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GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

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Telecom Sector Skill Council

Facilitator Guide

Sector
Telecom

Sub-Sector
Network Managed Services

Occupation
Network Operation and Maintenance

Reference ID: **TEL/Q6207,** Version **5.0**
NSQF Level **4**

Optical Network Terminal Technician

This book is sponsored by
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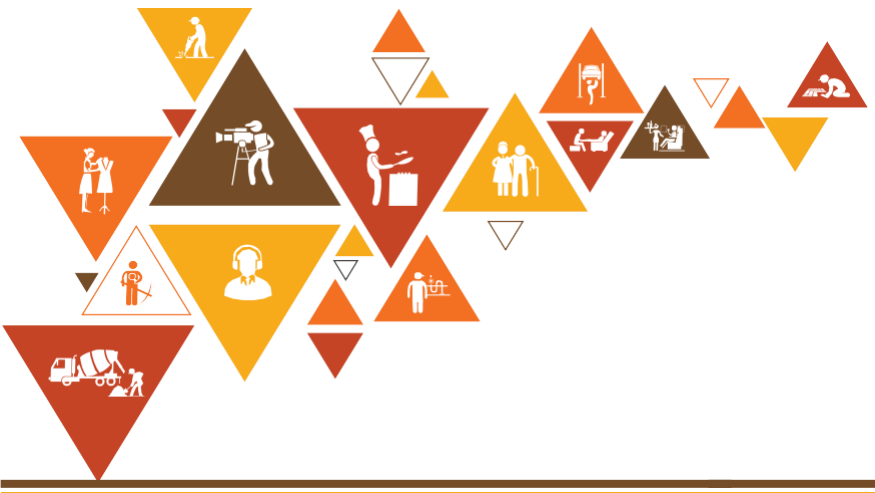

"Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission."

Shri Narendra Modi
Prime Minister of India

Acknowledgements

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

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

About this Guide

The facilitator guide (FG) for Grass Root Telecom Provider is primarily designed to facilitate skill development and training of people, who want to become professional Grass Root Telecom Provider in various organizations. 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/N6226 – Maintain Site Hygiene and Implement Security
2. TEL/N6227 – Perform Preventive Maintenance
3. TEL/N6228 – Promote Usage of Telecom Devices and Provide services
4. TEL/N9109 – Followsustainablepracticesintelecominfrastructuremanagement
5. DGT/VSQ/N0101 - Employability Skills (30 Hours)

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

Symbols Used

Ask

Explain

Elaborate

Notes

Objectives

Do

Demonstrate

Activity

Team Activity

Facilitation Notes

Practical

Say

Resources

Example

Summary

Role Play

Learning Outcomes

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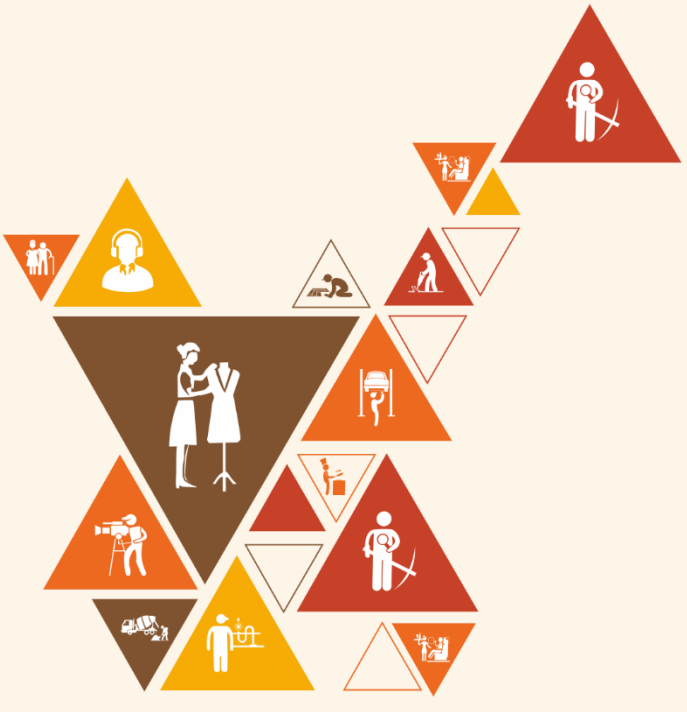
1. Role and Responsibilities of an Optical Network Terminal Technician

Unit 1.1 - Introduction to Communications
Unit 1.2 - Industry Outlook - Global & National
Unit 1.3 - Responsibilities of an Optical Network Terminal Technician
Unit 1.4 - Electromagnetic Spectrum
Unit 1.5 - Introduction to Mobile Technology
Unit 1.6 - Introduction to Optical Communication System



TEL/N6226

Key Learning Outcomes

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

1. Explain the history and evolution of the telecom industry.
2. Describe different types of communication systems used in telecommunications.
3. Identify and compare various transmission media and their applications.
4. Analyze the growth and development of the telecom sector in India.
5. Explain the key aspects of the Electromagnetic Spectrum and its significance in telecommunications.
6. Describe the features and properties of electromagnetic waves.
7. Elaborate on the key regions of the Electromagnetic Spectrum and their specific functions in communication.
8. Provide an overview of mobile communication technologies and their evolution.
9. Explain the need for fiber-optic communication in modern telecom networks.
10. Describe the architecture and working principles of optical communication systems.
11. Explain how optical fibers function as a communication channel, including their advantages and limitations.
12. Describe the working of optical transmitters and receivers, and their role in optical communication systems.

UNIT 1.1: Introduction to Communications

Unit Objectives

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

1. History of telecom
2. Types of Communication System
3. Various Transmission Media

Resources to be Used

- Available objects such as a duster, pen, notebook, projector and other teaching aids
- Presentation slides
- Multimedia

1.1.1 Note

This is the first session of this program. Introduce yourself, explain the program and the purposes of the program in detail. Describe the participants that how the program will help them to get a job. Ensure the participants understand how their entire course duration will be structured and how they will be benefit from the course.

1.1.2 Say

Good morning and warm welcome to this training program on Grass root Telecom Provider. Now let us start the unit by discussing about the history of telecom and the basic components of communication.

1.1.3 Do

Share with the participants about the details of historical mlie-stones of communications, tele-communication basics & its components.

1.1.4 Ask

Ask the participants whether they know telecom evolutions. If yes, ask them to name the evolution and list it on blackboard and complete it with the points given in the participant handbook.

1.1.5 Elaborate

Refer to participant handbook to explain the various telecom evolutions in the history of telecom and refer it to explain the following.

1. Communication system:

Communication is an exchange of Information between 2 parties/person/ nodes. Any communications system aims at best and effective exchange of information. Communication system communicates Voice, SMS, Video, text, Music, live sessions from one point to other. Technically on Network front communication system consists of device which transmits the information, and a device which receives it. Channel is a medium through which the communication takes place. Channel could be wired medium or wireless medium (over AIR).

Types

Simplex system:

Simplex communication is a communication channel that sends information in one direction only. The International Telecommunication Union (ITU) defines the system as communication-channel that operates in one direction at one given time.

Half duplex system:

In Half-duplex system, there are still two clearly defined paths/channels and each party can communicate with the other but not simultaneously; the communication is one direction at a time.

Full duplex system:

A duplex communication system is a point-to-point system composed of two connected parties or devices that can communicate with one another in both directions.

1.1.6 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 1.2: Industry Outlook - Global & National

Unit Objectives

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

1. Telecom Growth in India

Resources to be Used

- Available objects such as a duster, pen, notebook, projector and other teaching aids
- Presentation slides

1.2.1 Note

This is the second session of the program which talks about global and national industry outlooks on telecom. Kindly explain about it to participants to enable them to perform their task effectively.

1.2.2 Say

Let us have a quick recap of the previous session.

1.2.3 Do

Begin with revising the things explained in previous session. Ask the following question

- Name the important telecom evolutions in telecom industry
- Name the basic components of Communication
- Name the all transmission channel classifications

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

1.2.4 Say

Now let us begin a new session on Telecom growth in India.

1.2.5 Do

Tell the participants to get ready for an activity on Telecom Growth in India.

1.2.6 Activity

Ask Participants to refer Participant handbook and internet to study in details about the telecom growth in India.

Skill Practice	Time	Resources
• Self-study Internet Browsing	01 Hrs	Writing pad, Internet, Computer, PH

1.2.7 Elaborate

Refer to Participant handbook in order to get a better understanding about the telecom growth in India.

1.2.8 Say

Let us talk about one of the main telecom organization ITU (International Telecom Union).

1.2.9 Do

Share details to the participants on International Telecom Union.

1.2.10 Elaborate

Refer to participant handbook to explain the participants about ITU and its features.

1.2.11 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 1.3: Responsibilities of an Optical Network Terminal Technician

Unit Objectives

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

1. Describe the roles and responsibilities of a Grass Root Telecom Provider
2. Understand the organizational policies pertinent to GRTP
3. Identify the standard checklists and schedules recommended by OPCOs

Resources to be Used

- Available objects such as a duster, pen, notebook, projector and other teaching aids
- Presentation slides

1.3.1 Note

This is the session of the program which state the role and responsibilities of Grass Root Telecom Provider and scope of GRTP. . Kindly explain about it to participants to enable them to perform their task effectively.

1.3.2 Say

Let us have a quick recap of the previous session.

1.3.3 Do

Begin with revising the things explained in previous session. Ask the following question

- List the responsibilities of GRTP in telecom industry
- Understand the organizational policies pertinent to GRTP

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

1.3.4 Say

Now let us begin a new session on roles and responsibilities of a Grass Root Telecom Provider and its scope.

1.3.5 Do

Tell the participants to get ready for an activity on understanding role and responsibilities of GRTP.

1.3.6 Activity

- Conduct a group discussion on the skills required for a GRTP
- Ask the participants what they have learnt from this exercise
- Ask if they have any questions and close the discussion by summarizing the responsibilities of GRTP

Skill Practice	**Duration**	Resources
Group Discussion	01 Hour	Participant handbook, pen, notebook, laptop, overhead projector, microphone (if required), etc.

1.3.7 Elaborate

Refer to Participant handbook in order to get a better understanding about the session.

1.3.8 Do

- Ensure that all the trainees participate in the group discussion • Ensure a friendly atmosphere during the group discussion • Guide the students in identifying key points

1.3.9 Notes for Facilitation

- Encourage peer learning
- Answer all the doubts raised by the trainees in the class
- Discuss the proper communication technique in group discussion

UNIT 1.4: Electromagnetic Spectrum

Unit Objectives

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

1. Electro Magnetic Spectrum

Resources to be Used

- Available objects such as a duster, pen, notebook, projector and other teaching aids
- Presentation slides
- Multimedia

1.4.1 Note

This is the third session of the program which talks about Electromagnetic spectrum. Kindly explain the EMS details to participants to enable them to perform their task effectively.

1.4.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

1.4.3 Do

Begin with revising the things explained in previous session. Ask the following questions

- Explain the major milestones of Indian telecom sector
- What are the functionalities of ITU?

Encourage participants to give answers. if they have any doubt, clarify it and Tell them about what they are going to study in new session.

1.4.4 Say

Now let us begin a new session on Electromagnetic Spectrum (EMS).

1.4.5 Ask

Ask participant about the details of EMS. If they are responding properly, collect their ideas and list it on whiteboard.

1.4.6 Do

Share the details of Electromagnetic spectrum, its applications and the features to participants.

1.4.7 Elaborate

Electromagnetic Spectrum: Electromagnetic spectrum is a group of frequency ranges based on the frequency ranges. An electromagnetic wave is transverse, meaning that even as it moves forward, it oscillates in a direction perpendicular to the line of propagation.

Electromagnetic Spectrum Uses / Application

Radio Waves: Used for Broadcasting & communication purpose -their longer wavelength means they travel further in the earth's atmosphere, reflecting off hills and the upper atmosphere.

Microwaves: Used for Cooking food (microwave are absorbed by water molecules causing them to vibrate -heat up) & Satellite transmission (their wavelength penetrates our atmosphere).

Infrared: Used for Heater & night vision equipment - all objects, including people, give out infrared rays which can be detected even at night. It's also used for television remote controls.

Visible Light: Used for Human vision, photography & optical fibers it's fine only part of the spectrum we can see.

Ultraviolet: Used for Florescent lamps - they have chemicals inside them which absorb ultraviolet rays & convert the energy to visible light.

X-Rays: Used for Medical equipment - they enable us to see the internal structure of objects & materials by passing through some substances (Eg: Body tissue) but being observed by others (Eg: Bone).

Gamma Rays: Used for Sterilizing food & medical equipment - they are highly penetrative & can kill cancer cells.

1.4.8 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 1.5: Introduction to Mobile Technology

Unit Objectives

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

1. Overview of Mobile Technology

Resources to be Used

- Available objects such as a duster, pen, notebook, projector and other teaching aids
- Presentation slides
- Multimedia

1.5.1 Note

This is the fourth session of the program which talks about mobile technologies. Kindly explain about mobile technologies to the participants to enable them to perform their task effectively.

1.5.2 Say

Good morning and warm welcome to this training program on Grass root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

1.5.3 Do

Begin with revising the things explained in previous session. Ask the following question

- Define EMS (Electromagnetic Spectrum)
- What is the frequency ranges of Electromagnetic Waves?

Encourage participants to give answers, if they have any doubt clarify it and tell them about what they are going to study in new session.

1.5.4 Say

Now let us begin with a new session on Mobile technology.

1.5.5 Ask

Ask following questions to participants to verify their knowledge on mobile technologies.

- Arrange the mobile technologies in the increasing order of Data rate
- Define LTE 4G
- List 4G and 3G mobile operators in your region

1.5.6 Do

Share the details to participants about evolution of Mobile technology.

1.5.7 Elaborate

1G (or 1-G) refers to the first generation of wireless telephone technology (mobile telecommunications). These are the analog telecommunications standards that were introduced in the 1980s and continued until being replaced by 2G digital telecommunications.

2G (or 2-G) second-generation 2G wireless telephone technology. Second generation 2G cellular telecom networks were commercially launched on the GSM standard in Finland by Radio linja (now part of Elisa Oyj) in 1991. Three primary benefits of 2G networks over their predecessors were that phone conversations were digitally encrypted and 2G introduced data services for mobile, starting with SMS text messages.

3G is the third generation of mobile telecommunications technology. This is based on a set of standards used for mobile devices and mobile telecommunications use services and networks that comply with the International Mobile Telecommunications-2000 (IMT-2000) specifications by the International Telecommunication Union.

4G provides huge data rate for downlink and uplink access in addition to the usual voice and other services of 3G, mobile broadband Internet access. Continuing with 4G, 4.5G is a grouping of disparate mobile telephony and data technologies designed to provide better performance than 4G systems, as an interim step towards deployment of full 5G capability.

1.5.8 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 1.6: Introduction to Optical Communication System

Unit Objectives

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

1. Need For Fiber Optic Communications
2. Optical Communication systems
3. Optical Fibers as a communication Channel
4. Optical Transmitters & Receivers

Resources to be Used

- Available objects such as a duster, pen, notebook, projector and other teaching aids
- Presentation slides
- Multimedia

1.6.1 Note

This is the Fifth session of the program which talks about optical communication. Kindly explain the optical communication details to participants to enable them to perform their task effectively.

1.6.2 Say

Good morning and warm welcome to the training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

1.6.3 Do

Begin with revising the things explained in previous session. Ask the following question

- List all mobile technologies with data rate
- Discuss the need of high data rate

Encourage participants to give answers, if they have any doubt clarify it & tell them about what they are going to study in new session.

