.
6. Discuss the methods for identifying ESD-sensitive parts, packages, and areas, including the use of precautionary labels, packaging, and handling instructions.
7. Describe proper handling, storage, and stacking methods for ESD-sensitive components, sub-assemblies, and assemblies to prevent failures.
8. Demonstrate the correct method to pack and unpack electronic components in compliance with ESD processes.
9. Show how to handle semi-finished products after assembly operations using ESD-free trays and conveyor lines.
10. Determine the voltage buildup during routine activities (walking, soldering, cleaning), discharge paths, and associated risks in non-ESD safe areas.
11. Show how to identify and remove non-essential items and equipment carrying electrostatic generating potential.
12. Explain essential grounding techniques and accessories (tables, mats, flooring, wrist straps) for minimizing electrostatic risks, including regular inspections and audits.
13. Show how to properly ground all components in the work area.
14. Show how to implement advanced grounding techniques to mitigate electrostatic risks.
15. Discuss the procedures for conducting ESD audits on workstations, flooring, protective gear, and facility areas, ensuring compliance with ISO 9001 (quality) and ISO 27001 (information security).
16. Demonstrate how to ensure compliance with ISO 27001 standards for information security in ESD-sensitive operations.
17. Elucidate the use of ionized air guns, machine vision systems, and smart manufacturing techniques for real-time ESD.
18. Demonstrate the use of machine vision systems to identify ESD safety violations and ensure compliance.

Unit 5.1: ESD and Its Effects on Electronic Components

Unit Objectives

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

1. Elucidate the basics of Electrostatic Discharge (ESD), its sources in the workplace, and its impact on electronic components and product performance.
2. Explain the necessity of following ESD policies, procedures, and safety guidelines to protect electronic components and ensure product quality.
3. Demonstrate how to follow safe work practices as per the ESD process and protocol.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, ESD wrist straps and mats, Sample electronic components, ESD signage/posters, PPE

Say

- This unit introduces Electrostatic Discharge (ESD) and why it is a major risk in electronics assembly and handling.
- You will learn how static electricity is generated, how it damages components, and how ESD control prevents defects.
- We will also focus on correct ESD-safe work practices required on the shop floor.
- Proper ESD handling ensures product reliability and reduces hidden failures.

Ask

- Have you ever experienced a small electric shock due to static electricity?
- What kinds of electronic components do you think are most sensitive to ESD?
- Why do you think ESD damage is not always immediately visible?
- What ESD precautions have you observed in electronics workplaces?

Do

- Observe ESD sources such as clothing, footwear, and work surfaces.
- Identify ESD protection equipment available at the workstation.
- Practice correct wearing of ESD wrist straps and grounding methods.
- Review sample ESD safety signs and instructions.

Elaborate

- Use the following guiding questions to deepen understanding:

1. What is Electrostatic Discharge and how is it generated?
2. How does ESD affect electronic components and long-term product performance?
3. What are the common sources of ESD in the workplace?
4. Why must ESD policies and procedures be followed strictly?
5. What safe work practices help prevent ESD damage?

Explain concepts with simple examples and real-life scenarios.

Demonstrate

- Demonstrate proper use of ESD wrist straps, mats, and grounding points.
- Show correct handling of ESD-sensitive components.
- Demonstrate ESD-safe movement and storage practices.
- Explain correct disposal or storage of ESD-protective materials.

Activity

1. **Activity Name:** ESD Safe Work Practice Exercise
2. **Objective:** Enable learners to apply ESD safety practices at the workstation.
3. **Type:** Individual / Group
4. **Resources:** ESD kits, sample components, checklist
5. **Duration:** 20–30 minutes
6. **Instructions:**
   - Learners set up an ESD-safe workstation and demonstrate correct practices.
   - Peers and facilitator verify compliance using a checklist.
7. **Outcome:** Learners gain confidence in applying ESD safety protocols consistently.

Notes for Facilitation

- Reinforce that ESD damage can be invisible but serious.
- Keep examples practical and workplace-oriented.
- Continuously correct unsafe handling during the session.
- Use visuals and demonstrations more than theory.
- Emphasize discipline and consistency in ESD practices.

Unit 5.2: Classification of ESD Materials

Unit Objectives

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

1. Describe the classification and properties of ESD-safe materials, appropriate PPEs, and the use of storage/packaging solutions like trays and bags.
2. Demonstrate the correct use of ESD tools/equipment such as static voltage checkers, wrist straps, shoe grounders, air ionizers, and ionized air guns.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, ESD-safe materials samples, ESD trays and bags, Wrist straps and shoe grounders, Static voltage checker, Air ionizer / ionized air gun, PPE

Say

- This unit explains how ESD materials are classified and why selecting the right material is critical for component protection.
- You will learn about conductive, dissipative, and anti-static materials used in electronics manufacturing.
- The session also covers different ESD tools and how they help neutralize static charges.
- Correct selection and usage of ESD materials ensure long-term product reliability.

Ask

- What happens if ESD-sensitive components are stored in regular plastic bags?
- Why is PPE important in ESD-controlled areas?
- How do air ionizers help in reducing static charge?
- What ESD tools have you seen used on electronics shop floors?

Do

- Observe and differentiate between ESD-safe and non-ESD materials.
- Handle ESD trays and bags and identify their markings.
- Practice checking wrist strap grounding using a static voltage checker.
- Observe the working of air ionizers and ionized air guns (demonstration or video).

Elaborate

Use the following guiding questions to deepen understanding:

1. How are ESD materials classified based on their electrical properties?
2. What role do PPE and ESD-safe storage play in component protection?
3. How do wrist straps and shoe grounders safely discharge static electricity?
4. Why are air ionizers used in ESD-sensitive work areas?
5. What issues arise from using incorrect or damaged ESD materials?

Clarify terms such as conductive, dissipative, and anti-static using simple examples.

Demonstrate

- Demonstrate identification of different ESD material categories.
- Show correct use and testing of wrist straps and shoe grounders.
- Demonstrate safe handling and storage of components in ESD trays and bags.
- Show operation of static voltage checkers and air ionizers.

Activity

1. **Activity Name:** ESD Material Identification and Tool Usage
2. **Objective:** Enable learners to correctly select and use ESD materials and tools.
3. **Type:** Group
4. **Resources:** ESD samples, tools, checklist
5. **Duration:** 25–30 minutes
6. **Instructions:**
   • Groups classify provided materials and demonstrate appropriate ESD tool usage.
   • Learners identify incorrect practices and suggest corrections.
7. **Outcome:** Learners gain practical understanding of ESD material classification and protection methods.

Notes for Facilitation

- Reinforce that not all plastic materials are ESD-safe.
- Encourage learners to check equipment functionality before use.
- Avoid deep electrical theory—keep explanations application-oriented.
- Emphasize inspection of PPE and materials for wear and damage.
- Link material selection to compliance and audit readiness.

Unit 5.3: ESD Safety Procedures

Unit Objectives

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

1. Discuss the methods for identifying ESD-sensitive parts, packages, and areas, including the use of precautionary labels, packaging, and handling instructions.
2. Describe proper handling, storage, and stacking methods for ESD-sensitive components, sub-assemblies, and assemblies to prevent failures.
3. Demonstrate the correct method to pack and unpack electronic components in compliance with ESD processes.
4. Show how to handle semi-finished products after assembly operations using ESD-free trays and conveyor lines.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, ESD labels and symbols charts, ESD bags and trays, Sample electronic parts and sub-assemblies, Conveyor line visuals, PPE

Say

- This unit focuses on ESD safety procedures followed during handling, storage, packing, and movement of electronic components.
- You will learn how to identify ESD-sensitive items and zones using labels and markings.
- We will also cover correct packing, unpacking, and handling of semi-finished products on the shop floor.
- Following these procedures prevents hidden failures and ensures consistent product quality.

Ask

- How can you identify an ESD-sensitive component or area?
- What damage can occur if ESD-sensitive items are stacked incorrectly?
- Why is ESD-safe packing important during transportation and storage?
- What precautions are needed while moving semi-finished assemblies?

Do

- Observe ESD symbols, labels, and packaging materials.
- Identify ESD-sensitive areas in a sample workstation layout.
- Practice placing components in ESD trays correctly.
- Observe correct handling of semi-finished products through trays or conveyor visuals.

Elaborate

Use the following guiding questions to deepen understanding:

1. How are ESD-sensitive components, packages, and areas identified?
2. What are the correct handling and stacking practices for ESD items?
3. Why must ESD-safe packing and unpacking procedures be followed strictly?
4. What risks are associated with improper handling of semi-finished products?
5. How do ESD-free trays and conveyors reduce static-related failures?

Explain each point using shop-floor examples and simple scenarios.

Demonstrate

- Demonstrate identification of ESD-sensitive parts using labels and packaging.
- Show correct packing and unpacking of components using ESD-safe bags and trays.
- Demonstrate proper stacking and storage of ESD-sensitive sub-assemblies.
- Show correct handling of semi-finished products using ESD-free trays or conveyor lines.

Activity

1. **Activity Name:** ESD-Safe Packing and Handling Exercise
2. **Objective:** Enable learners to apply correct ESD handling and packing methods.
3. **Type:** Group
4. **Resources:** ESD trays, bags, labels, sample components
5. **Duration:** 25–30 minutes
6. **Instructions:**
   • Groups identify ESD-sensitive items, pack them correctly, and demonstrate safe handling.
   • Learners check compliance using a simple checklist.
7. **Outcome:** Learners gain confidence in following ESD safety procedures during handling and storage.

Notes for Facilitation

- Reinforce visibility and meaning of ESD labels and symbols.
- Stress discipline in packing, stacking, and movement of components.
- Correct unsafe handling immediately during practice.
- Use real workplace examples of ESD failures.
- Emphasize consistency in following ESD procedures across all stages.

Unit 5.4: Levels of Electrostatic Voltage Generation

Unit Objectives

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

1. Determine the voltage buildup during routine activities (walking, soldering, cleaning), discharge paths, and associated risks in non-ESD safe areas.
2. Show how to identify and remove non-essential items and equipment carrying electrostatic generating potential.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, ESD voltage level charts, Static voltage generation table (activity vs voltage), Sample shop-floor items (plastic covers, bottles, papers), ESD signage, PPE

Say

- In this unit, we will understand how static electricity is generated during normal shop-floor activities.
- Simple actions like walking, wiping surfaces, or handling plastic can create very high electrostatic voltages.
- You will learn how these voltages discharge and damage ESD-sensitive components.
- We will also identify common non-essential items that increase ESD risks and learn how to remove them.

Ask

- Can normal walking generate static electricity?
- Why do ESD failures occur more in non-controlled areas?
- What items on a workstation might generate static without us realizing it?
- How can removing small items improve ESD safety?

Do

- Observe voltage level charts showing static buildup from routine activities.
- Identify non-essential items (plastic, paper, foam, cloth) at a sample workstation.
- Discuss how electrostatic discharge can occur when touching PCB or connectors.
- Rearrange a mock workstation to remove ESD-risk items.

Elaborate

(Explain each point using shop-floor examples and simple scenarios)

How are ESD-sensitive components, packages, and areas identified?

• ESD-sensitive items carry warning symbols (hand-in-triangle).

• ESD areas are marked with floor tapes, posters, and signboards.

What are the correct handling and stacking practices for ESD items?

• Always hold PCBs by edges, not by pins or solder joints.

• Stack only in ESD trays; never place directly on benches.

Why must ESD-safe packing and unpacking be followed strictly?

• Removing components from normal plastic can instantly discharge high voltage.