1.6.4 Say

Now let us begin a new session on the topic of Optical Communication system.

1.6.5 Do

Share the details of Optical communication system and its components to participants.

1.6.6 Elaborate

Refer Participant handbook to explain the participants about Need for Fiber optic Communications and components of optical communication system.

1.6.7 Say

Let us talk about Optical fibers as communication channel and its features.

1.6.8 Do

Share the details of Optical fibers and the significance of repeaters & WDM to participants.

1.6.9 Elaborate

Optical Communication Systems : Differ in principle from microwave systems only in the frequency range of the carrier wave used to carry the information. The optical carrier frequencies are typically 200 THz, in contrast with the microwave carrier frequencies (1 GHz). An increase in the information capacity of optical communication systems by a factor of up to 10,000 is expected simply because of such high carrier frequencies used for light wave systems.

Its characteristics are as follows:

1. A large number of electronic (digital) signals are combined using time division multiplexing (TDM) and presented to the optical transmission system as a single data stream.
2. This single data stream is carried in an optical channel at speeds ranging from 155 Mbps to 1.2 Gbps.
3. The wavelength used maximum time is almost always 1310 nm.
4. Every 30-50 km the signal is received at a repeater station, converted to electronic form, re-clocked and re-transmitted. This completely re-generates the signal (a very small amount of jitter is added to the signal but this is generally not significant). This process removes all distortions caused by noise and signal dispersion etc.

1.6.9 Elaborate Continued

5. When such a system needs to be upgraded (to run at a higher speed for example) all of the equipment in the link must be replaced. This is because the repeaters are code and speed sensitive devices.

REPEATERS: optical power reduces to only 1% after 100 km. For this reason, fiber losses remain an important design issue and determines the repeater or amplifier spacing of a long-haul light wave system. Another important design issue is fiber dispersion, which leads to broadening of individual optical pulses with propagation. If optical pulses spread significantly outside their allocated bit slot, the transmitted signal is severely degraded. Eventually, it becomes impossible to recover the original signal with high accuracy.

WDM Systems: In fiber-optic communications, wavelength-division multiplexing (WDM) is a technology which multiplexes a number of optical carrier signals onto a single optical fiber by using different wavelengths (i.e., colors) of laser light.

1.6.10 Say

Now let us begin with new session on Optical transmitters and receivers.

1.6.11 Do

Tell the participants to get ready for an activity on optical transmitters and receivers.

1.6.12 Activity

Ask Participants to refer Participant handbook and internet to study in details about the optical transmitters and receivers.

Skill Practice	Time	Resources
• Optical transmitters & Optical Receivers	30 Min	Writing pad, Internet, Computer, PH

1.6.13 Elaborate

Optical Transmitter: The role of an optical transmitter is to convert the electrical signal into optical form and to launch the resulting optical signal into the optical fiber. Figure shows the block diagram of an optical transmitter. It consists of an optical source, a modulator, and a channel coupler.

Optical Receiver: An optical receiver converts the optical signal received at the output end of the optical fiber back into the original electrical signal. It consists of a coupler, a photo detector, and a demodulator. The coupler focuses the received optical signal onto the photo detector.

1.6.14 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

Exercise

Answers to exercises for PHB

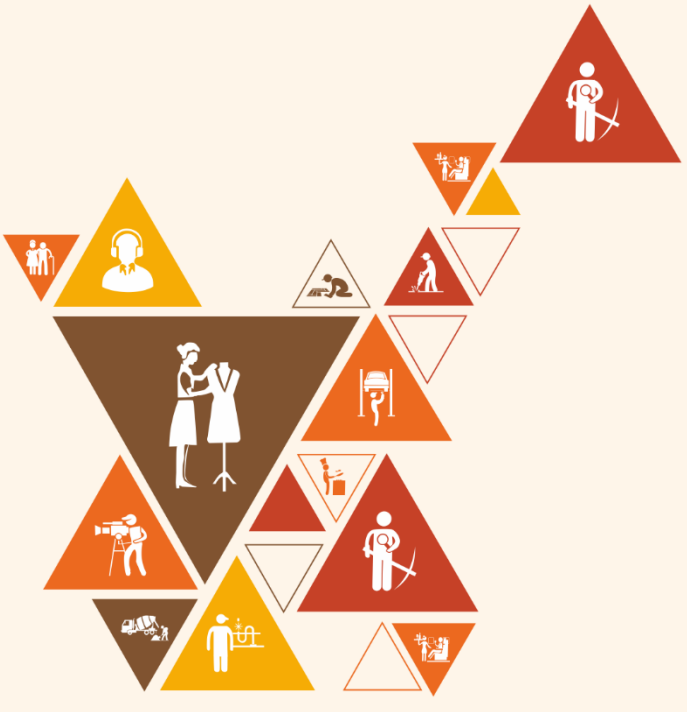
Descriptive

1. Unit 1.1 Exercise
2. Refer Unit 1.1: Communication Systems
3. Topic – 1.1.2 Basics of Communication System
4. Refer Unit 1.1: Communication Systems
5. Topic – 1.1.3 Types of Communication System
6. Refer Unit 1.1: Communication Systems
7. Topic – 1.1.4 Transmission Medium/ media/ channel system
8. Refer Unit 1.1: Communication Systems
9. Topic – 1.1.3 Types of Communication System
10. Unit 1.2 Exercise
11. Refer Unit 1.2: Industry Outlooks: Global and National Topic – 1.2.1 Telecom Growth in India
12. Refer Unit 1.2: Industry Outlooks: Global and National Topic – 1.2.2 International Telecommunication Union (ITU) Unit 1.3 Exercise
13. Refer Unit 1.3: Role and Responsibilities of GRTP and scope of GRTP Topic – Key tasks in a network maintenance checklist
14. Unit 1.3 Exercise (Contd.)
15. Refer Unit 1.3: Role and Responsibilities of GRTP and scope of GRTP Topic – Characteristics of Incentive Plan
16. Refer Unit 1.3: Role and Responsibilities of GRTP and scope of GRTP Topic – Job Description
17. Unit 1.4 Exercise
18. Refer Unit 1.4: Electromagnetic Spectrum (EMS) Topic – 1.4.1 Electromagnetic Spectrum
19. Refer Unit 1.4: Electromagnetic Spectrum (EMS)
20. Topic – 1.4.3 Electromagnetic Wave Use and Frequency Waves
21. Refer Unit 1.4: Electromagnetic Spectrum (EMS) Topic – 1.4.2 Features of Electromagnetic Spectrum
22. Refer Unit 1.4: Electromagnetic Spectrum (EMS)
23. Topic – 1.4.2 Electromagnetic Spectrum uses / applications
24. Unit 1.5 Exercise
25. Refer Unit 1.5: Mobile Technology
26. Topic – 1.5.2 Overview of Mobile Technology
27. Refer Unit 1.5: Mobile Technology
28. Topic – 1.5.2 Mobile Communication Technologies
29. Unit 1.6 Exercise
30. Refer Unit 1.6: Introduction to Optical Communication Systems Topic - 1.6.1 Need for Fiber Optical Communication
31. Refer Unit 1.6: Introduction to Optical Communication Systems Topic - 1.62 Optical Communication system
32. Refer Unit 1.6: Introduction to Optical Communication Systems
33. Topic - 1.6.4 Optical Transmitters and Receivers

Notes

2. Maintaining Site Hygiene and Implement Security

Unit 2.1 - Overview of Computer Networks
Unit 2.2 - IP Addressing
Unit 2.3 - Configuring Network
Unit 2.4 - Optical Line Terminal (OLT)/Network Operation Center (NOC)
Unit 2.5 - Equipment Used at Site



TEL/N6226

Key Learning Outcomes

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

1. Explain the fundamentals of computer networks, including their purpose, components, and evolution.
2. Differentiate between various types of networks such as LAN, WAN, MAN, and PAN, based on scale, functionality, and use cases.
3. Analyze common network topologies (e.g., star, bus, ring, mesh) and evaluate their advantages and limitations.
4. Interpret and assign IP addresses, understanding IPv4 and IPv6 formats and their roles in network identification.
5. Explain how to apply subnetting techniques to divide networks efficiently and enhance routing and security.
6. Elaborate on how to configure basic network connectivity settings, including IP configuration, gateway setup, and DNS resolution, to establish reliable communication between devices.

UNIT 2.1: Overview of Computer Networks

Unit Objectives

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

1. Overview of Computer Networks
2. Types of Network
3. Network Topologies

Resources to be Used

- Available objects such as a duster, pen, notebook, projector and other teaching aids
- Presentation slides
- Multimedia

2.1.1 Note

This is the session of the program which talks about computer networks. Kindly explain computer network details to participants to enable them to perform their task effectively.

2.1.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

2.1.3 Do

Begin with revising the things explained in previous session. Ask the following question

- What are the important components of optical communication system?
- What is a repeater?

Encourage participants to give answers, if they have any doubt clarify it & tell them about what they are going to study in new session.

2.1.4 Say

Now let us start new session on Computer Networks.

2.1.5 Do

Share the details of Computer networks and its classifications to participants.

2.1.6 Ask

Ask the participants whether they know about networks and internet. Ask them to explain the advantages of internet and list it on blackboard.

2.1.7 Elaborate

A network is an interconnection of a group of computers that can communicate and share resources such as hard disks and printers. This is a group of computers and other devices that are connected by some type of transmission media. The initial idea of a network was perceived by Department of Defense (DOD) in USA for the purpose of security

Local Area Networks (LANs):
A LAN is a small-scale network that extends over relatively small distances

Metropolitan area network (MAN) : A network that interconnects users with computer resources in a geographic area or region larger than that covered by even a large local area network (LAN) but smaller than the area covered by a wide area network (WAN).

Wide Area Networks (WANs) : Provides network connectivity spanning across the large geographical area

Network Categories: The resources and software capabilities that nodes in a network share are commonly known as services.

- Peer to peer
- Client/server

Network topologies:
Network topology is a schematic layout or a map of the arrangement of nodes over a network. There are five types of network topologies are as follows: -
1. BUS 2. RING 3. Mesh 4. STAR 5. CELLULAR

2.1.8 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 2.2: IP Addressing

Unit Objectives

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

1. IP addressing
2. Subnetting

Resources to be Used

- Available objects such as a duster, pen, notebook, projector and other teaching aids
- Presentation slides
- Multimedia

2.2.1 Note

This is the Seventh session of the program which talks about IP addressing. Kindly explain the details of IP addressing to participants to enable them to perform their task effectively.

2.2.2 Say

Good Morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

2.2.3 Do

Begin with revising the things explained in previous session. Ask the following question

- What is a network?
- What are the different types of network topologies?

Encourage participants to give answers, if they have any doubt clarify it & tell them about what they are going to study in new session.

2.2.4 Say

Let us begin a new session on IP address, its classification and features.

2.2.5 Do

Share the details of IP addressing and its features to participants.

2.2.6 Ask

Ask the participants whether they know about IP address. Ask them to give some examples of IP addresses and list it on blackboard.

2.2.7 Elaborate

IP Address: The major purpose of IP addressing is to exchange data across the network between two hosts using datagram's, or packets. Packets are broken-up independent pieces of data that consist of header and trailer information, and they contain source and delivery addresses, along with various control information. These source and destination addresses allow packets to reach the proper destination; the packets can be reassembled in the correct sequence by the receiving machine

IPv4 is 32 bit, which is divided into four blocks of each of 8 bits. Dots separate each 8 bits (octet). IP Address is composed of two distinct parts

1. Network address
2. Host address.

Ipv4 addressing is divided into five structured classes of addresses (A, B, C, D, and E), which help in identification and ease of Administration:

1. The first three classes A, B, C are the main, commercially available classes.
2. Classes D and E are the reserved for the Multicast and the research and development (R&D).

Class	1st 8 bit	2nd 8 bit	3rd 8 bit	4th 8 bit
A Class	Network address	Host address	Host address	Host address
B Class	Network address	Network address	Host address	Host address
C Class	Network address	Network address	Network address	Host address

Class	Range Address	First Three Bits
A Class	1 – 126	0
B Class	128 – 191	10
C Class	192 – 223	110

2.2.8 Do

Tell the participants to get ready for an activity on IP Address and subnet masking.

2.2.9 Activity

Ask Participants to refer Participant handbook to study in details about the importance of subnet masking and subnetting calculations

Skill Practice	Time	Resources
• Subnetting	02 Hrs	Writing pad, Computer, PH

2.2.10 Elaborate

There are loads of reasons in favor of sub-netting, including the following benefits:

Reduced Network Traffic: Without good routers, packet traffic could grind the entire network down to a near standstill. With routers, most traffic will stay on the local network; only packets destined for other networks will pass through the router.

Optimized Network Performance: This is a result of reduced network traffic. Simplified management it's easier to identify and isolate network problems in a group of smaller connected networks than within one vast network.

Facilitated spanning of the major geographical distances: Because WAN links are considerably slower and more expensive than LAN links, a single large network that spans long distances can create problems in every area previously listed. Connecting multiple smaller networks make the system more efficient.

To Create a Subnet follows these Steps:

1. Determine the number of required network Ids:
   - One for each subnet
   - One for each wide area networks connection
2. Number of required host IDs per subnet:
   - One for each TCP/IP host
   - One for each router interface
3. Based on the above requirements, create the following:
   - One subnet masks for your entire network
   - A unique subnet ID for each physical segment
   - A range of host IDs for each subnet

2.2.11 Do

Tell the participants to get ready for an activity on RJ45 crimping.

2.2.12 Activity

Ask Participants to refer Participant handbook and internet to study in details about the Crimping of RJ45.

Skill Practice	Time	Resources
• Rj45 Connectorization for straight through cable/Cross over cable	01 Hrs	Crimper, RJ45 Connectors, Ethernet Cable

2.2.13 Elaborate

Refer Participant handbook to explain the participants about the steps of crimping.

2.2.14 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 2.3: Configuring Network

Unit Objectives

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

1. Configuring Network Connectivity

Resources to be Used

- Available objects such as a duster, pen, notebook, projector & other teaching aids
  Presentation slides
- Multimedia

2.3.1 Note

This is the eighth session of the program which talks about Configurations of computer network. Kindly explain the network configuration details to participants to enable them to perform their task effectively.

2.3.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

2.3.3 Do

Pick some students to explain the procedure of crimping. Call a participant to do the crimping practical with the help of all others. Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

2.3.4 Say

Now let us begin a new session on Network configuration.

2.3.5 Do

Share the details of network connectivity configurations to participants.

2.3.6 Ask

Ask participants, whether they know about basic computer network configuration, if they says yes, ask to tell the procedure. Motivate them to give answer.

2.3.7 Elaborate

The networking functionality built into Windows 7 enables you to share all kind of resources with computer users. Before we can share the resources, the first thing we have to do is configure the network, what are the Hardware requirement, how to connect to the network and share the resources.

- Hardware Requirements
- Installing the Hardware
- Connecting to the Network
- Network & Sharing Center
- Troubleshooting Networks

Refer Participant handbook to explain the participant about configuration procedures.

2.3.8 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time
- Prepare Multimedia or collect multimedia pictures
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 2.4: Optical Line Terminal (OLT)/Network Operation Center (NOC)

Unit Objectives

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

1. Optical Lin Terminal
2. Network Operations Center (NOC)
3. Coordinate with Gram Panchayat Officials

Resources to be Used

- Available objects such as a duster, pen, notebook, projector & other teaching aids Presentation slides
- Multimedia

2.4.1 Note

This is the session of the program which talks about issues and upgradation of technology related to OLT /NOC. Kindly explain the need to coordinate with Gram Panchayat Officials and duties of field engineer.