• ESD bags control charge release slowly, preventing damage.

What risks are associated with improper handling of semi-finished products?

• Semi-finished items have exposed circuits with no enclosure protection.

• Uncontrolled handling can damage components before final testing.

How do ESD-free trays and conveyors reduce static-related failures?

• They safely dissipate accumulated static charge to ground.

• They prevent direct contact between product and charged surfaces.

Demonstrate

- Demonstrate voltage buildup during common activities using charts.
- Show examples of static-generating items at a workstation.
- Demonstrate correct and incorrect handling of ESD-sensitive products.
- Show how removal of non-essential items reduces ESD risks.

Activity

1. **Activity Name:** Static Risk Identification on Shop Floor
2. **Objective:** Enable learners to identify voltage-generating activities and ESD risks.
3. **Type:** Group
4. **Resources:** Workstation layout image, item list, ESD checklist
5. **Duration:** 20–25 minutes
6. **Instructions:**
   • Groups identify activities and items that generate static voltage.
   • Learners suggest corrective actions to eliminate risks.
7. **Outcome:** Learners understand how everyday actions cause ESD damage and how to control them.

Notes for Facilitation

- Stress that ESD is generated even without feeling a shock.
- Use simple numbers (e.g., walking can generate thousands of volts).
- Repeatedly connect examples to shop-floor practices.
- Encourage learners to observe their own work habits.
- Reinforce removal of non-essential items as a discipline, not an option.

Unit 5.5: Grounding

Unit Objectives

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

1. Explain essential grounding techniques and accessories (tables, mats, flooring, wrist straps) for minimizing electrostatic risks, including regular inspections and audits.
2. Show how to properly ground all components in the work area.
3. Show how to implement advanced grounding techniques to mitigate electrostatic risks.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, ESD tables and mats, Grounding cords and wrist straps, Conductive footwear or shoe grounders, Ground point diagram, Grounding inspection checklist, PPE

Say

- This unit focuses on grounding, which is one of the most effective controls for preventing electrostatic discharge.
- You will learn how grounding safely dissipates static charges away from sensitive components.
- We will cover common grounding accessories, correct grounding methods, and why inspections are mandatory.
- Proper grounding protects components, improves product reliability, and ensures ESD compliance.

Ask

- Why is grounding critical in an ESD-controlled area?
- What can happen if grounding connections are loose or damaged?
- Which items in your workstation need grounding?
- How often do you think grounding systems should be checked?

Do

- Observe grounding points at a sample ESD workstation.
- Identify grounding accessories such as mats, wrist straps, and flooring connections.
- Review a grounding inspection checklist and discuss audit frequency.
- Identify improper grounding examples shown in visuals.

Elaborate

Use the following guiding questions to deepen understanding:

1. What is grounding and how does it reduce electrostatic risk?
2. What grounding accessories are used at ESD workstations?
3. How should operators, work surfaces, and tools be grounded together?
4. Why are regular inspections and grounding audits required?
5. What advanced grounding practices help further reduce ESD risks?

Explain concepts using simple current-flow and real shop-floor examples.

Demonstrate

- Demonstrate correct wearing and grounding of an ESD wrist strap.
- Show proper grounding connection of tables, mats, and work surfaces.
- Demonstrate grounding verification using visual indicators or testers (if available).
- Explain advanced grounding practices such as common ground points and equipotential bonding.

Activity

1. **Activity Name:** Grounding Setup and Inspection Exercise
2. **Objective:** Enable learners to set up and verify a grounded workstation.
3. **Type:** Group
4. **Resources:** Grounding accessories, workstation layout, inspection checklist
5. **Duration:** 25–30 minutes
6. **Instructions:**
   • Groups assemble a grounded workstation using provided equipment.
   • Learners inspect grounding connections and identify missing or faulty points.
7. **Outcome:** Learners gain practical experience in grounding implementation and inspection.

Notes for Facilitation

- Emphasize that grounding must be continuous and not intermittent.
- Reinforce inspection and audit discipline.
- Avoid deep electrical theory—focus on application and safety.• Continuously correct improper grounding during demonstrations.
- Link grounding failures to real ESD damage cases.

Unit 5.6: ESD Audit

Unit Objectives

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

1. Discuss the procedures for conducting ESD audits on workstations, flooring, protective gear, and facility areas, ensuring compliance with ISO 9001 (quality) and ISO 27001 (information security).
2. Demonstrate how to ensure compliance with ISO 27001 standards for information security in ESD-sensitive operations.
3. Elucidate the use of ionized air guns, machine vision systems, and smart manufacturing techniques for real-time ESD.
4. Demonstrate the use of machine vision systems to identify ESD safety violations and ensure compliance.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, ESD audit checklist, Grounding and PPE inspection sheets, ISO 9001 & ISO 27001 overview slides, Ionized air gun, Machine vision demo videos/images, Smart manufacturing dashboard visuals, PPE

Say

- This unit focuses on ESD audits, which ensure that ESD controls are implemented correctly and consistently.
- You will learn how audits help meet quality and information security standards such as ISO 9001 and ISO 27001.
- We will explore how advanced tools like ionized air guns and machine vision enhance real-time ESD compliance.
- Regular audits help prevent ESD failures and improve operational discipline.

Ask

- Why are ESD audits necessary even when safety measures are in place?
- How do ESD controls connect with ISO quality and information security standards?
- What advantages do machine vision systems provide during audits?
- How can real-time monitoring prevent ESD violations?

Do

- Review a sample ESD audit checklist and identify key checkpoints.
- Observe ionized air gun usage for neutralizing static charges.
- Analyze machine vision images/videos showing ESD compliance and violations.
- Discuss examples of information security risks in ESD-sensitive environments.