2.4.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on OLT/NOC, let us revise the previous session.

2.4.3 Do

Pick some students to explain the procedure of OLT and NOC. Call a participant to explain others about his/her understanding on the subject. Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

2.4.5 Do

Share the details of OLT/NOC with participants.

2.4.6 Ask

Ask participants, whether they know about NOC Technician and its duties, if they says yes, ask to tell about it. Motivate them to give answer.

2.4.7 Elaborate

The NOC and SOC both perform vital tasks for the corporation, including identifying, looking into, and fixing problems. Both organisations put in a lot of effort to fix issues fast before they have an impact on business. Additionally, both frequently use a hierarchical method of incident resolution. They concentrate on quite dissimilar topics, though. As a result, each sets of employees have unique talents, expertise, and working methods. A NOC technician must understand the ins and outs of network and application monitoring and management, while a SOC analyst will focus exclusively on security.

Refer Participant handbook to explain the participant about details of OLT /NOC

2.4.8 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time
- Prepare Multimedia or collect multimedia pictures
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 2.5: Equipment Used at Site

Unit Objectives

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

1. Describe the various equipment used at site
2. Understand the wiring set up at a site for maintenance and repair

Resources to be Used

- Available objects such as a duster, pen, notebook, projector & other teaching aids
  Presentation slides
- Multimedia

2.5.1 Note

This is the session of the program which talks about various equipment used at site and also about the wiring set up for maintenance and repair.

2.5.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on Oequipment used at site, let us revise the previous session.

2.5.3 Do

Explain about the Charge Controller Unit (CCU), Solar Photo Voltaic System (SPV), Telephone Junction Box (TJB), Battery Bank and Fire Extinguisher. State about the wiring set up at a site for efficient maintenance and repair.

2.5.4 Ask

Ask participants, whether they know about maintenance activities / procedures. In addition to their response, discuss and share some maintenance advice on choosing right cable , how to prevent damage and make cable reel adjustments.

2.5.5 Elaborate

Maintenance Activities / schedule:

- Select the cable that is most suited for your industry's needs. Learn about the various types of cables that are sold on the market.
- Select the cable size that is appropriate for your industry. You can check for things like mechanical strength, ambient temperature, carrying capacity, voltage loss, and safety restrictions.
- Staff should receive periodic maintenance training and education so they can recognise any failure's symptoms.
    - Keep a watchful eye on the installation of the wiring. During installation, avoid twisting or kinking the wires. It is important to lay wires as straight as you can.
    - Prevent strife and collisions.
    - Note the smallest bent radius.
    - Avoid any collisions, piercings, or crushing that could rip the wire jacket apart.
    - Keep cables and wires away from flames.

2.5.6 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time
- Prepare Multimedia or collect multimedia pictures
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

Exercise

Answers to exercises for PHB

Descriptive:

1. Unit 2.1 Exercise
2. Refer Unit 2.1: Overview of Computer Networks Topic – 2.1.1 Overview of Computer Networks
3. Refer Unit 2.1: Overview of Computer Networks Topic – 2.1.2 Types of Networks
4. Refer Unit 2.1: Overview of Computer Networks Topic – 2.1.3 Network Topology
5. Unit 2.2 Exercise
6. Refer Unit 2.2: IP addressing Topic – 2.2.1 IP Addressing
7. Refer Unit 2.2: IP addressing
8. Topic – 2.2.3 Steps to do crimping of ethernet cables
9. Refer Unit 2.2: IP addressing
10. Topic – 2.2.2 Understanding of Subnetting
11. Unit 2.3 Exercise
12. 1. Refer Unit 2.3: Configuring Network Topic – 2.3.1 Configuring Network
13. Refer Unit 2.3: Configuring Network Topic – 2.3.1 Configuring Network

Fill ups

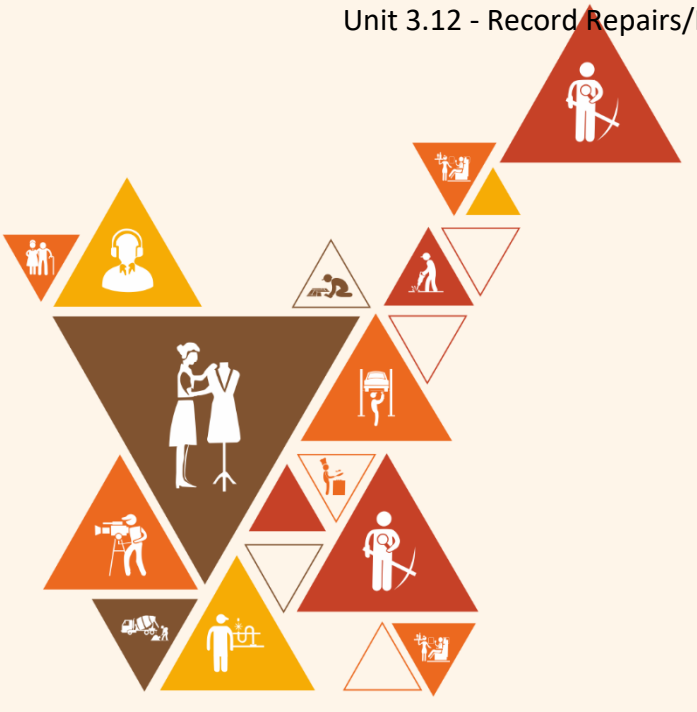
Unit 2.4 Exercise

OLT 2. NOC 3. monitor, detect and analyze

Notes

3. Preventive Maintenance of Optical Network Terminal (ONT) Components

Unit 3.1 - Fibre Optics Overview
Unit 3.2 - Light in Fiber
Unit 3.3 - Transmission of Light in Fiber
Unit 3.4 - Optical Sources
Unit 3.5 - Gigabit Capable Passive Optical Network (GPON)
Unit 3.6 - Global Position System (GPS)
Unit 3.7 - PON Maintenance & ONT – CCU Indicators
Unit 3.8 - ONT Status Check
Unit 3.9 - ONT Service Configuration
Unit 3.10 - ONT Preventive Maintenance
Unit 3.11 - ONT Maintenance and Troubleshoot
Unit 3.12 - Record Repairs/Replacements



Key Learning Outcomes

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

1. Explain the history of fiber optics and its evolution as a communication medium.
2. Analyze the advantages and disadvantages of optical fiber compared to traditional copper cabling.
3. Identify the main components of an optical fiber and describe the function of each (core, cladding, coating).
4. Differentiate between various optical fiber types based on their refractive index profiles and propagation modes.
5. Describe the principles of light transmission within an optical fiber, including Snell's Law and the concept of Critical Angle.
6. Understand key transmission impairments in optical fiber, such as dispersion (modal and chromatic), attenuation (loss), and noise.
7. Explain how light is generated for optical communication, including the working principles of LEDs and Lasers, and their respective applications.
8. Define key optical phenomena such as polarization and interference as they relate to optical communication.
9. Summarize the characteristics of optical radiation and the role of optical light guides in transmitting data.

UNIT 3.1: Fibre Optics Overview

Unit Objectives

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

1. Fiber optics basics
2. Advantages and disadvantages of optical fiber
3. Optical fiber standards

Resources to be Used

- Available objects such as a duster, pen, notebook, projector & other teaching aids
  Presentation slides
- Multimedia

3.1.1 Note

This is the ninth session of the program which talks about fiber optic basics. Kindly explain the fiber optic details to participants to enable them to perform their task effectively.

3.1.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

3.1.3 Do

Begin with revising the things explained in previous session. Ask the following question

- What is a network?
- What are the different types of network topologies?

Encourage participants to give answers. If they have any doubt, clarify it and tell them about what they are going to study in new session.

3.1.4 Say

Let us start a new discussion on History of fiber optics.

3.1.5 Ask

Ask to participants, whether they know about the optical fibers and its features. If they say yes, ask them to list that features on black board. Ask them to compare it with the conventional transmission channels.

3.1.6 Do

Share the details about overview of fiber optics to the participants.

3.1.7 Elaborate

Refer Participant handbook to explain the evolution of fiber optics technology.

3.1.8 Do

Share with the participants about the advantages and disadvantages of optical fiber.

3.1.9 Elaborate

Advantages of Optical fiber:

- Low Power Loss - An optical fibre offers low power loss. This allows for longer transmission distances.
- Interference - Fibre optic cables are immune to electromagnetic interference.
- Size - In comparison to copper, a fibre optic cable has nearly 4.5 times as much capacity as the wire cable has and a cross sectional area that is 30 times less.
- Weight - Fibre optic cables are much thinner and lighter than metal wires. They also occupy less space with cables of the same information capacity.
- Safety - Since the fibre is a dielectric, it does not present a spark hazard.
- Security - Optical fibers are difficult to tap. As they do not radiate electromagnetic energy, emissions cannot be intercepted
- Flexibility - An optical fibre has greater tensile strength than copper or steel fibres of the same diameter.
- Cost - The raw materials for glass are plentiful, unlike copper. This means glass can be made more cheaply than copper.
- Extremely high bandwidth – No other cable-based data transmission medium offers the bandwidth that fiber does.

3.1.9 Elaborate Continued

- Easy to accommodate increasing bandwidth – Using many of the recent generations of fiber optic cabling, new equipment can be added to the inert fiber cable that can provide vastly expanded capacity over the originally laid fiber.
- Resistance to electromagnetic interference – Fiber has a very low rate of bit error (10 EXP-13)

Disadvantages:

- Cost - Cables are expensive to install but it lasts longer than copper cables.
- Fragile - Fibers can be broken or have transmission losses when wrapped around curves of only a few centimeters radius.
- Protection - Optical fibers require more protection around the cable compared to copper.
- Installation costs, while dropping, are still high – Despite the fact that fiber installation costs are dropping by as much as 60% a year, installing fiber optic cabling is still relatively costly.
- Special test equipment is often required – The test equipment typically and traditionally used for conventional electron-based networking is of no use in a fiber optic network.
- Susceptibility to physical damage – Fiber is a small and compact cable, and it is highly susceptible to becoming cut or damaged during installation or construction activities.
- Wildlife damage to fiber optic cables – Many birds, for example, find the Kevlar reinforcing material of fiber cable jackets particularly appealing as nesting material, so they peck at the fiber cable jackets to utilize bits of that material.

3.1.10 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time
- Prepare Multimedia or collect multimedia pictures
- Collect Videos, Prepare some question & answer before taking a class
- Prepare PPT & some revised previous topic & Current topic.

UNIT 3.2: Light in Fiber

Unit Objectives

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

1. Fiber structure
2. Glass as a medium
3. Transmission capacity
4. Fiber refractive index profiles

Resources to be Used

- Available objects such as a duster, pen, notebook, projector & other teaching aids, Presentation slides
- Multimedia

Notes

- This is the tenth session of the program which talks about light in fiber. Kindly explain the light propagation details to participants to enable them to perform their task effectively.

Say

- Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

Do

- Begin with revising the things explained in previous session. Ask the following question
  - What are the benefits of using Optical fiber?
  - What are the limitations of optical fiber?
- Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

Say

- Let us start a new session on Optical fiber structure.

3.2.5 Do

Share details of physical structure and refractive Index of optical fibers to participants.

3.2.6 Elaborate

Fiber is essentially a waveguide for light. It uses a principal known as "Total Internal Reflection". Fiber cables are internally composed of two layers: Known as the "core" and the "cladding". The cladding layer has a higher index of refraction than the core. When light tries to pass from a lower to a higher index of refraction, at the correct angle, it is reflected back instead. This causes light to be continuously reflected back into the core, allowing the light to travel to the other end of the fiber.

Optical Fiber Sizes

The international standard for outer cladding diameter of most single-mode optical fibers is 125 microns (µm) for the glass and 245 µm for the coating. This standard is important because it ensures compatibility among connectors, splices, and tools used throughout the industry. Standard single-mode fibers are manufactured with a small core size, approximately 8 to 10 µm in diameter. Multimode fibers have core sizes of 50 to 62.5 µm in diameter.

Refractive index profile

A refractive index profile is the distribution of refractive indices of materials within an optical fiber. Some optical fiber has a step-index profile, in which the core has one uniformly-distributed index and the cladding has a lower uniformly-distributed index. Other optical fiber has a graded-index profile, in which the refractive index varies gradually as a function of radial distance from the fiber center. Graded-index profiles include power-law index profiles and parabolic index profiles.

For an optical fiber, a step-index profile is a refractive index profile characterized by a uniform refractive index within the core and a sharp decrease in refractive index at the core-cladding interface so that the cladding is of a lower refractive index. The step-index profile corresponds to a power-law index profile with the profile parameter approaching infinity. The step-index profile is used in most single-mode fibers and some multimode fibers.

A step-index fiber is characterized by the core and cladding refractive indices n1 and n2 and the core and cladding radii a and b. Examples of standard core and cladding diameters 2a/2b are 8/125, 50/125,62.5/125, 85/125, or 100/140 (units of µm). The fractional refractive-index change = $n_1 - n_2$ /1 << The value of n1 is typically between 1.44 and 1.46, n^1 is typically between 0.001 and 0.02. Step-index optical fiber is generally made by doping high-purity fused silica glass (SiO2) with different concentrations of materials like titanium, germanium, or boron.

3.2.7 Do

Share the details of light propagation and transmission capacity of optical fibers to participants.

3.2.8 Ask

Ask to participants, whether they know about properties of light. If they say yes, ask them to list that features on black board.

3.2.9 Elaborate

Light Propagation

Visible light extends from 380 nm (violet) to 780 nm (red), for smaller wavelengths ultra-violet radiation (UV) occurs. Longer wavelengths correspond to the infrared region (IR). Optical Fibres communication elements operate in the micrometer wavelength zone of the frequency spectrum (frequencies between 1014Hz to 1015 Hz).

Refraction of Light:

This section presents the study of the phenomenon interactively. Input parameters, the refractive indices of the two media and the angle of incidence can be varied and the propagation of light can be studied.

Light Guidance:

This section presents the interactive study of the light propagation through the fibers. By varying the refractive indices of the medium in front of the fiber, medium inside the fiber, medium of the cladding of the fiber and the angle of incidence, the passage of light in the meridional plane through the fiber can be traced.

Technology and Maximum Bandwidth	
Techology	**Maximum Bandwidth**
Fiber Optics	10 Gbps (and beyond with DWDM)
Laser	1 Gbps
Ethernet	1 Gbps
ATM	622 Mbps (and beyond)
Microwave	155 Mbps
Satellite	155 Mbps (Experimental 622 Mbps)
Ultra Wideband	100 Mbps
LMDS	100 Mbps
TechNet's Recommendation	100 Mbps / Home or Small Business
VDSL	520 Mbps
Cable Codes	30 Mpbs
ADSL	9 Mbps
HDSL	2 Mbps
E1 leased line	2 Mbps
ISDN PRI	2 Mbps
Frame Relay	2 Mbps - specs up to 62 Mbps
ISDN BRI	128 Kbps
Analog	56 Kbps

3.2.10 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 3.3: Light Propagation and Related Losses

Unit Objectives

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

1. Polarization
2. Interference
3. Chromatic dispersion
4. Propagation Modes
5. Snell's Law
6. Propagation Modes

Resources to be Used

Available objects such as a duster, pen, notebook, projector & other teaching aids
Presentation slides

- Multimedia

3.3.1 Note

This is the eleventh session of the program which talks about Light propagation and related losses in fiber. Kindly explain the Fiber optic losses details to participants to enable them to perform their task effectively

3.3.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

3.3.3 Do

Begin with revising the things explained in previous session. Ask the following question

- What are the important elements of optical fiber?
- What is refractive Index?