Elaborate

Use the following guiding questions to deepen understanding:

1. What are the key steps involved in conducting an ESD audit?
2. How does ISO 9001 influence ESD quality practices on the shop floor?
3. Why is ISO 27001 relevant in ESD-controlled and digital environments?
4. How do ionized air guns support real-time ESD control?
5. How can machine vision systems detect and prevent ESD safety violations?

Relate audit outcomes to continuous improvement and risk prevention.

Demonstrate

- Demonstrate inspection of ESD workstations, grounding points, flooring, and PPE using an audit checklist.
- Show proper use of ionized air guns in ESD-sensitive areas.
- Demonstrate (conceptually or via video) machine vision systems identifying ESD violations.
- Demonstrate documentation and reporting of audit findings.

Activity

1. **Activity Name:** Mock ESD Audit and Compliance Review
2. **Objective:** Enable learners to conduct a basic ESD audit and identify gaps.
3. **Type:** Group
4. **Resources:** Audit checklists, workstation visuals, compliance forms
5. **Duration:** 30 minutes
6. **Instructions:**
   - Groups perform a mock ESD audit on a sample workstation layout.
   - Learners record non-compliance points and suggest corrective actions.
7. **Outcome:** Learners gain practical understanding of ESD audit processes and compliance verification.

Notes for Facilitation

- Emphasize audits as preventive, not punitive.
- Keep ISO explanations aligned to shop-floor relevance.
- Encourage observation-based auditing habits.
- Focus on documentation accuracy and traceability.
- Reinforce continuous improvement and compliance culture.

Exercise

Answers to exercises for PHB

Multiple Choice Question

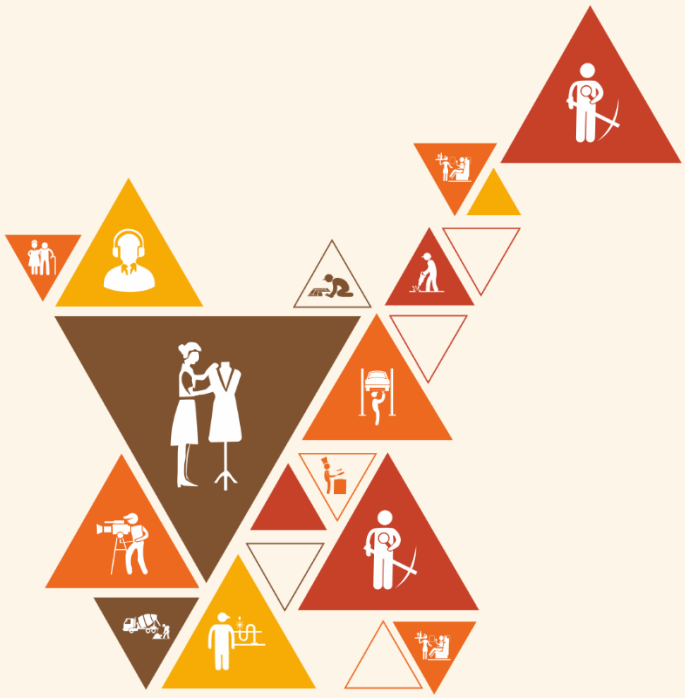
1. b) Electro Static Discharge
2. c) Winter
3. b) 5
4. b) Resistance
5. a) Personal Protective Equipment
6. a) 99% of all particles measuring up to 0.6
7. a) True
8. a) True
9. c) Toxic
10. c) Sound