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

3.3.4 Say

Now let us start a new session on Light propagation and related loss.

3.3.5 Do

Share with participants polarization, interference and Dispersion to participants.

3.3.6 Elaborate

Refer participant hand book to explain more details on polarization, interference and Dispersion to participants.

3.3.7 Do

Share the details of Snell's law and critical angle to participants.

3.3.8 Activity

Ask Participants to refer Participant handbook and practice the calculation exercise by using Snell's law and derive the equation of Critical angle from definition.

Skill Practice	Time	Resources
• Snell's law, Critical angle Calculations practice	01 Hrs	Writing pad, Internet, Computer, PH

3.3.9 Elaborate

Refer Participant handbook to explain participants about Snell's law and critical angle.

3.3.10 Say

Let us start a new session on Noises and Losses in optical fiber communication.

3.3.11 Do

Share the details of noises & losses in optical fibers to participants.

3.3.12 Elaborate

Noise is defined as the deviation from an ideal signal, and is usually associated with random processes. By definition it corrupts the information content and fidelity of the signal, particularly at low levels. In our case, we will be dealing with voltage noise, current noise, and optical intensity noise.

Noise can be classified in a number of ways.

1. Intrinsic or Extrinsic
2. Random or Coherent
3. Additive or Multiplicative
4. Stationary
5. Ergotis

Fiber Loss Mechanisms

Optical beam power traveling along the fiber decreases exponentially with distance. There are different optical fiber losses mechanisms:

1. Rayleigh scattering,
2. Absorption,
3. Macroscopic and microscopic bends,
4. Simulated nonlinear scattering.

3.3.13 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 3.4: Optical Sources

Unit Objectives

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

1. Optical Sources
2. LED Classifications
3. LED Output Characteristics
4. Laser Output Characteristics
5. Light Sources
6. Optical radiation

Resources to be Used

- Available objects such as a duster, pen, notebook, projector & other teaching aids

3.4.1 Note

This is the twelfth session of the program which talks about optical sources. Kindly explain the optical source details to participants to enable them to perform their task effectively.

3.4.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

3.4.3 Do

Begin with revising the things explained in previous session. Ask the following question

- What are the loss mechanism occurred in optical fiber?
- What are the classifications of noise?
- Explain polarization

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

3.4.4 Say

Now let us start a new session on optical source.

3.4.5 Do

Share the details of light generation in industry to participants.

3.4.6 Elaborate

Taking the most general view, there is only one way that light can be produced: that is, through the rapid change of state of an electron from a state of relatively high energy to a (more stable) state of lower energy. When this happens the energy has to go somewhere and it is often34 emitted in the form of light. Of course, this almost always takes place in the context of a particular material and Structure. The electron concerned could be bound within a molecule (albeit loosely) or it could be relatively free within the material.

Electrical Discharge

When an electric current is passing through a gas(such as neon), energy from the current “ionizes” (breaks the chemical bonds in) the gas. This process injects energy into electrons within the gas and when these electrons are reclaimed into molecules energy is given off in the form of light.

Electric Current

This is different from electrical discharge. This is the principle involved in semiconductor lasers and LEDs. An electric current applied to a semiconductor p-n junction requires that electrons and holes recombine at the junction. This recombination results in electrons going from the high energy “conduction” band to the lower more stable “valence” band. This can result in either spontaneous emission or lasing depending on how the device is constructed

3.4.7 Do

Share the details of LED and Lasers to participants.

3.4.8 Elaborate

Light Emitting Diodes (LEDs)

Almost all light sources used in communications today are made from semiconductors. Light Emitting Diodes are simpler than lasers but have a lot in common with them.

Characteristics of LEDs

Low Cost

LEDs have been very low in cost compared to communication lasers. This is highly controversial. Communication LEDs and lasers are not too different in their structures and are comparable in manufacturing cost.

Low Power

The maximum light output of an LED has typically been a lot lower than that of a laser (about 100 microwatts). However, recently a new class of LEDs, with output of up to 75 millwatts, has become available.

Relatively Wide Spectrum Produced

LEDs do not produce a single light wavelength but rather a band of wavelengths. The range (or band) of wavelengths produced is called the "spectral width" and is typically about .05 of the wavelength (50 to 100 nm)

Incoherent Light

The light produced is neither directional nor coherent. This means that you need a lens to focus the light onto the end of a fiber. LEDs are not suitable for use with single-mode fiber for this reason (it is too hard to get the light into the narrow core).

Digital Modulation

LEDs cannot produce pulses short enough to be used at gigabit speeds. However, systems using LEDs operate quite well at speeds of up to around 300 Mbps.

Lasers

LASER is an acronym for "Light Amplification by the Stimulated Emission of Radiation". Lasers produce far and away the best kind of light for optical communication.

The key principle in laser operation is the principle of stimulated emission.

1 An electron within an atom (or a molecule or an ion) starts in a low energy stable state often called the "ground" state.
2. Energy is supplied from outside and is absorbed by the atomic structure whereupon the electron enters an excited (higher energy) state.
3. A photon arrives with energy close to the same amount of energy as the electron needs to give up reaching a stable state. (This is just another way of saying that the wavelength of the arriving photon is very close to the wavelength at which the excited electron will emit its own photon.)
4. The arriving photon triggers a resonance with the excited atom. As a result the excited electron leaves its excited state and transitions to a more stable state giving up the energy difference in the form of a photon.

3.4.9 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 3.5: Gigabit Capable Passive Optical Network (GPON)

Unit Objectives

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

1. Bharath net/ NFON vision and mission
2. GPON architecture and design

Resources to be Used

- Available objects such as a duster, pen, notebook, projector & other teaching aids
  Presentation slides
- Multimedia

3.5.1 Note

This is the twenteith session of the program which talks about GPON. Kindly explain the GPON details to the participants to enable them to perform their task effectively.

3.5.2 Say

Good morning and warm welcome to the training program Grass Root Telecom Provider. Before begin a new session let us revise the previous session.

3.5.3 Do

Begin with revising the things explained in previous session. Ask the following question

- List all optical transmission bands and its range
- List all optical network components

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

3.5.4 Say

Let us start a new session on Gigabit Passive Optical Network (GPON).

3.5.5 Do

Share the details of NOFL/ Bharath net to participants.

3.5.6 Elaborate

The National Optical Fibre Network (NOFN),now Bharath net is a project initiated in 2011 and funded by Universal Service Obligation Fund to provide broadband connectivity to over two lakh (200,000) Gram panchayats of India at a cost of Rs.20,000 crore ($3 billion).Government of India has given approval of the project on 25-10- 2011. The project provides internet access using existing optical fiber and extending it to the Gram panchayaths. The project was intended to enable the government of India to provide e-services and e- applications nationally.

A special purpose vehicle Bharat Broadband Network Limited (BBNL) was created as a Public Sector Undertaking (PSU) under the Companies Act of 1956 for the execution of the project. The project will be funded by the Universal Service Obligation Fund (USOF) .The GPON order for BBNL to connect 200,000 villages is awarded to United Telecoms Limited (UTL).

NOFN Implementation

The Indian government approved a cabinet note on the scheme to create the National Optical Fiber Network dated 25 October 2011. The implementation framework, budget, technology architecture and other issues related to NOFN were worked out by a high level committee constituted by the Department of Telecom (DoT) under the chairmanship of an adviser to the Prime Minister and Chairman UIDAI (constituted on 26 April 2011).

3.5.7 Do

Share the details of GPON services and its Principle to participants.

3.5.8 Elaborate

Passive optical network is a telecommunications technology that implements a point-to-multipoint architecture (P2MP), in which unpowered Fiber Optic Splitters are used to enable a single optical fiber to serve multiple end-points such as customers, without having to provision individual fibers between the hub and customer.

Gigabit Passive Optical Network (GPON) technology node is the access necessary to deliver multimedia services (voice, data, video and other content-content) for residential and business customers.

3.5.8 Elaborate Continued

PON - Key Elements

ODN : Optical Distribution Network an ODN realizes the optical transmission from the OLT towards the users and vice versa. It utilizes passive optical components.

OLT : Optical Line Termination service provider endpoint of a PON and is placed in a CO or head end.

ONT : Optical Network Termination ONT is a device that terminates the PON and presents native service interfaces to the user. An ONT is typically located on the customer's premises.

ONU : Optical Network Unit an ONU is the PON-side half of the ONT, terminating the PON, and may present one or more converged interfaces, such as XDSL or Ethernet, toward the user. An ONU typically requires a separate subscriber unit to provide native user services such as telephony

3.5.9 Do

Share the details of GPON services and its Principle to participants.

3.5.10 Elaborate

Passive optical network is a telecommunications technology that implements a point-to-multipoint architecture (P2MP), in which unpowered Fiber Optic Splitters are used to enable a single optical fiber to serve multiple end-points such as customers, without having to provision individual fibers between the hub and customer.

Gigabit Passive Optical Network (GPON) technology node is the access necessary to deliver multimedia services (voice, data, video and other content-content) for residential and business customers.

GPON-based FTTx technology below:

1. FTTH (Fiber to the Home)
2. FTTB (Fiber to the Building)
3. FTTZ (Fiber to the Zone)
4. FTTT (Fiber to the Tower)
5. FTTC (Fiber to the Curb)

GPON Principle

Data Multiplexing

GPON adopts Wavelength Division Multiplexing (WDM) technology, facilitating bi-direction communication over a single fiber. To separate upstream/downstream signals of multiple users over a single fibre, GPON adopts two multiplexing mechanism:

1. In Downstream direction, data packets are transmitted in a broadcast manner;
2. In Upstream direction, data packets are transmitted in a TDMA manner.

Refer participant handbook to get more details on GPON.

3.5.11 Do

Share the details of GPON standards to participants.

3.5.12 Elaborate

Refer participant handbook to get more details of following standards.

- **ITU-T G.984.1**
- **ITU-T G.984.2**
- **ITU-T G.984.3**
- **ITU-T G.984.4**

3.5.13 Do

Share the details of GPON devices and its feature to participants

3.5.14 Elaborate

Refer participant handbook to get more details on the following GPON devices and its features.

- OLT
- ONT
- CCU
- SPV

3.5.15 Do

Share the details of ONT installation to participants.

3.5.16 Elaborate

Refer participant handbook to explain ONT installation.

3.5.17 Do

Share the details of GPON design to participants.

3.5.18 Elaborate

Refer participant handbook to explain Ethernet & GPON design.

3.5.19 Do

Tell the participants to get ready to do activities on GPON elements.

3.5.20 Activity

- Set guidelines pertaining to discipline
- Make groups and show case ONT hardware, CCU –SPV hardware, OLT hardware to each groups
- Showcase the functionality of EMS & NMS and ask them to work on the different features of these applications

Skill Practice	Time	Resources
• Show case ONT hardware Show case CCU-SPV hardware Show case EMS ,NMS applications • Show case OLT hardware and Cards	05 Hrs	ONT,ONU,CCU-SPV,OLT,EMS and NMS Software BSNL Exchange Site visit or any other exchange as per availability

3.5.21 Elaborate

Refer Participant handbook to Explain more about GPON.

3.5.22 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 3.6: Global Position System (GPS)

Unit Objectives

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

1. Global Position System (GPS)
2. GPS - utility and application

Resources to be Used

- Available objects such as a duster, pen, notebook, projector & other teaching aids
  Presentation slides
- Multimedia

3.6.1 Note

This is the twenty-first session of the program which talks about GPS. Kindly explain the GPS details to participants to enable them to perform their task effectively.

3.6.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

3.6.3 Do

Begin with revising the things explained in previous session. Ask the following question

- What is NOFN?
- What are the components of Passive optical networks?
- What are the GPON devices? Explain its features

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

3.6.4 Say

Let us begin a new session on GPS, which is very important in every field surveys using for tracking.

3.6.5 Ask

Ask participant whether they know about GPS and its applications. if they say yes, ask them to list all advantages and applications of GPS in communication system.

3.6.6 Do

Share the details of GPS (Global position System) to participants.

3.6.7 Elaborate

GPS Navigation

Navigation is a field of study that focuses on the process of monitoring and controlling the movement of a craft or vehicle from one place to another. The field of navigation includes four general categories: land navigation, marine navigation, aeronautic navigation, and space navigation. Refer fig

- Once map or compass screen comes up:
- Start walking. You must be moving for navigation mode to work.
- Turn so compass points to top of unit or the arrow points down the map track.
- When you get close, Switch to coordinate screen to find final coordinates.
- GPS usually has a 5 to 10 meter error, more in poor conditions.
- Mark where the GPS takes you and search a 10 meter full circle around the point.

3.6.8 Do

Tell the participant to get ready for the activity on GPS devices.

3.6.9 Activity

Makes groups on the name of different GPON networks and ask them to find out different coordinates by navigation mode of GPS.
Ask them to calibrate the GPS device.

Skill Practice	Time	Resources
• Find out the coordinates position in the center premises. • Calibrate device using Known position coordinates.	02 Hrs	GPS Module, Compass, Standard GPS device

3.6.10 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 3.7: PON Maintenance & ONT – CCU Indicators

Unit Objectives

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

1. PON maintenance and troubleshoot
2. Features of ONT hardware
3. ONT – LED identity
4. CCU monitoring panel indicators

Resources to be Used

- Available objects such as a duster, pen, notebook, projector & other teaching aids Presentation slides
- Multimedia

3.7.1 Note

This is the twenty-second session of the program which talks about PON maintenance and ONT-CCU indicators. Kindly explain PON maintenance and the Indicators details to participants to enable them to perform their task effectively.

3.7.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

3.7.3 Do

Begin with revising the things explained in previous session. Ask the following question

- What is GPS?
- What are the steps of GPS NAVIGATION?

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

3.7.4 Say

Let us begin a new session of PON maintenance and troubleshooting.

3.7.5 Do

Share the details of PON maintenance and troubleshooting steps to participants.

3.7.6 Elaborate

Point-to-Point FTTx Network

When a failure occurs on a point-to-point FTTx network, the network completely shuts down. It is then easy to disconnect the fiber without further affecting the customer issue. To troubleshoot and fix FTTx network problems, an Optical Time Domain Reflectometry (OTDR) test can be performed with any test wavelength, such as 1310 or 1550 nm as the transmission signals are shut down.

Point-to-Multipoint FTTH Network (PON) Topology

Troubleshooting a point-to-multipoint fiber-to-the-home (FTTH) network (also defined as a PON network) differs significantly. The International Telecommunications Union (ITU-T) and Institute of Electrical and Electronic Engineers (IEEE) have created several standards for optical access systems based on PON architecture (G.982, G.983 or G.984 for ITU and 802.3ah or 802.3av for IEEE).

In order to troubleshoot PON networks in service, two dedicated tools are available:

-PON power meter

-In-service 1625 or 1650 nm OTDR

Traffic wavelengths are typically 1310/1490 or 1310/1490/1550 nm. A PON power meter is normally employed to verify that the signal is transmitted correctly to and from the ONT. A PON meter measures the power levels of all the signals and can then discriminate whether the issue comes from the customer's ONT or from the network. The use of a classical OTDR with 1310 or 1550 nm test wavelengths would interfere with the traffic signals and disturb the traffic. At the same time, the traffic signals could also disturb the receiver of the OTDR, making it difficult to interpret OTDR traces. Because of these mutual disturbances, classical OTDRs cannot be used, and specific in-service OTDRs are required (see section on Specific In-service Portable OTDR Device).

Recommended Steps for locating faults

Despite the fact companies with diverse fiber networks have their own methods and procedures, most of them optimize their fault location process to reduce the number of truck rolls.

The schematic in Figure 7 offers a complete viewof:

1. All of the possible fault locations, depending on how many customers are affected
2. The best location to shoot an OTDR while minimizing truck rolls
3. Whether or not a specific in-service OTDR device should be used

Complete PON Test Tools

Installation Phase

The following equipment may be used:

1. Loss test set (provides insertion loss and ORL, either uni-directionally or bi directionally)
2. OTDR

3.7.6 Elaborate Continued

Turn-up Phase

The following equipment should be used in conjunction:

1. A PON power meter (1310/1490, 1490/1550, or 1310/1490/1550 nm)
2. IP testers (voice, data, video) and coaxial testers

Maintenance and Troubleshooting Phase

The following equipment should be used in conjunction:

1. A PON power meter (1310/1490, 1490/1550, or 1310/1490/1550 nm)
2. A loss test set or an OTDR
3. IP testers (voice, data, video) and coaxial testers

3.7.7 Say

Let us start a new session on Features of ONT Hardware

3.7.8 Do

Share the details of ONT hardware features to participants.

3.7.9 Elaborate

Functions and features-ONT11

- **In Upstream direction** - ONT11 connects to OLT in the network through a passive optical network (PON) port to provide integrated access service
- **In Downstream direction**
  - - ONT11 connects with LAN Switches, PC, and STB etc. through Ethernet ports, to access data and video services
  - .- RJ11 ports are provided on ONT to connect phone or fax through POTS interfaces for extending Voice and FAX services

3.7.9 Elaborate Continued

.**System Management Interfaces**

- System management has been provided through two standardized interfaces:
- Local Management Interface: The local manager is able to install, monitor, control and configure the GPON system.
- EMS Interface: A GUI based Element Management System is provided to control and monitor the GPON system. This EMS interacts with the GPON system using standard SNMP V3 protocol. The EMS is able to support all the functions like Operation, Administration, and maintenance.

Battery level

- Various levels are displayed through LEDs as shown below:
  - 100 – 75: Battery charged level is between 75 to 100 % and the LED will be ON Green.
  - 5 – 50: Battery charged level is between 50 to 75 % and the LED will be ON Green.
  - 50 – 25: Battery charged level is between 25 to 50 % and the LED will be ON Green.
  - Low: Battery charged level is below 25 % and the LED will be RED. the ONT will be off or otherwise if ONT is on the same should be made off if both the inputs are absent.
- Current and Voltage monitoring points are also provided on the CCU panel. These monitoring points help to measure the voltage and current for various requirements like Mains output, Solar output, CCU load (ONT Input) and Battery.

Battery Indications

- Mains Charge: Amber LED should be ON when battery is being charged through AC.
- Mains I/P Normal: AC mains are in operating range the LED will be ON & Green.
- Mains I/P over Voltage: AC voltage above the operating voltage level; LED is RED.
- Mains I/P under Voltage: AC voltage below the operating voltage level; LED is RED.
- Mains O/P OL: High current is being derived on AC mains.
- Mains O/P OV: High voltage is being delivered for battery charging; LED is RED.
-
- Solar Panel Reverse: When SPV panel wires are connected with reverse polarity the LED will be RED.
- Solar Charge: Amber LED should be ON when battery is being charged through Solar Input.
- Solar OV / Fault: This shows the either the Solar panel voltage is high or not available. The LED will be RED in such conditions.
- Battery Reverse: If LED is RED, this indicates that the Battery is connected in reverse polarity and action is required accordingly.

3.7.10 Do

Tell the participants to get ready to do activities on ONT hardware

3.7.11 Activity

- Play some relevant videos giving graphical representation on different types of FTTX
- Field visit to nearby BSNL office and understand different PON elements and its functionalities
- Execute and understand the Connectorization of PON networks by the guidance of BSNL executives

Skill Practice	Time	Resources
• Field Visit to BSNL office Understand PON elements and its features • Execute Connectorisation & maintenance procedure by taking the guidance from the officers • Demo on ONT service Configuration	04 Hrs	Field visit

3.7.11 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 3.8: ONT Status Check

Unit Objectives

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

1. ONT Status Check
2. LED Verification
3. CCU Status Verification
4. ONT Service Configurations
5. ONT Preventive Maintenance
6. ONT Registration Failures and Solutions

Resources to be Used

- Available objects such as a duster, pen, projector & other teaching aids
  Presentation slides
- Multimedia

3.8.1 Note

This is the twenty-third session of the program which talks about ONT status check. Kindly explain the ONT status check details to participants to enable them to perform their task effectively.

3.8.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

3.8.3 Do

Begin with revising the things explained in previous session. Ask the following question

- How do you identify ONT status?
- What are the connectivities available in ONT devices?
- List all services offered by ONT
- Explain ONT site survey Procedure.

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

3.8.4 Say

Let us start a new session on ONT services and Maintenance.

3.8.5 Do

Share the details of ONT status check to participants.

3.8.6 Elaborate

Refer participant handbook to explain ONT status check to participants.

3.8.7 Do

Tell the participants to get ready for the activity on ONT services.

3.8.8 Activity

- Set guidelines pertaining to discipline
- Field Visit to real time GPON functioning site (GP)
- Make groups and show case ONT hardware, CCU –SPV hardware, OLT hardware to each groups.
- Showcase the functionality CCU coupler Unit and Identify the ONT - LED status

Skill Practice	Time	Resources
Show case ONT hardware, CCU – SPV hardware, OLT hardware to each groups. Showcase the functionality CCU Coupler Unit and Identify the ONT LED status	02 Hrs	Demonstration on GPON

3.8.9 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 3.9: ONT Service Configuration

Unit Objectives

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

1. ONT Service Configuration

Resources to be Used

- Available objects such as a duster, pen, projector & other teaching aids
  Presentation slides
- Multimedia

3.9.1 Note

This is the twenty-fourth session of the program which talks about ONT service configuartion. Kindly explain the ONT configuration details to participants to enable them to perform their task effectively.

3.9.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provide. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

3.9.3 Do

Begin with revising the things explained in previous session. Ask the following question

- Define ONT
- Define CCU

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

3.9.4 Say

Let us begin a new session on ONT service Configuration.

3.9.5 Do

Share the details of ONT service configurations.

3.9.6 Elaborate

Refer Participant handbook to explain the different service configurations in ONT.

3.9.7 Do

Tell the participant to get ready for the activity.

3.9.8 Activity

- Set guidelines pertaining to discipline
- Showcase and explain ONT service configurations

Skill Practice	Time	Resources
• Show case and explain ONT Service Configurations 1. IP TV Configuration 2. Wifi Configuration 3. PPPoE Configuration 4. High Speed Internet Service Configuration	02 Hrs	Demonstration on GPON

3.9.9 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 3.10: ONT Preventive Maintenance

Unit Objectives

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

1. ONT Preventive & Patrolling Maintenance

Resources to be Used

- Available objects such as a duster, pen, notebook, projector & other teaching aids
  Presentation slides
- Multimedia

3.10.1 Note

This is the twenty-fifth session of the program which talks about ONT preventive maintenance. Kindly explain ONT preventive maintenance details to participants to enable them to perform their task effectively.

3.10.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

3.10.3Do

Begin with revising the things explained in previous session. Ask the following question

- Explain ONT Wi-Fi configuration
- Explain IP TV configurations

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

3.10.11Say

Let us begin a with a new topic ONT preventive maintenance.

3.10.12 Do

Share the details of ONT preventive maintenance to participants.

3.10.13 Ask

Ask the participants whether they know about Do's and Don'ts at the work field. If they say yes, ask them to write the do's and don'ts on black board.

3.10.14 Elaborate

Refer Participant handbook to explain in details about preventive maintenance.

3.10.15 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 3.11: ONT Maintenance and Troubleshoot

Unit Objectives

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

1. ONT - Registration failures and solutions

Resources to be Used

- Available objects such as a duster, pen, notebook, projector & other teaching aids
  Presentation slides

3.11.1 Note

This is the twenty-sixth session of the program which talks about ONT maintenance and troubleshoot. Kindly explain the ONT maintenance and troubleshoot details to participants to enable them to perform their task effectively.

3.11.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

3.11.3 Do

Begin with revising the things explained in previous session. Ask the following question

- Explain patrolling practices of handling optical fibers

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

3.11.4 Say

Let us start a new session on ONT Maintenance and trouble shooting.

3.11.5 Do

Share the details of ONT registration failures and solution to participants.

3.11.6 Activity

- Set guidelines pertaining to discipline
- Field Visit to real time GPON functioning site (GP)
- Demonstrate and explain ONT Failing and solutions

ONT registration Failures

Skill Practice	Time	Resources
• Demonstrate and explain ONT Failing and solutions ONT registration Failures	04 Hrs	Active ONT at GP

3.11.7 Elaborate

Refer Participant handbook to explaining details about ONT Maintenance and troubleshooting.

3.11.8 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 3.12: Record Repairs/Replacements

Unit Objectives

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

1. Record repairs/replacements undertaken during fault rectification

Resources to be Used

- Available objects such as a duster, pen, notebook, projector & other teaching aids Presentation slides

3.12.1 Note

This is the session of the program which talks about record repairs/replacements undertaken during fault rectification. Kindly explain the significance of recording and storing the data.

3.11.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session, let us revise the previous session.

3.11.3 Do

Begin with revising the things explained in previous session. Ask the following question

- Explain about ONT maintenance and troubleshoot

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

3.11.4 Say

Let us start a new session on record repairs/replacements undertaken during fault rectification.

3.12.5 Do

Share the details of reports to be maintained on frequent basis to ensure status updates

3.12.6 Elaborate

Refer Participant handbook to explaining details about ONT Maintenance and troubleshooting.

3.12.7 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

Exercise

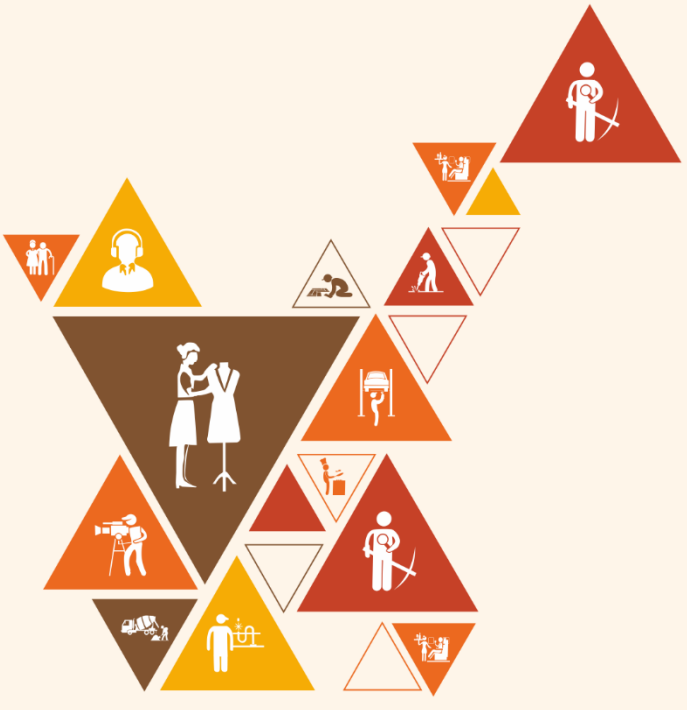
Answers to exercises for PHB

Descriptive
Unit 3.1 Exercise
Refer Unit 3.1: Fibre Optics Overview
Topic – 3.1.1 History of Fibre Optics
Refer Unit 3.1: Fibre Optics Overview
Topic – 3.1.2 dvantage and Disadvantages of Optical Fiber
Refer Unit 3.1: Fibre Optics Overview Topic – 3.1.3 Optical Fibre Standards
Unit 3.2 Exercise
Refer Unit 3.2: Light in Fibre Topic – 3.2.1 Fiber Structure
Refer Unit 3.2: Light in Fibre
Topic – 3.2.2 Fibre Glass as medium
Refer Unit 3.2: Light in Fibre
Topic – 3.2.4 Fibre Refractive Index Profiles
Unit 3.3 Exercise
Refer Unit 3.3: Light Propagation and Related Losses
Topic – 3.3.1 Polarization and 3.3.2 Interference
Refer Unit 3.3: Light Propagation and Related Losses Topic 3.3.3 Chromatic Dispersion
Refer Unit 3.3: Light Propagation and Related Losses Topic 3.3.5 Snell's Law
Refer Unit 3.3: Light Propagation and Related Losses Topic 3.3.6 Critical ngle
Refer Unit 3.3: Light Propagation and Related Losses Topic 3.3.8 Noise and Loss
Unit 3.4 Exercise
Refer Unit 3.4: Optical Sources Topic - 3.4.2 LED
Refer Unit 3.4: Optical Sources Topic - 3.4.3 Laser
Refer Unit 3.4: Optical Sources Topic - 3.4.4 Optical Light Guides
Unit 3.5 Exercise
Refer Unit 3.5:GPON
Topic 3.5.1 GPON (pg 105)
Refer Unit 3.5:GPON
Topic 3.5.1 GPON (pg 107)
Refer Unit 3.5:GPON Topic 3.5.1 GPON (pg 84)
Refer Unit 3.5:GPON
Topic 3.5.1 GPON (pg 106)
Refer Unit 3.5:GPON Topic 3.5.1 GPON (pg 91)
Unit 3.9 Exercise (Contd.)
Refer Unit 3.9: ONT Service Configuration Topic 3.9.5 IPTV Configuration
Refer Unit 3.9: ONT Service Configuration
Topic 3.9.6 Phone(voice)/F Service Configuration
Unit 3.10 Exercise
Refer Unit 3.10: ONT Preventive Maintenance
Topic Topic 3.10.1 ONT Preventive Measurements
Refer Unit 3.10: Preventive Maintenance
Topic 3.10.1 ONT Preventive Measurements (pg 165)
Unit 3.11 Exercise
Refer Unit 3.11: ONT Maintenance and Troubleshoot Topic 3.11.1 ONT- Registrations Failures and Solutions
Refer Unit 3.11: ONT Maintenance and Troubleshoot
Topic 3.11.1 ONT- Registrations Failures and Solutions

Notes

4. Promote Usage of Telecom Devices & Provide Services

Unit 4.1 - Approach to Common Service Centers (CSC)
Unit 4.2 - Digital Devices & Digital Approaches
Unit 4.3 - Monitoring & Maintenance of Electrical Systems
Unit 4.4 - Revenue Management and Record Maintenance



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Key Learning Outcomes

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

1. Explain the purpose and significance of the CSC Outreach Programme, and describe its role in extending digital services to rural and underserved communities.
2. Understand the concept of Network for Information & Communication Technologies (NICT) and its application in enhancing the effectiveness of Common Services Centres (CSCs).
3. Identify major Internet Service Providers (ISPs) and understand their role in enabling internet connectivity in various regions.
4. Demonstrate understanding of broadband technology, including types, usage, and the benefits of high-speed internet in promoting digital inclusion.
5. Analyze the impact of digitization in India, and discuss key government initiatives driving digital transformation across sectors.
6. Recognize and operate various digital devices such as smartphones, tablets, computers, routers, and modems commonly used for telecom and e-services.
7. Identify popular mobile and web-based applications, and understand the compatible devices and platforms required for effective usage.
8. Provide support for accessing and using various e-services, including government portals, online payments, and citizen service platforms.
9. Understand the structure and function of e-terminals and kiosks, and explain their role in delivering public services in remote locations.
10. Navigate and promote key utility apps and service links, helping users access essential digital resources like DigiLocker, mAadhaar, UMANG, BHIM, etc.
11. Understand the basics of electrical systems and their various types, relevant to powering telecom and digital devices.
12. Identify types of batteries and power banks, and explain their applications in maintaining device uptime and portability.
13. Understand the function and importance of UPS (Uninterruptible Power Supply) systems in ensuring uninterrupted power supply to critical telecom equipment.
14. Apply basic electrical maintenance practices to ensure the safe and effective functioning of digital and telecom infrastructure.
15. Demonstrate methods of revenue management and record maintenance, including proper documentation of service transactions and financial records to ensure accountability and transparency in CSC operations.