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



TEL/N9107

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

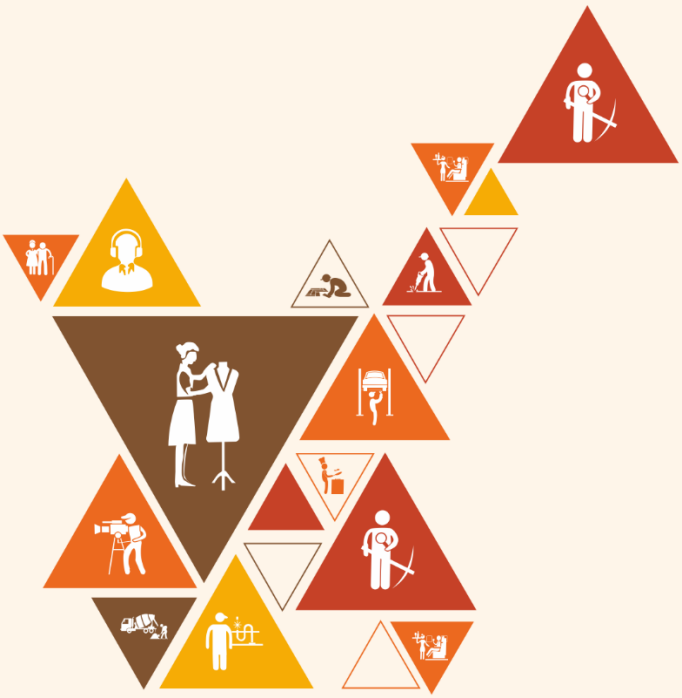
D. Fill in the Blanks

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

Notes

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



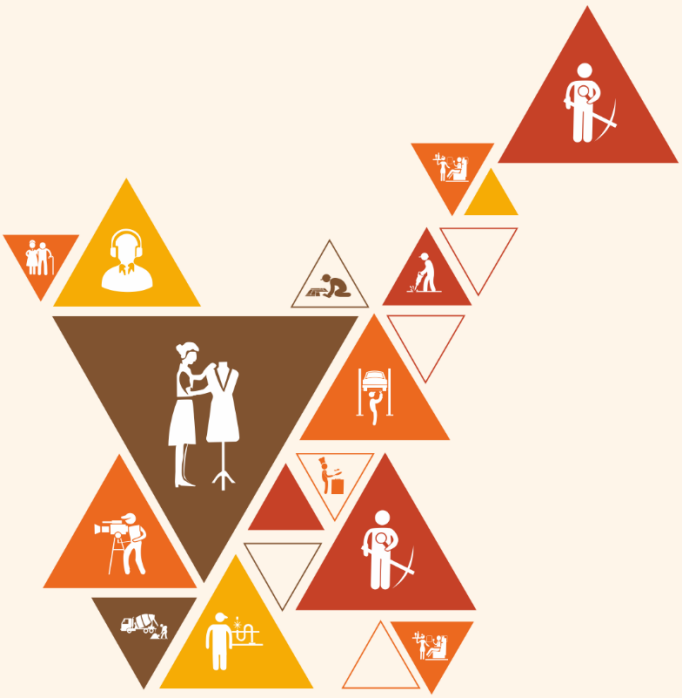
DGT/VSQ/N0101

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:	Line Assembler - Telecom Products		
Qualification Pack Name & Ref. ID	TEL/Q4200, V5.0		
Version No.	5.0	**Version Update Date**	08/05/2025
Pre-requisites to Training (if any)	Not Applicable		
Training Outcomes	**By the end of this program, the participants will be able to:** 1. Follow procedures for outside plant cable installation. 2. Prepare cables for splicing. 3. Install passive FTTH/X components. 4. Construct FTTH/X cabling inside the building. 5. Follow safety precautions pertaining to optical fiber. 6. Organize work and resources as per health and safety standards. 7. Communicate, develop interpersonal skills and develop sensitization towards gender and person with disability.		

SL. No.	Module Name	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
Preparing Workspace for Assembly Operations (TEL/N2506)	Module 1: Introduction to the sector and the job role of a Line Assembler - Telecom Products	Introduction to Telecom Assembly Industry	• Understand the telecom manufacturing sector and assembly line operations • Identify the role and responsibilities of a line assembler	KU1, KU3	Lecture, Industry Overview	Presentation slides, product samples, organizational charts	3 Theory
		Safety Standards & PPE in Assembly Operations	• Apply safety standards in assembly operations • Understand environmental compliance requirements • Use personal protective equipment correctly	KU6	Safety Workshop, Compliance Training	PPE kits, safety manuals, compliance checklists	2 Theory
	Module 2: Preparing Workspace for Assembly Operations	ERP Systems & Component Retrieval Basics	• Understand ERP systems for inventory tracking • Learn basic component retrieval procedures	PC1, KU7	Lecture, System Demonstration	ERP software demo, inventory lists	3 Theory
		Hands-on Component Retrieval Practice	• Retrieve components from stores as per work instructions • Verify components against inventory records	PC1, PC6	Hands-on Practice	Storage systems, barcode scanners, inventory records	2 Theory / 4 Practical
		Work Instruction Interpretation Skills	• Interpret and confirm understanding of assembly instructions • Read technical diagrams and assembly drawings	PC2, KU1	Instruction Reading Exercises	Work instruction manuals, assembly diagrams	3 Theory

SL. No.	Module Name	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
Preparing Workspace for Assembly Operations (TEL/N2506)	Module 2: Preparing Workspace for Assembly Operations	Ergonomic Parts Arrangement Workshop	• Arrange assembly parts ergonomically for smooth workflow • Optimize workspace layout for efficiency	PC3, KU2	Ergonomic Setup Practice	Assembly benches, component trays, layout tools	2 Theory / 4 Practical
		Electronic Component Handling Safety	• Handle electronic components safely • Apply ESD protection measures	KU2	Safety Workshop, Hands-on Practice	ESD protection equipment, component samples	2 Theory / 4 Practical
		Component Inspection Fundamentals	• Learn defect identification techniques • Understand quality control standards	PC4, KU1	Quality Inspection Lecture	Component samples, inspection guidelines	3 Theory
		Hands-on Quality Inspection Practice	• Check components for defects and non-conformance • Practice using inspection tools	PC4	Quality Inspection Workshop	Inspection tools, defective/non-defective samples	2 Theory / 6 Practical
		5G Hardware Identification & Segregation	• Identify and segregate 5G-specific hardware • Understand 5G component specifications	PC5, KU10	Component Identification Training	5G hardware samples, identification charts	3 Theory

SL. No.	Module Name	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
Preparing Workspace for Assembly Operations (TEL/N2506)	Module 2: Preparing Workspace for Assembly Operations	5G Component Handling Workshop	• Handle 5G-specific components safely • Apply special handling procedures	KU10	Hands-on Workshop	5G components, handling tools, ESD equipment	2 Theory / 4 Practical
		Basic Tool Identification & Selection	• Identify different assembly tools • Select appropriate tools for specific tasks	PC7, KU4	Tool Identification Lecture	Various assembly tools, tool charts	3 Theory
		Tool Calibration & Compliance Checks	• Check calibration of measuring instruments • Verify tool compliance with standards	PC8, KU4	Calibration Workshop	Calibration equipment, measuring instruments	3 Theory
		Tool Functionality Testing Workshop	• Test tools for functionality • Report tool malfunctions properly	PC9	Hands-on Testing Practice	Various tools, testing equipment, reporting forms	2 Theory / 6 Practical
		IoT-Enabled Tools Introduction	• Understand IoT-enabled tools for compliance monitoring • Learn basic IoT tool operation	PC10, KU8	Demonstration, System Overview	IoT-enabled tools, monitoring software	3 Theory

SL. No.	Module Name	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
Preparing Workspace for Assembly Operations (TEL/N2506)	Module 2: Preparing Workspace for Assembly Operations	IoT Tool Operation Practice	• Use IoT-enabled tools to monitor performance • Interpret IoT tool data	KU8	Hands-on Workshop	IoT tools, monitoring systems, data analysis software	2 Theory / 4 Practical
		3D Printing Fundamentals	• Understand 3D printing applications in assembly • Learn 3D printing workstation setup	PC11, KU9	Lecture, Demonstration	3D printers, prototypes, setup guides	3 Theory
		3D Printer Setup Workshop	• Set up 3D printing workstations • Prepare printers for operation	PC12	Hands-on Setup Practice	3D printers, setup tools, calibration equipment	2 Theory / 4 Practical
		3D Printed Part Inspection	• Ensure 3D-printed parts meet specifications • Check for defects in printed components	PC13, KU9	Quality Control Workshop	3D printed samples, measurement tools	2 Theory / 4 Practical
		3D Component Integration Practice	• Follow best practices for using 3D-printed components • Integrate printed parts into assemblies	PC14	Integration Workshop	3D printed components, assembly materials	2 Theory / 4 Practical

SL. No.	Module Name	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
Preparing Workspace for Assembly Operations (TEL/N2506)	Module 2: Preparing Workspace for Assembly Operations	Mechanical Fasteners & Applications	• Understand types of mechanical fasteners • Learn proper fastener selection and application	KU3, KU5	Lecture, Demonstration	Fastener samples, application tools	3 Theory
		Soldering Consumables Workshop	• Select and handle soldering consumables • Apply soldering best practices	KU5	Hands-on Practice	Soldering equipment, consumables, practice boards	2 Theory / 4 Practical
		Comprehensive Workspace Setup Project	• Apply all skills in integrated workspace setup • Complete end-to-end preparation process	PC1-PC14	Project-based Learning	Complete workstation setup, assessment checklist	4 Theory / 8 Practical
2. Assembly Operations in Production Line (TEL/N2507))	Module 3: Performing Assembly Operations in Telecom Production	Assembly Preparation & Safety Compliance	• Check availability of all parts and tools • Conduct pre-assembly safety checks • Arrange parts in correct sequence	PC1, PC2, PC3, PC4, KU1	Workshop, Safety Drills	Assembly checklists, safety equipment, parts inventory	3 Theory / 2 Practical
		Technical Documentation Interpretation	• Interpret technical diagrams and schematics • Read assembly specifications accurately • Understand electronic circuit diagrams	PC5, KU11	Lecture, Diagram Reading Practice	Technical drawings, schematics, specification sheets	4 Theory

SL. No.	Module Name	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
2. Assembly Operations in Production Line (TEL/N2507))	Module 3: Performing Assembly Operations in Telecom Production	Component Handling & Basic Assembly	• Handle components carefully with proper tools • Assemble RFID tags and wireless modules • Apply basic quality checks	PC6, PC7, PC8, KU3, KU4	Hands-on Workshop	RFID tags, Wi-Fi/Bluetooth modules, assembly tools	2 Theory / 6 Practical
		IoT Integration in Assembly	• Utilize IoT sensors for placement accuracy • Track assembly line efficiency using IoT • Understand IoT role in modern assembly	PC9, KU14	Demonstration, Hands-on Practice	IoT sensors, tracking systems, efficiency monitors	3 Theory / 2 Practical
		Robotic Process Automation (RPA)	• Operate RPA tools for pick-and-place assembly • Understand RPA in modern assembly lines • Program basic RPA sequences	PC10, KU14	Workshop, Programming Practice	RPA systems, programming software, pick-and-place robots	2 Theory / 4 Practical
		Machine Vision Systems	• Use machine vision for real-time quality inspection • Detect defects using vision systems • Validate processes with machine vision	PC11, KU16	Demonstration, Hands-on Training	Machine vision cameras, inspection software, defect samples	3 Theory / 2 Practical
		Augmented Reality for Assembly	• Use AR tools for interactive training • Troubleshoot assembly processes with AR • Apply AR-based assembly guidance	PC12, KU15	AR Workshop, Interactive Training	AR headsets/glasses, AR software, training modules	3 Theory / 2 Practical

SL. No.	Module Name	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
2. Assembly Operations in Production Line (TEL/N2507)	Module 4: Managing Production and Post-Assembly Activities	ERP & Digital Inventory Management	• Use ERP systems to track materials • Schedule production using digital tools • Log component usage accurately	PC13, PC14, PC15	System Training, Hands-on Practice	ERP software, inventory management systems	3 Theory / 2 Practical
		Quality Compliance & Verification	• Conduct intermediate and final compliance checks • Align with ISO 9001 quality standards • Verify assembly against specifications	PC16, PC22, KU1	Quality Workshop, Compliance Training	Quality check tools, ISO standards documents, checklists	4 Theory
		Workstation Management & Cleanup	• Secure workstation post-assembly • Remove loose components and consumables • Follow proper cleanup procedures	PC17, KU6	Workshop, Cleanup Practice	Workstation organization tools, cleanup equipment	1 Theory / 4 Practical
		Inventory Reconciliation	• Reconcile used components with issued inventory • Document discrepancies accurately • Follow store procedures for returns	PC18, PC19	Hands-on Practice, Documentation	Inventory sheets, reconciliation forms, return procedures	2 Theory / 4 Practical
		Documentation & Reporting	• Maintain proper documentation of completed work • Record inventory usage accurately • Create assembly completion reports	PC20, KU2	Documentation Workshop	Report templates, digital documentation systems	2 Theory / 3 Practical

SL. No.	Module Name	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
2. Assembly Operations in Production Line (TEL/N2507)	Module 4: Managing Production and Post-Assembly Activities	Waste Management & Environmental Compliance	• Dispose of hazardous/non-hazardous waste safely • Follow waste management protocols • Apply environmental compliance standards	PC21, KU17	Safety Workshop, Waste Handling	Waste bins, safety equipment, disposal guidelines	3 Theory / 2 Practical
		Advanced Electronic Assembly	• Handle PCBs including baking and flux application • Apply basic soldering techniques • Identify and rework assembly defects	KU8, KU9	Hands-on Workshop	PCBs, soldering equipment, flux, rework tools	2 Theory / 6 Practical
		RF Circuits & Power Supply Assembly	• Assemble telecom RF circuits • Build and test power supplies • Assemble multiplexers	KU12, KU10	Technical Workshop	RF components, power supply kits, multimeters	2 Theory / 4 Practical
		Connectors, Cables & Wiring	• Identify pin configurations of connectors • Assemble cables and wires properly • Test connector functionality	KU13, KU5	Hands-on Practice	Connectors, cables, wire strippers, testers	2 Theory / 4 Practical
	Module 5: Assembly and Testing of Mobile Phone Accessories	Introduction to Mobile Phone Accessories	• Identify types and functions of mobile accessories • Understand accessory specifications and components • Learn industry standards and BIS certification	KU1, KU8	Lecture, Product Demonstration	Chargers, cables, batteries, audio devices, specification sheets	3 Theory