UNIT 4.1: Approach to Common Service Centers

Unit Objectives

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

1. Common Service centers (CSC) Outreach Programme
2. Network for Information & Communication technologies(NICT) for CSC
3. Internet Service Providers (ISP)
4. Broadband

Resources to be Used

- Available objects such as a duster, pen, notebook, projector & other teaching aids
  Presentation slides
- Multimedia

4.1.1 Note

This is the twenty-seventh session of the program which talks about approach to common service centers. Kindly explain the common service centers details to participants to enable them to perform their task effectively.

4.1.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

4.1.3 Do

Begin with revising the things explained in previous session. Ask the following question

- List the ONT dos and don'ts

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

4.1.4 Say

Let us begin a new session on approach to common service centers (CSC).

4.1.5 Do

Share the details of service centers Outreach program and NICT cash collection centers to participants.

4.1.6 Elaborate

Common service centers are providing various govt. services to people like Certificates (Birth, Death, Domicile, caste, Income etc) MNREGA payments, NIELIT's CCC courses and non-government service, Bank account opening, withdrawal/ deposit, loan document, online railways, and airline ticket booking, DTH recharge, etc. It includes an exhibition van which is giving hand on experience about various public services available through this Centre. While other interesting elements of the exhibition like nukkad natak, audio visual experience and VLE assistance is educating people about convenience and transparency of services available through CSCs.

Common service centers are part of National e-governance plan which is a major initiative of the Government of India for ushering in e-Governance for improving the quality of basic governance, on a massive scale in areas of concern to the common man. The vision of NeGP is to "Make all Government services accessible to the common man in his locality, through common service delivery outlets and ensure efficiency, transparency & reliability of such services at affordable costs to realize the basic needs of the common man".

Vision of CSC SPV

To develop CSCs as a dependable, reliable, and ubiquitous IT enabled network of Citizen Service Points connecting local population with the Government departments, business establishments, banks and insurance companies and educational institutions, with an impact on primary, secondary and tertiary sectors of the country's economy.

Role of CSC SPV

Ensure ubiquitous presence of citizen service points in all geographies, in line with the vision of 'Digital India' and to operationalize CSCs across States/UTs. Support GOI / States/ UTs to enable delivery of G2C services. Facilitate integration of e-Governance services (Central/State MMPs) portals and NIC driven applications. Support State Designated Agencies (SDAs) in setting up of state CSC portals using requisite API integration with payment gateway, etc.

Objectives of CSC 2.0

Non-discriminatory access to e-Services for rural citizens by making CSCs complete service delivery centers, utilizing the infrastructure already created in terms of other Mission Mode Projects. Expansion of self-sustaining CSC network till the Gram Panchayat level – 2.5 lakh CSCs, i.e. at least one CSC per Gram Panchayat, more than one preferred. Empower District e-Governance Society (DeGS) under the district administration for implementation.

4.1.6 Elaborate Continued

NICT Cash Collection Centers

Network for Information and Communication Technology's (NICT) is an Indian non-governmental organization that has been working in the field of technology solutions for better service delivery. The SDA of Madhya Pradesh - Madhya Pradesh State Electronics Development Corporation (MPSEDC) - appointed NICT as the Service Centre Agency (SCA) for establishing CSCs in 2158 locations in Indore and Ujjain, Madhya Pradesh.

4.1.7 Ask

Ask participant whether they know about ISP's, If yes ask them to list major ISPs in their region. Ask them about the features of broadband and list it on blackboard and explain in details.

4.1.8 Do

Share with participant about Internet service providers and broadband.

4.1.9 Elaborate

Internet Service Provider

An Internet service provider (ISP) is an organization that provides services accessing and using the Internet. Internet service providers may be organized in various forms, such as commercial, community- owned, non-profit, or otherwise privately owned. Internet services typically provided by ISPs include Internet access, Internet transit, and domain name registration, web hosting, Usenet service and colocation. ISPs provide Internet access, employing a range of technologies to connect users to their network. Available technologies have ranged from computer modems with acoustic couplers to telephone lines, to television cable (CATV), wireless Ethernet (wi-fi), and fiber optics. For users and small businesses, traditional options include copper wires to provide dial-up, DSL, typically asymmetric digital subscriber line (ADSL), cable modem or Integrated Services Digital Network (ISDN) (typically basic rate interface). Using fiber-optics to end users is called Fiber to The Home or similar names.

4.1.9 Elaborate Continued

Broadband

In telecommunications, broadband is wide bandwidth data transmission which transports multiple signals and traffic types. The medium can be coaxial cable, optical fiber, radio, or twisted pair. In the context of Internet access, broadband is used to mean any high-speed Internet access that is always on and faster than traditional dial-up access.

In telecommunications, a broadband Signaling method is one that handles a wide band of frequencies. "Broadband" is a relative term, understood according to its context. Wider (broader) the bandwidth of a channel then greater the information carrying capacity of the channel. In radio, for example, a very narrow band will carry Morse code, a broader band will carry speech, and a still broader band will carry music without losing the high audio frequencies required for realistic sound reproduction. This broad band is often divided into channels or "frequency bins" using pass band techniques to allow frequency-division multiplexing instead of sending a higher-quality signal.

In data communications, a 56k modem will transmit a data rate of 56 kilobits per second (Kbit/s) over a 4- kilohertz-wide telephone line (narrowband or voice band). In the late 1980s, the Broadband Integrated Services Digital Network (B-ISDN) used the term to refer to a broad range of bit rates, independent of physical modulation detail

4.1.10 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 4.2: Digital Devices and Digital Approaches

Unit Objectives

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

1. Digitization in India
2. Digital Devices
3. Apps & Related Devices
4. E Services
5. E terminal & Kiosk
6. Utility Apps Links

Resources to be Used

- Available objects such as a duster, pen, projector & other teaching aids
  Presentation slides
- Multimedia

4.2.1 Note

This is the twenty-eighth session of the program which talks about digital devices and digital approaches. Kindly explain the electrical system details to participants to enable them to perform their task effectively.

4.2.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

4.2.3 Do

Begin with revising the things explained in previous session. Ask the following question

- List all ISPs in India
- What is Broadband?

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

4.2.4 Say

Let us start a new topic that is Digitization in India.

4.2.5 Do

Share the details of Digitization in India to participants.

4.2.6 Ask

Ask participants whether they know about digital India project, if yes ask them to explain the project aim and details

4.2.7 Elaborate

Refer to Participant handbook and internet to explain Digitization in India

4.2.8 Say

Let us a start a new session on Digital devices and applications

4.2.9 Do

Share the details of digital devices and related Applications.

4.2.10 Elaborate

Refer Participant handbook to explain the following

1. Desktop
2. Laptop
3. Smart phones
4. OS – (Android, Apple IOS, Windows)
5. Tablets

4.2.11 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 4.3: Monitoring & Maintenance of Electrical System

Unit Objectives

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

1. Electrical Systems & its types
2. Batteries & Power banks
3. UPS
4. Electrical Maintenance

Resources to be Used

- Available objects such as a duster, pen, projector & other teaching aids
  Presentation slides
- Multimedia

4.3.1 Note

This is the twenty-ninth session of the program which talks about monitoring and maintenance of electrical system. Kindly explain the electrical system details to participants to enable them to perform their task effectively.

4.3.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

4.3.3 Do

Begin with revising the things explained in previous session. Ask the following question

- Explain need of smart smartphones and Apps.
- Discuss digitization in India

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

4.3.4 Say

Let us begin a new session of monitoring and maintenance of Electrical systems.

4.3.5 Do

Share the details of Electrical systems and its types to participants.

4.3.6 Elaborate

Refer Participant handbook to explain about electrical systems and its types.

4.3.7 Say

Let us discuss on batteries and Power banks using in GPON.

4.3.8 Do

Share the details of batteries and power bank using in GPON to participants..

4.3.9 Elaborate

A battery is an electrochemical cell (or enclosed and protected material) that can be charged electrically to provide a static potential for power or released electrical charge when needed. A battery generally consists of an anode, a cathode, and an electrolyte. Common types of commercial batteries and some of their characteristics and advantages are summarized in the following table. Battery types not shown include the Zinc-Air, Flooded Lead Acid, and Alkaline batteries.

CCU & SPV

Power to ONT is derived from AC mains, Solar panel & battery bank. CCU – charge coupler unit consists of controller board, battery and serge boards for AC mains and solar panel. SPV is single integrated switch mode power supply that can work in both single-phase AC mains input as well as solar photovoltaic panel output (SPV)

Solar panel

The SPV is mounted & fixed onto the specialty designed module mounting structure. The orientation of SPV panel mounted on a structure can be adjusted in 2 axes

UPS

The Uninterruptible power supply (UPS) is an online power protection system that prevents loss of valuable electronic information, minimizes equipment downtime, and minimizes the adverse effect on equipment production because of unexpected power problems.

4.3.10 Say

Let us start a new discussion on Electrical maintenance.

4.3.11 Do

Share the details of Electrical maintenance to participants.

4.3.12 Elaborate

The electrical maintenance technician installs or repairs equipment that has electrical components either on site or at centralized repair facilities. Maintenance electricians use testing devices to discover problems with wiring, fixtures, or other electrical equipment. They replace or repair the defective elements using various types of hand or power tools.

Refer Participant handbook to explain following

1. Equipment handling
2. Precautions
3. Testing and Status Check
4. Do's & Don'ts in Electrical Operations
5. Health & Safety Precautions

4.3.13 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

UNIT 4.4: Revenue Management and record maintenance

Unit Objectives

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

1. Revenue Management and Record Maintenance

Resources to be Used

- Available objects such as a duster, pen, projector & other teaching aids
- Presentation slides
- Multimedia

4.4.1 Note

This is the thirtieth session of the program which talks about Revenue management and record maintenance. Kindly explain the safety details to participants to enable them to perform their task effectively.

4.4.2 Say

Good morning and warm welcome to this training program on Grass Root Telecom Provider. Before begin a new session on electromagnetic spectrum, let us revise the previous session.

4.4.3 Do

Begin with revising the things explained in previous session. Ask the following question

- Explain UPS.
- What are the do’s and don'ts in electrical operations?

Encourage participants to give answer. If they have any doubt, clarify it and tell them about what they are going to study in new session.

4.4.4 Say

Let us start a new session on Revenue Management and Record Maintenance.

4.4.5 Do

Share the details of revenue management and record maintenance to participants.

4.4.6 Elaborate

Refer Participant handbook to explain the details of revenue management and record maintenance.

4.4.7 Notes for Facilitation

- Maintain a teaching pace appropriate to the students because they are learning these technical topics from a practical viewpoint for the first time.
- Prepare Multimedia or collect multimedia pictures.
- Collect Videos, Prepare some question & answer before taking a class.
- Prepare PPT & some revised previous topic & Current topic.

Exercise

Answers to exercises for PHB

Descriptive

Unit 4.1 Exercise

1. Refer Unit 4.1: pproach to Common Service Centers (CSC)
   Topic – 4.1.1 Outreach Programme
2. Refer Unit 4.1: pproach to Common Service Centers (CSC)
   Topic 4.1.2 System for Information & Communication Technologies (NICT) Cash Collection Centers
3. Refer Unit 4.1: pproach to Common Service Centers (CSC) Topic
   4.1.3 Internet Service provider
4. Refer Unit 4.1: pproach to Common Service Centers (CSC) Topic
   4.1.4 Broadband

Unit 4.2 Exercise

1. Refer 4.2 : Digital Devices & Digital pproaches
   Topic - 4.2.1 Digitization in India
2. Refer 4.2 : Digital Devices & Digital pproaches
   Topic - 4.2.1 Digital Devices
3. Refer 4.2 : Digital Devices & Digital pproaches
   Topic - 4.2.1 Smart Phones
4. Refer 4.2 : Digital Devices & Digital pproaches
   Topic - 4.2.1 pps & Related Devices Continued
5. Refer 4.2 : Digital Devices & Digital pproaches Topic - 4.2.2 E terminal &iosk
6. Refer 4.2 : Digital Devices & Digital pproaches Topic - 4.2.3 E Services

Unit 4.3 Exercise

1. Refer 4.3 : Monitoring & maintenance of Electrical Systems Topic - 4.3.1 Electrical Systems & its types
2. Refer 4.3 : Monitoring & maintenance of Electrical Systems Topic - 4.3.2 Batteries & Power banks
3. Refer 4.3 : Monitoring & maintenance of Electrical Systems Topic - 4.3.3 UPS
4. Refer 4.3 : Monitoring & maintenance of Electrical Systems Topic - 4.3.4 Electrical Maintenance
5. Refer 4.3 : Monitoring & maintenance of Electrical Systems Topic - 4.3.4 Do's & Don'ts in Electrical Operations
6. Refer 4.3 : Monitoring & maintenance of Electrical Systems Topic - 4.3.4 Health & Safety Precautions.

Unit 4.4 Exercise

Refer 4.4 : Revenue Management and record maintenance Topic - 4.4.1Revenue Management and record maintenance

Descriptive

Unit 4.4 Exercise (Continued)

2. Refer 4.4 : Revenue Management and record maintenance

Topic - 4.4.1 Revenue Management and record maintenance (pg 211)

3. Refer 4.4 : Revenue Management and record maintenance

Topic - 4.4.1 Revenue Management and record maintenance (pg 212)

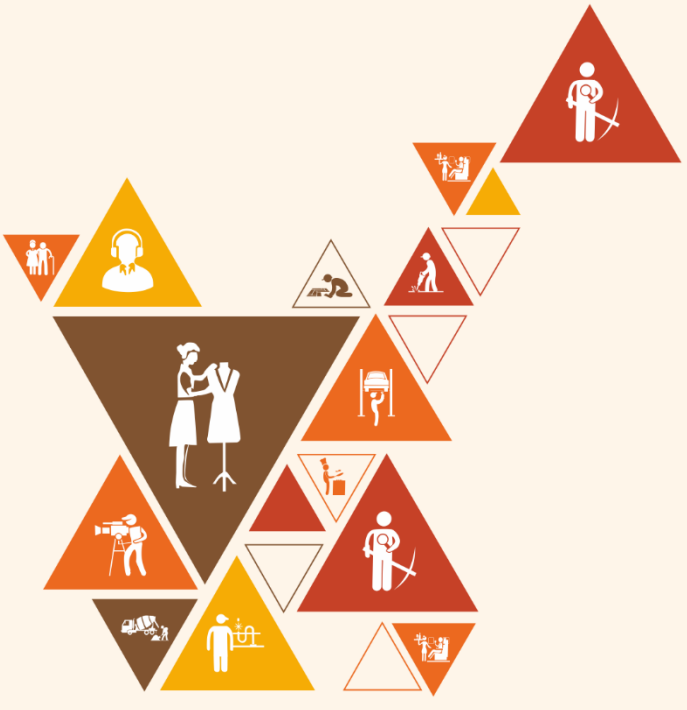
4. Refer 4.4 : Revenue Management and record maintenance

Topic - 4.4.1 Revenue Management and record maintenance (pg 213)

Notes

5. Sustainable Practices in Telecom Infrastructure Management

Unit 5.1 - Managing Hazardous and E-waste at Telecom Sites
Unit 5.2 - Adopting Green Energy and Resource Efficiency
Unit 5.3 - Following Waste Reduction Strategies
Unit 5.4 - Ensuring Compliance with Environmental Regulations



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Key Learning Outcomes

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

1. Categorize, store, and dispose of hazardous materials and e-waste from telecom sites.
2. Apply green energy solutions and optimize resource efficiency at telecom facilities.
3. Employ effective strategies to reduce, reuse, and recycle waste across operations.
4. Adhere to all relevant environmental laws and regulations for telecom sites.
5. Identify and mitigate environmental risks associated with telecom site operations.