SL. No.	Module Name	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
3. Assembly of Mobile Phone Accessories	Module 5: Assembly and Testing of Mobile Phone Accessories	Functional Testing & Compliance	• Test electrical functionality and durability • Verify compliance with quality standards • Identify and rectify minor assembly errors	PC8, PC9, PC11, KU8	Testing Workshop, Compliance Practice	Testing equipment, compliance standards, sample defects	1 Theory / 4 Practical
		Digital Systems & Production Tracking	• Use digital tools for component tracking • Apply ERP systems for production progress • Record production outputs digitally	PC10, KU10	System Training, Hands-on Practice	ERP software, digital tracking tools, production records	1 Theory / 4 Practical
		Post-Assembly Activities & Packaging	• Package, label, and store finished accessories • Document production outputs and quality issues • Follow workplace safety and cleanliness guidelines	PC12, PC13, PC15	Packaging Workshop, Documentation	Packaging materials, labels, storage systems, safety equipment	1 Theory / 4 Practical
		Waste Management & Defect Handling	• Dispose of defective components properly • Handle rejected accessories per guidelines • Apply waste disposal best practices	PC14, KU9	Safety Workshop, Waste Handling	Waste disposal containers, defective samples, safety gear	1 Theory / 4 Practical
4. ESD Safe Procedures and Practices (TEL/N2508)	Module 6: ESD Safe Procedures and Best Practices	Fundamentals of Electrostatic Discharge	• Understand ESD principles and physics • Identify ESD sources in workplace • Recognize impact on electronic components	KU1, KU2, KU5	Theory Lecture, Case Studies	ESD demonstration kits, component damage samples, videos	3 Theory

SL. No.	Module Name	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
4. ESD Safe Procedures and Practices (TEL/N2508)	Module 6: ESD Safe Procedures and Best Practices	ESD Policies & Safety Guidelines	• Learn ESD policies and procedures • Understand safety guidelines for different areas • Identify ESD-sensitive parts and areas	PC1, KU1, KU3	Workshop, Policy Review	ESD policy manuals, safety guidelines, labeling systems	2 Theory
		ESD Tools & Equipment Operation	• Use static voltage checkers and wrist straps • Operate air ionizers and ionized air guns • Apply shoe grounders correctly	PC2, PC3, KU6	Hands-on Training, Equipment Practice	Wrist straps, static meters, ionizers, shoe grounders	1 Theory / 4 Practical
		Work Area Preparation & Grounding	• Ground all components in work area • Set up ESD-safe workstations • Remove electrostatic generating items	PC4, PC8, KU6	Setup Workshop, Grounding Practice	ESD mats, grounding cables, workstation setup tools	1 Theory / 4 Practical
		Packaging & Handling Procedures	• Pack/unpack electronic components safely • Handle semi-finished products with ESD-free trays • Use appropriate storage/packaging solutions	PC5, PC6, KU4, KU8	Packaging Workshop, Handling Practice	ESD bags, trays, containers, handling tools	1 Theory / 4 Practical
		Advanced Grounding Techniques	• Implement advanced grounding methods • Conduct regular grounding inspections • Mitigate electrostatic risks effectively	PC8, KU6	Technical Workshop, Inspection Practice	Advanced grounding equipment, inspection tools	1 Theory / 4 Practical

SL. No.	Module Name	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
4. ESD Safe Procedures and Practices (TEL/N2508)	Module 6: ESD Safe Procedures and Best Practices	Machine Vision & Smart Monitoring	• Use machine vision for ESD compliance monitoring • Identify safety violations automatically • Apply smart manufacturing techniques	PC7, KU9	Technology Demo, Hands-on Practice	Machine vision systems, monitoring software	1 Theory / 4 Practical
		ESD Audits & Compliance Verification	• Conduct comprehensive ESD audits • Ensure ISO 9001 and 27001 compliance • Verify workstation and facility compliance	KU7, PC9	Audit Workshop, Compliance Practice	Audit checklists, compliance forms, testing equipment	1 Theory / 4 Practical
		Component Handling & Stacking Methods	• Apply proper handling techniques • Implement safe stacking methods • Prevent failures during storage	KU8	Handling Workshop, Storage Practice	Component samples, storage racks, handling equipment	1 Theory / 3 Practical
		Integrated ESD Safety Project	• Apply all ESD procedures in real scenario • Conduct complete workstation setup • Perform comprehensive ESD audit	PC1-PC9, KU1-KU9	Project-based Learning, Simulation	Complete ESD setup, audit tools, project scenarios	0 Theory / 7 Practical
5. Follow sustainability practices in telecom production and assembly line processes (TEL/N9107)	Module 7: Sustainable Practices in Telecom Production and Assembly	Sustainability Fundamentals & Regulations	• Understand organizational sustainability policies • Learn EPR guidelines and ISO 14001 • Identify relevant environmental laws	KU1, KU2, PC16	Lecture, Regulation Review	Policy documents, ISO standards, regulation manuals	3 Theory