UNIT 5.1: Workplace Health and Safety

Unit Objectives

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

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

Resources to be Used

- Participant handbook, white board marker pen, notebook, whiteboard, flipchart, laptop, overhead projector, laser pointer, etc.

Notes

- In this unit, we will discuss about workplace health & safety.

Say

Good morning and welcome back to this training program on Telecom E-Waste Handler. In this session, we will discuss about workplace health & safety practices.

Ask

Ask the trainees the following questions:

- What do you understand by workplace safety?

Write down the trainees' answers on the whiteboard/flipchart.
Draw appropriate cues from the answers and start teaching the lesson.

Say

In this session, we will discuss the following points:

- Safety: Tips to design a safe workplace
- Non-Negotiable employee safety habits

Let us participate in an extempore activity to understand this unit better.

Activity

- This activity will be based on individual performance.
- Provide each trainee with a printout/Xerox copy of the safety hazard report
- Now ask each of them to fill up the report individually
- After completing, collect all the forms and evaluate them
- End the session by providing constructive feedback

Activity	Duration (in mins)	Resources Used
Role-play – Safety Hazard Report	40 minutes	Participant handbook, whiteboard, notebook, laptop, pen, pencil, marker, printout/Xerox copy of safety hazard report, etc.

Do

- Ensure that the report contains all possible hazards in the workplace, safety measures, and ways to counter the hazards if they occur
- Guide the trainees throughout the activity
- Ask the trainees if they have any questions
- Encourage other trainees in the class to answer it and encourage peer learning in the class
- Explain the consequences of not following the safety guidelines at the workplace

UNIT 5.2: Different types of Health Hazards

Unit Objectives

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

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

Resources to be Used

- Participant handbook, pen, notebook, whiteboard, markers, flipchart, laptop, overhead projector, laser pointer, equipment and tools, safety signs and symbols, safety equipment

Notes

- In this unit, we will discuss about different types of health hazards and first aid techniques

Say

- Good morning and welcome back to this training program on Telecom E-Waste Handler. In this session, we will discuss about different types of health hazards.

.

Ask

Ask the trainees the following questions:

- What is a health hazard?
- Can you name any health hazards that may occur at the workplace?
- Write down the trainees' answers on the whiteboard/flipchart.

Draw appropriate cues from the answers and start teaching the lesson.

Notes for Facilitation

- Illness, injuries, and pain are part of human life. This can happen anyway. Every individual is prone to illness and injuries at anytime and anywhere.
- In case of any of these, some kind of immediate medical attention or treatment is needed to reduce the discomfort, pain, and deterioration of the condition

- Explain the first aid techniques for injuries due to various causes. For burns, electric shock, fracture due to accidental fall etc.
- Explain the concept of CRP and give a demonstration using a video how to administer CRP for a patient suffering a heart attack.
- Through a demonstration explain the use of various safety gadgets used in the workplace.

Say

In this session, we will discuss the following points:

- First aid
- First aid techniques
- For burns
- For broken bones and fractures
- For heart attack/stroke
- For head injury
- Using breathing apparatus
- Briefing and guidance for firefighters
- Evacuation process
- Special evacuation requirements for specially-abled persons
- Importance of fire safety drills
- Let us participate in an activity to understand this unit better.

Activity

- This session will be in the form of a "Show and Explain " activity.
- In this activity, bring a few PPE (relevant to the job role) to the class and demonstrates each of them - safety helmet, safety goggles, gloves, ear muff, respirator, harness, safety boots, etc.
- Now ask the trainees to identify the PPE and state their usage
- After the session, you will select a few volunteers and make them wear PPEs.
- The focus of this activity is to select and use appropriate personal protective equipment compatible with the work and compliant with relevant occupational health and safety guidelines.

Activity	Duration (in mins)	Resources Used
Practical activity - PPE	40 minutes	Participant handbook, laptop, overhead projector, internet connection, various protective equipment like safety helmet, safety goggles, gloves, ear muff, respirator, harness, safety boots, etc.

Do

- Ensure that all trainees participate in the activity
- Share your inputs and insight to encourage the trainees and add to what they talk about

Summarize

- Ask the participants what they have learnt so far.
- Ask if they have any questions related to what they have talked about so far.
- Close the discussion by summarizing the different health hazards and video demo of how to wear the PPE kits and first aid techniques.

UNIT 5.3: Importance of Safe Working Practices

Unit Objectives

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

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

Resources to be Used

- Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Notes

- In this unit, we will discuss about the importance of safe working practices.

Say

- Good morning and welcome back to this training program on Telecom E-Waste Handler. In this session, we will discuss about the importance of safe working practices

Ask

Ask the trainees the following questions:

- List a few personal hygiene tips that you regularly follow.
- How social distancing helps to reduce the spread of Covid 19?
- What are the various covid protocols people followed during the pandemic?

Write down the trainees' answers on the whiteboard/flipchart.

Draw appropriate cues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

- Basic hygiene practices
  - Personal hygiene
  - Personal hygiene practices at home
- Importance of social distancing
  - Social distancing and isolation
  - Self-quarantine
  - Disposing off the PPE kits
- Safe workplace practices
  - Supplies and Accessories in the first aid box
  - CPR

Say

- Let us participate in a practical activity to understand this unit better.

Notes for Facilitation

- Familiarize the trainees with the first aid box and the supplies inside it.
- Explain the importance of first aid and why is it good to know how to administer CRP for a patient who has suffered a heart attack.
- Answer all the questions/doubts raised by the trainees in the class
- Encourage other trainees to answer queries/questions and boost peer learning in the class

Practical

- Gather all the trainees in the laboratory and divide them into groups of two
- Ask each group to demonstrate the correct process for performing CRP
- Ensure the students follow all the steps of CPR in the correct sequence
- This activity can also be performed on a dummy, if available

Activity	Duration (in mins)	Resources Used
Practical activity - CPR	60 minutes	Participant handbook, whiteboard, notebook, laptop, pen, marker, dummy (if available), etc.

Do

- Prepare in advance and use appropriate energisers
- Encourage the students to explore how the training session can help them improve their work
- Keep the ambience constructive and positive
- Ensure each contribution is given fair consideration

UNIT 5.4: Reporting Safety Hazards

Unit Objectives

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

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

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Say

- Good morning and welcome to this training program on Customer Care Executive (Repair Centre) In this session, we will discuss about reporting safety hazards.

Ask

- Ask the trainees the following questions:
  - What is a safety hazard?
  - Write down the trainees' answers on the whiteboard/flipchart.
- Draw appropriate cues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

- Methods of reporting safety hazards
- Describing hazard matrix
- Hazard report form

Say

- Let us participate in an activity to understand this unit better.

Notes for Facilitation

- Explain the trainees about reporting the safety hazards to the people concerned.
- Explain the 6C's of communication protocols followed in the organizations.
  - Communicate First
  - Communicate Rightly
  - Communicate Credibly
  - Communicate Empathetically
  - Communicate to instigate appropriate action
  - Communicate to promote respect
  - Explain about the Hazard report form
  - Ask the trainees if they have any questions
- Encourage other trainees to take part in the activity and encourage peer learning in the class
- Discuss the exercises at the end of the chapter in the Participant Handbook and encourage them to answers.

Activity

- Divide the class into small groups
- Conduct a quiz and ask questions related to the unit
- Display all questions on the projector screen
- Display the correct answer after all groups have got their chances of answering a given question

Activity	Duration (in mins)	Resources Used
Quiz – Interpreting Signs	40 minutes	Laptop, internet connection, overhead projector, white screen, whiteboard, markers, laser pointer

Do

- Ask a student to maintain the scores on the whiteboard
- Jot down the crucial points on the whiteboard as the students speak
- Share your inputs and insight to encourage the students and add to what they talk about
- Ensure that all students participate in the class
- Ask a student to summarise what was discussed in the session
- Demonstrate enthusiasm for the subject matter, course and participant's work

UNIT 5.5: Waste Management

Unit Objectives

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

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

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Say

- Good morning and welcome back to this training program on Telecom Customer Care Executive (Repair Centre).
- In this session, we will discuss about waste management.

Ask

- Ask the trainees the following questions:
  - What do you understand by waste management?
  - What are the sources of medical waste?
- Write down the trainees' answers on the whiteboard/flipchart.
- Draw appropriate cues from the answers and start teaching the lesson.

Elaborate

- In this session, we will discuss the following points:
  - Introduction to e-waste
  - What is e-waste?
  - Electronic goods/gadgets are classified under three major heads
  - E-waste management process
  - Recyclable and non-recyclable waste
  - Colour codes of waste collecting bins
  - Waste disposal methods
  - Sources of waste
  - Source of Pollution
- Types of Pollution – Air, Water, Soil, Noise, Light

Say

- Let us participate in an extempore activity to understand this unit better.

Notes for Facilitation

- Encourage other participants to answer it and encourage peer learning in the class
- Answer all the doubts in case any of the participants

Activity

- This activity will be based on individual performance.
- In this activity, you will give two topics to the trainees
- The first topic in this session will be air pollution.
- The second topic on which the trainees will prepare their extempore will be on waste disposal method.
- You will randomly pick up trainees and separate them into two groups.
- Ensure that the trainees are equal in number.
- Allot the trainees 2 minutes to prepare the topic you will give them.
- After the time is up, you will call out any trainee and ask them to speak on the topic for 5 minutes.
- The trainee, with a simple explanation but rich content, will be appreciated with accolades.

Activity	Duration (in mins)	Resources Used
Extempore	40 minutes	Participant Handbook, Whiteboard, Notebook, Pen, Pencil, Marker, etc.

Do

- Do a de-briefing of the activity
- Conduct a doubt clarification session if needed.
- Encourage the quiet and shy trainees to open up and speak

UNIT 5.6: Organization's focus on Greening of Jobs

Unit Objectives

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

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

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Say

- Good morning and welcome back to this training program on Telecom Customer Care Executive (Repair Centre).
- In this session, we will discuss about greening of Jobs

Ask

- Ask the trainees the following questions:
  - What is ESG?
  - Write down the trainees' answers on the whiteboard/flipchart.
- Draw appropriate cues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

- What is ESG?
- ESG stands for Environmental, Social, and Governance.
- Environmental, social, and governance (ESG) investing refers to a set of standards
- for a company's behaviour used by socially conscious investors to screen potential investments.
- Investors are increasingly applying these non-financial factors as part of their analysis process to identify material risks and growth opportunities.
- Factors of ESG
- Environmental
- Social
- Governance

Say

- Let us participate in a group discussion to explore the unit a little more.

Notes for Facilitation

- Encourage other participants to answer it and encourage peer learning in the class
- Answer all the doubts in case any of the participants
- Discuss the proper combination technique in group discussion
- Make sure everybody understood the concept of greening of Jobs

Activity

- Conduct a group discussion in the class on the factors of ESG
- Ask the participants what they have learnt from this exercise
- Ask if they have any questions related to what they have talked about so far
- Close the discussion by summarising the importance of the ESG in recent times

Activity	Duration (in mins)	Resources Used
Group Discussion	45 minutes	Participant Handbook, Whiteboard, Notebook, laptop, Pen, Pencil, Marker, microphone and speakers etc.

Do

- Do a de-briefing of the activity
- Conduct a doubt clarification session if needed.
- Encourage the quiet and shy trainees to open up and speak
- Ensure a friendly and cordial atmosphere during the group discussion
- Give chance to each and everybody to give their opinion
- Guide the students in identifying key points

Ask

- If they can, why can't you?
- Discuss concepts related to 'Creativity and Innovation' with the participants as given in the Participant Handbook.

Say

- Recall the stories on motivation.
- What is the inner drive that motivates people to succeed?
- Let's learn more about such creative and innovative entrepreneurs with the help of an activity.

Do

- Conduct a doubt clarification session if needed.
- Encourage the non-participating trainees to open up and speak

Team Activity

- This is a group activity.
- Think of any one famous entrepreneur and write a few lines about him or her.

Activity De-brief

- Why did you choose this particular entrepreneur?
- What is his/her brand name?
- What creativity does he/she possess?
- What was innovative about their ideas?

Summarize

- Summarize the unit by asking participants if they know of some people who are highly creative and innovative in their approach.
- Ask them to share some experiences about these people with the class.

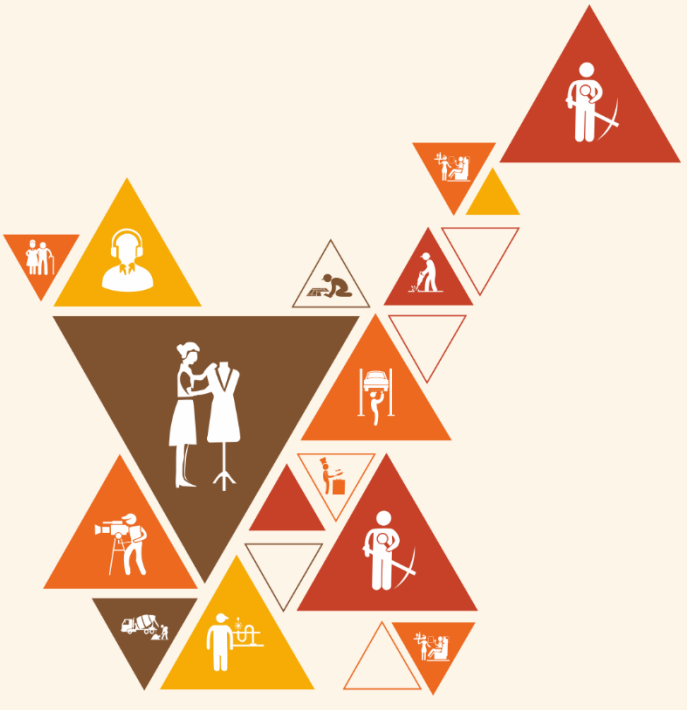
Notes for Facilitation

- Source for stories on innovations:
- http://www.rediff.com/getahead/report/achievers-top-31-amazing-innovations-from-young-Indians/20151208.htm