SL. No.	Module Name	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
5. Follow sustainability practices in telecom production and assembly line processes (TEL/N9107)	Module 7: Sustainable Practices in Telecom Production and Assembly	Component Identification & Categorization	• Identify recyclable, refurbishable, hazardous components • Categorize PCBs, cables, batteries, casings • Apply proper labeling procedures	PC1, PC2, KU3, KU7	Hands-on Workshop, Identification Practice	Component samples, categorization charts, labeling systems	2 Theory / 3 Practical
		Inventory Management & E-Waste Storage	• Maintain recyclable/hazardous material inventory • Store e-waste per EPR guidelines • Implement tracking systems	PC3, PC4, KU5	System Training, Storage Practice	Inventory software, storage containers, tracking tools	2 Theory / 3 Practical
		Green Manufacturing Practices	• Use energy-efficient equipment and tools • Follow low-emission soldering processes • Optimize material and energy use	PC6, PC7, PC8, KU4	Workshop, Efficiency Practice	Energy-efficient tools, soldering equipment, monitoring devices	2 Theory / 3 Practical
		Equipment Maintenance & ISO Compliance	• Conduct maintenance of energy-efficient machinery • Adopt ISO 14001 compliance workflows • Calibrate sustainable equipment	PC9, PC10, KU2	Maintenance Workshop, Compliance Practice	Maintenance tools, calibration equipment, ISO documents	2 Theory / 2 Practical
		Waste Disposal & Recycling Protocols	• Dispose of hazardous waste safely • Deposit recyclable materials properly • Coordinate with authorized recyclers	PC11, PC12, PC15, KU5	Safety Workshop, Disposal Practice	Hazardous waste containers, recycling bins, safety gear	2 Theory / 3 Practical

SL. No.	Module Name	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
5. Follow sustainability practices in telecom production and assembly line processes (TEL/N9107)	Module 7: Sustainable Practices in Telecom Production and Assembly	Documentation & Waste Audits	• Maintain disposal/recycling documentation • Conduct periodic waste audits • Identify waste reduction opportunities	PC13, PC14, KU9	Audit Workshop, Documentation	Audit checklists, documentation templates, audit tools	2 Theory / 3 Practical
		Compliance Monitoring & Reporting	• Check sustainability guideline adherence • Report deviations and improper practices • Follow corrective actions	PC5, PC18, PC19, KU8	Monitoring Workshop, Reporting Practice	Compliance checklists, reporting forms, corrective action plans	2 Theory / 3 Practical
		Integrated Sustainability Project	• Apply all sustainable practices in real scenario • Conduct comprehensive waste audit • Complete compliance documentation	PC1-PC19, KU1-KU9	Project-based Learning, Simulation	Complete waste management setup, project scenarios	0 Theory / 7 Practical

Annexure II
Assessment Criteria

CRITERIA FOR ASSESSMENT OF TRAINEES

Assessment Criteria for Line Assembler - Telecom Products	
Job Role	Line Assembler - Telecom Products
Qualification Pack	TEL/Q4200 V5.0
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 aggregate marks.
6	In case of unsuccessful completion, the trainee may seek reassessment on the Qualification File.

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
TEL/N2506.Preparing Workspace for Assembly Operations	30	50	0	20	100	20
TEL/N2507.Assembly Operations in Production Line	30	50	0	20	100	20
TEL/N2510.Assembly of Mobile Phone Accessories	30	50	0	20	100	20
TEL/N2508.ESD Safe Procedures and Practices	30	50	0	20	100	15
TEL/N9107.Follow sustainability practices in telecom production and assembly line processes	30	50	0	20	100	15
DGT/VSQ/N0101.Employability Skills (30 Hours)	20	30	-	-	50	10
Total	**170**	**280**	**-**	**100**	**550**	**100**

Annexure - III

QR Codes –Video Links

Chapter Name	Unit Name	Topic Name	YouTube Link	QR Code
1. Introduction (TEL/N2506)	Unit 1.1 – Introduction to the Sector	Overview of Telecom Sector	https://www.youtube.com/watch?v=gUpxJX4sPWk	
	Unit 1.2 – Fundamentals of Electronics	Basics of Electronics	https://youtu.be/pBJgKpgMojY?si=njrztykO_iUGSmvL	
	Unit 1.3 – Active and Passive Components	Active vs Passive Components	https://www.youtube.com/watch?v=X-qd5afdCMo	
	Unit 1.3 – Understanding of Diodes, Transistors, and Logic Gates	Diodes, Transistors & Logic Gates Basics	https://www.youtube.com/watch?v=Hjw_w019GZ8	
	Unit 1.4 – Fundamentals of PCB	PCB Basics and Structure	https://www.youtube.com/watch?v=Z2LgmIGE2nI	

Chapter Name	Unit Name	Topic Name	YouTube Link	QR Code
2. Preparing Workspace for Assembly Operations (TEL/N2506)	Unit 2.1 – Component Handling and Verification	Safe Handling and Verification of Components	https://www.youtube.com/watch?v=B3yAPf9YXzU	
	Unit 2.2 – Assembly Tools and Procedures	Assembly Tools and Their Usage	https://www.youtube.com/watch?v=gqBTGupyquo	
3. Assembly Operations in Production Line (TEL/N2507)	Unit 3.1 – Performing Assembly Operations in Telecom Production	Telecom Assembly Process Overview	https://www.youtube.com/watch?v=9R48ALp45c0	
4. Assembly & Testing of Mobile Phone Accessories (TEL/N2510)	Unit 4.1 – Mobile Accessories and Electronic Concepts	Mobile Accessories Assembly Concepts	https://www.youtube.com/watch?v=cgKZv0dIBYM	
5. ESD Safe Procedures and Practices (TEL/N2508)	Unit 5.1 – ESD and Its Effects on Electronic Components	ESD Basics and Impact	https://www.youtube.com/watch?v=pWhtyz-UFZc	

NCVET
कौशल गुणवत्ता प्रगति

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
RE IMAGINE FUTURE

Telecom Sector Skill Council

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