Notes

6. 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



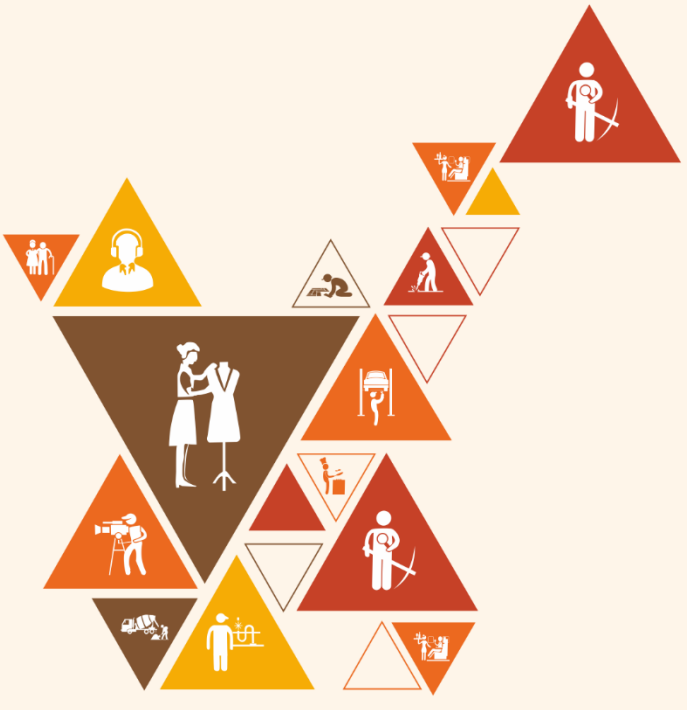
DGT/VSQ/N0101

7. 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:	Optical Network Terminal Technician		
Qualification PackName & Ref. ID	TEL/Q6207,		
Version No.	5.0	**Version Update Date**	8/04/2024
Pre-requisites toTraining (if any)	12th Class OR 10th Class + I.T.I OR Diploma (Science/Electronics/Telecom/IT and other relevant fields)		
Training Outcomes	**At the end of the program, the learner should have acquired the listed knowledge and skills to:** • Maintain site security and hygiene • Perform preventive maintenance of Optical Network (ONT) Components • Promote use of devices and provide services • Organize work and resources as per Health and Safety standards • Interact effectively with team members and customers		

Module Name	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
Module 1: Introduction to the sector and the job role of an Optical Network Terminal Technician	Introduction to ONT Technology & Sector	• Understand ONT technology and applications • Learn the role and responsibilities of an ONT Technician • Identify key stakeholders in ONT operations	KU1, KU4	Lecture, Role Discussion, Industry Overview	ONT models, network diagrams, role cards	3 Theory
	Regulatory Framework & Standards	• Learn industry standards and regulatory requirements • Understand compliance requirements for telecom sites • Study environmental sustainability guidelines	KU9	Compliance Workshop, Standards Review	Regulatory documents, compliance checklists, standards manuals	2 Theory
Module 2: Ensure Security and Hygiene at ONT Sites	Site Security Fundamentals	• Implement security measures for ONT sites • Conduct security assessments and checks • Apply physical security protocols	PC1, KU4	Security Workshop, Assessment Practice	Security assessment tools, checklists, security equipment	5 Theory / 8 Practical
	Site Hygiene & Maintenance Protocols	• Perform custodial functions for hygiene maintenance • Apply cleaning and maintenance standards • Implement hygiene monitoring systems	PC1, PC6, KU4	Hygiene Workshop, Maintenance Practice	Cleaning equipment, hygiene checklists, maintenance tools	5 Theory / 8 Practical
	Stakeholder Coordination & Communication	• Communicate with OLT and NOC supervisors • Coordinate with Gram Panchayat officials • Report issues and request upgrades effectively	PC2, PC3	Role-playing, Communication Drills	Communication devices, reporting templates, coordination charts	5 Theory / 8 Practical
	Environmental Compliance & Eco-practices	• Implement eco-friendly site management • Ensure environmental compliance standards • Apply environmental impact reduction techniques	PC4, KU7, KU9	Environmental Workshop, Compliance Practice	Environmental guidelines, compliance tools, eco-practice checklists	5 Theory / 8 Practical
	Renewable Energy Systems Monitoring	• Check functionality of SPV systems and CCU • Monitor solar-powered energy sources • Optimize renewable energy performance	PC5, PC9, KU3, KU5	Technical Workshop, Monitoring Practice	SPV systems, CCU units, monitoring equipment	5 Theory / 8 Practical

		Battery Bank & Power Management	• Maintain battery banks and power systems • Ensure uninterrupted power supply • Apply power backup management techniques	PC5, PC9, KU5, KU6	Power Management Workshop	Battery banks, power meters, backup systems	5 Theory / 8 Practical
		Cable Management & Troubleshooting	• Check cable connectors for secure connections • Detect and repair damaged cables • Apply safety protocols for cable work	PC7, PC8, KU5	Cable Workshop, Repair Practice	Cable samples, connectors, repair tools, testers	5 Theory / 8 Practical
		Emergency Procedures & Fire Safety	• Use fire extinguishers correctly • Follow emergency protocols for hazards • Implement safety measures for different situations	PC11, KU8	Emergency Drills, Safety Training	Fire extinguishers, safety equipment, emergency plans	5 Theory / 8 Practical
		Documentation & Reporting Systems	• Record faults and maintenance activities • Document energy efficiency parameters • Follow reporting procedures	PC12, KU10	Documentation Workshop, Reporting Practice	Reporting forms, documentation systems, record books	5 Theory / 8 Practical
		Fault Escalation & Issue Resolution	• Report faults that cannot be rectified • Coordinate with supervisors for resolution	PC10, KU2	Escalation Workshop, Problem-solving	Escalation matrices, problem-solving tools, communication protocols	5 Theory / 8 Practical

SL	Module	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
	Module 3: Conduct Preventive Maintenance of ONT Components	Preventive Maintenance Fundamentals	• Understand PM guidelines and importance	PC1, KU1, KU2, KU3	Lecture, Guidelines Review	PM guidelines, network uptime charts, protocol manuals	4 Theory
			• Learn criticality of network uptime				
			• Study organizational protocols				
		Equipment Familiarization & Setup	• Identify ONT components and specifications	PC3, KU6, KU10	Hands-on Workshop, Equipment Setup	CCU, SPV, TJB, battery banks, testing equipment	3 Theory / 6 Practical
			• Ensure availability of testing equipment				
			• Set up maintenance workstations				
		CCU Maintenance & Alarm Management	• Read and follow CCU maintenance guidelines	PC1, PC2, PC6, KU6	Technical Workshop, Alarm Simulation	CCU units, alarm panels, SOP documents	3 Theory / 6 Practical
			• Interpret CCU panel alarms				
			• Take corrective actions per SOP				
		SPV System Maintenance	• Conduct preventive maintenance of SPV systems	PC2, PC7, KU6	Solar Workshop, Inspection Practice	SPV panels, testing equipment, replacement parts	3 Theory / 6 Practical
			• Inspect SPV panels for ageing				
			• Replace defective solar components				
		Battery Bank Maintenance	• Maintain battery banks as per schedule	PC2, PC7, KU6	Battery Workshop, Testing Practice	Battery banks, cell testers, maintenance tools	3 Theory / 6 Practical
			• Inspect battery cells for defects				
			• Apply battery maintenance best practices				
		Cable & Wiring Inspection	• Examine patch cords, pigtails, electrical wiring	PC8, KU7	Cable Workshop, Testing Practice	Patch cords, pigtails, cable testers, wiring samples	3 Theory / 6 Practical
			• Test cables for damage and faults				
			• Replace faulty components properly				

	SL	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
		Advanced Testing Tools - Spectrum Analyzers	• Use spectrum analyzers for interference analysis	PC9, KU8, KU9	Equipment Training, Analysis Practice	Spectrum analyzers, signal generators, test scenarios	3 Theory / 6 Practical
			• Identify signal loss issues				
			• Interpret spectrum analyzer data				
		Advanced Testing Tools - OTDRs	• Operate OTDRs for fault detection	PC9, KU8	OTDR Training, Diagnostic Practice	OTDR units, fiber test setups, diagnostic scenarios	3 Theory / 6 Practical
			• Conduct optical network diagnostics				
			• Interpret OTDR traces and results				
		Remote Monitoring & Real-time Diagnostics	• Use remote monitoring tools for fault detection	PC4, KU4	Monitoring Workshop, Remote Diagnostics	Remote monitoring software, diagnostic tools	3 Theory / 6 Practical
			• Perform real-time diagnostics				
			• Apply troubleshooting procedures				
		Documentation & Reporting Systems	• Document maintenance activities properly	PC5, KU3, KU5	Documentation Workshop, Reporting Practice	PM report forms, documentation systems, compliance tools	3 Theory / 6 Practical
			• Complete PM report forms accurately				
			• Maintain compliance documentation				
		Fault Escalation & Incident Reporting	• Report major equipment faults appropriately	PC10, KU5	Escalation Workshop, Reporting Drills	Escalation matrices, reporting templates, communication tools	2 Theory / 6 Practical
			• Follow escalation matrix procedures				
			• Coordinate with OLT/NOC supervisors				

	SL	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
	Module 4: Enable Digital Connectivity and Manage Service Operations	Digital Literacy & Social Impact	• Understand importance of digital literacy • Learn impact on social/economic inclusion • Identify target groups for digital adoption	PC1, KU1	Lecture, Case Studies, Group Discussion	Digital inclusion studies, impact reports, demographic data	4 Theory
		Device Knowledge & Specifications	• Identify types and specifications of digital devices • Understand capabilities of smartphones, tablets, e-terminals • Learn device selection criteria	PC2, KU2	Product Workshop, Comparison Analysis	Smartphones, tablets, e-terminals, specification sheets	3 Theory / 3 Practical
		Digital Promotion & Engagement Strategies	• Engage target groups effectively • Promote devices based on user requirements • Address literacy level considerations	PC1, PC2, PC4	Role-playing, Engagement Exercises	Engagement scripts, user personas, promotion materials	3 Theory / 3 Practical
		On-site Demonstrations & User Training	• Conduct effective device demonstrations • Enhance user confidence and adoption • Address usability concerns and misconceptions	PC3, PC4, KU9	Demonstration Workshops, Training Practice	Demonstration kits, training manuals, user guides	2 Theory / 6 Practical
		Networking Equipment Installation	• Install routers, modems, UPS systems • Set up networking cables and connections • Understand installation requirements	PC5, KU4	Installation Workshop, Hands-on Setup	Routers, modems, UPS, cables, installation tools	3 Theory / 6 Practical
		Device Configuration & Setup	• Configure smartphones and tablets • Set up e-terminals per provider guidelines • Assist with account and application setup	PC6, PC7, KU5	Configuration Workshop, Setup Practice	Various devices, configuration tools, setup guides	3 Theory / 6 Practical
		Troubleshooting & Technical Support	• Perform basic troubleshooting for common issues • Resolve hardware and software problems • Guide users on device maintenance	PC8, PC9, KU6	Troubleshooting Lab, Support Practice	Faulty devices, diagnostic tools, troubleshooting guides	3 Theory / 6 Practical

	SL	Session Name	Session Objectives	NOS/PC Covered	Methodology	Training Tools/Aids	Duration (hours)
		Security & Data Protection	• Implement security measures on devices • Guide users on software updates • Apply data protection and ethical handling	PC9, KU10	Security Workshop, Ethical Practice	Security software, update tools, data protection guidelines	3 Theory / 3 Practical
		Billing & Payment Processes	• Understand billing processes and cycles • Learn payment collection methods • Maintain compliance requirements	PC10, PC11, KU7	Financial Workshop, Process Training	Bills, receipts, payment systems, compliance documents	3 Theory / 3 Practical
		Documentation & Record Management	• Maintain transaction and payment records • Update rent agreements and utility bills • Apply documentation standards	PC12, KU8	Documentation Workshop, Record-keeping	Record books, agreement templates, documentation tools	3 Theory / 3 Practical
		Customer Service & Conflict Resolution	• Apply customer service principles • Handle complaints effectively • Resolve conflicts professionally	KU9	Service Workshop, Role-playing	Service scenarios, complaint forms, resolution guides	3 Theory / 3 Practical
		Revenue Management & Coordination	• Distribute bills and collect payments • Coordinate rent and service fee payments • Manage payment records with supervisors	PC10, PC11, PC13	Management Workshop, Coordination Practice	Billing systems, coordination tools, supervisor interfaces	3 Theory / 6 Practical
		Broadband & E-governance Promotion	• Promote broadband and internet services • Support e-governance initiatives • Demonstrate service benefits	KU3	Promotion Workshop, Service Demonstration	Broadband kits, e-governance materials, service demos	2 Theory / 4 Practical
		Integrated Service Operations Project	• Apply all skills in integrated scenario • Manage complete service operation cycle • Address complex user situations	PC1-PC13, KU1-KU10	Project-based Learning, Simulation	Complete service operation setup, project scenarios	0 Theory / 8 Practical

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

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

Annexure II
Assessment Criteria

CRITERIA FOR ASSESSMENT OF TRAINEES

Assessment Criteria for	
Job Role	Optical Network Terminal Technician
Qualification Pack	TEL/Q6207
Sector Skill Council	Telecom Sector Skill Council

S. No.	Guidelines for Assessment
1	The assessment for the theory part will be based on knowledge bank of questions approved by the SSC.
2	Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/ option NOS/ Set of NOS.
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre (as per assessment criteria below).
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training centre based on this criterion.
5	To pass the Qualifications File, every trainee should score a minimum of 70% of aggregate marks.
6	In case of unsuccessful completion, the trainee may seek reassessment on the Qualification File.

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
TEL/N6226 – Maintain Site Hygiene and Implement Security	**30**	**50**	**-**	**20**	**100**	**40**
TEL/N6227 – Perform Preventive Maintenance	**30**	**50**	**-**	**20**	**100**	**30**
TEL/N6228 – Promote Usage of Telecom Devices and Provide services	**30**	**50**	**0**	**20**	**100**	**20**
TEL/N9101 – Organize work and resources as per health and safety standards	**30**	**50**	**0**	**20**	**100**	**20**
TEL/N9102 – Interact Effectively with Team Members and Customers	**30**	**50**	**0**	**20**	**100**	**20**
DGT/VSQ/N0101 - Employability Skills (30 Hours)	**20**	**30**	**-**	**-**	**50**	**10**
Total	**110**	**180**	**0**	**60**	**350**	**100**

Annexure - III

QR Codes –Video Links

Chapter Name	Unit Name	Topic Name	URL	QR code (s)
Chapter 1: Role and Responsibilities of an Optical Network Terminal Technician	Unit 1.6 - Introduction to Optical Communication System	Optical Line Terminal and Power Summary	https://www.youtube.com/watch?v=RM0hEfOmLcI	
Chapter 2: Maintaining Site Hygiene and Implement Security	Unit 2.4 - Optical Line Terminal (OLT)/Network Operation Center (NOC)	Electromagnetic Spectrum Application	https://www.youtube.com/watch?v=FfKF7GoLw9U	
Chapter 3: Process of Carrying out Macro and Micronutrient Management of Field Crops	Unit 3.2: Fertilizer Application, Soil Conservation, and Crop Nutrition Management	Light Propagation Properties	https://www.youtube.com/watch?v=NB_kRRbYibI	
Chapter 5: Preventive Maintenance of Optical Network Terminal (ONT) Components	Unit 3.4 - Optical Sources	Fiber Manufacturing	https://www.youtube.com/watch?v=q8g75De09eM	
		First Aid at workplace	https://www.youtube.com/watch?v=Mgt812m9hrg	
Chapter 5: Sustainable Practices in Telecom Infrastructure Management	Unit 5.2 - Adopting Green Energy and Resource Efficiency	Handwashing Techniques	https://www.youtube.com/watch?v=IisgnbMfKvI	

Chapter Name	Unit Name	Topic Name	URL	QR code (s)
	Unit 5.3 - Following Waste Reduction Strategies	CPR	https://www.youtube.com/watch?v=Ey-qPao1Wms	
	Unit 5.4 - Ensuring Compliance with Environmental Regulations	E-Waste recycling and management	https://www.youtube.com/watch?v=Ey-qPao1Wms	

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

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