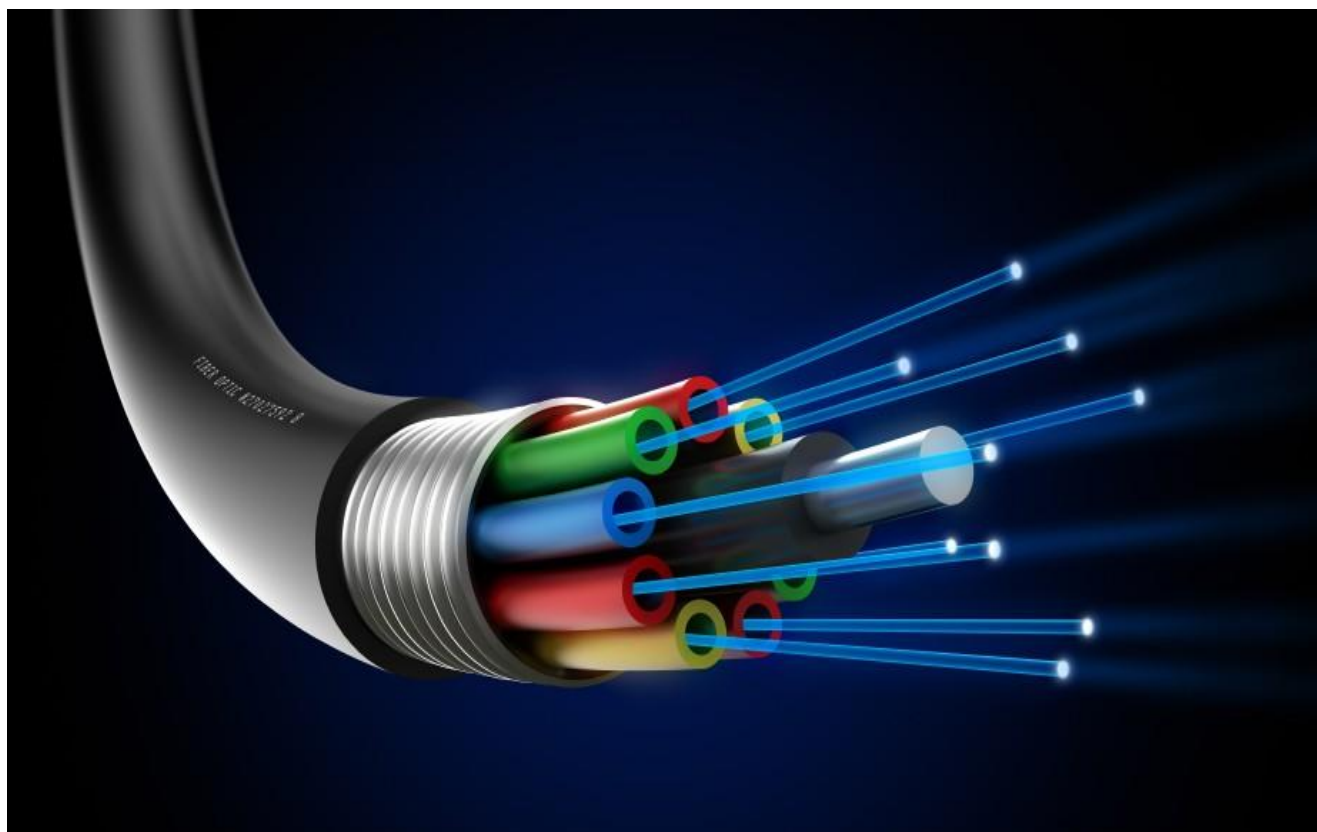




Model Curriculum

QP Name: Fiber to-the Home (FTTH/X) Installer

QP Code: TEL/Q4200

Version: 4.0

NSQF Level: 3.0

Model Curriculum Version: 4.0

Telecom Sector Skill Council || 3rd Floor, Plot No 126, Sector – 44 Gurgaon – 122003
Email: tssc@tsscindia.com

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Training Parameters

Sector	Telecom
Sub-Sector	Passive Infrastructure
Occupation	Operations and Maintenance - Passive Infrastructure
Country	India
NSQF Level	3.0
Aligned to NCO/ISCO/ISIC Code	NCO-2015/7422.0803
Minimum Educational Qualification and Experience	Grade 10 OR 8th grade pass with 3 years of experience in the operations and maintenance of passive infrastructure OR Previous relevant qualification of NSQF Level 2.5 with 1.5 years of experience in operations and maintenance of passive infrastructure
Pre-Requisite License or Training	NA
Minimum Job Entry Age	NA
Last Reviewed On	08-05-2025
Next Review Date	30-04-2028
NSQC Approval Date	08-05-2025
QP Version	4.0
Model Curriculum Creation Date	12-03-2025
Model Curriculum Valid Up to Date	30-04-2028
Model Curriculum Version	4.0
Minimum Duration of the Course	450 Hours
Maximum Duration of the Course	450 Hours

Program Overview

This section summarises the end objectives of the program along with its duration.

Training Outcomes

At the end of the program, the learner should have acquired the listed knowledge and skills to:

- Explain the process of installing Fiber-to-the-Home (FTTH/X) and Fiber-to-Anywhere (FTTx) cables.
- Elucidate the key steps involved in splicing optical fiber.
- Discuss the installation of passive FTTH/X components and their significance in network performance.
- Describe the best practices for in-building FTTH/X cabling to ensure efficiency and safety.
- Determine the essential work safety practices to follow while handling fiber optical cables.
- Explain the importance of following sustainability practices in telecom cabling operations.
- Discuss how to effectively organize work and resources as per health and safety standards in telecom installations.
- Discuss the Employability and Entrepreneurship Skills.

Compulsory Modules

The table lists the modules and their duration corresponding to the Compulsory NOS of the QP.

NOS and Module Details	Theory Duration (Hours)	Practical Duration (Hours)	On-the-Job Training Duration (Mandatory) (Hours)	On-the-Job Training Duration (Recommended) (Hours)	Total Duration (Hours)
TEL/N4143: Install Fiber-to-the-Home (FTTH/X) and Fiber-to-Anywhere (FTTx) Cables NOS Version No.: 1.0 NSQF Level: 3.0	20:00	40:00	30:00	00:00	90:00
Module 1: Introduction to the sector and the job role of a Fiber to-the Home (FTTH/X) Installer	05:00	00:00	00:00	00:00	05:00
Module 2: Pre-Installation and Installation Techniques	10:00	20:00	20:00	00:00	50:00
Module 3: FTTx Applications and Network Planning	05:00	20:00	10:00	00:00	35:00
TEL/N6400: Splice Optical Fiber NOS Version No.: 7.0 NSQF Level: 3.0	30:00	60:00	60:00	00:00	150:00
Module 4: Splicing Optical Fiber	30:00	60:00	60:00	00:00	150:00
TEL/N4200: Installation of Passive FTTH/X components	40:00	20:00	30:00	00:00	90:00

NOS Version No.: 6.0 NSQF Level: 3.0					
Module 5: Installation of Passive FTTH/X Components	40:00	20:00	30:00	00:00	90:00
TEL/N4201: In-building FTTH/X cabling NOS Version No.: 5.0 NSQF Level: 3.0	10:00	20:00	00:00	00:00	30:00
Module 6: In-building FTTH/X cabling	10:00	20:00	00:00	00:00	30:00
TEL/N4131: Work Safety Practices with Fiber Optics NOS Version No.: 5.0 NSQF Level: 3.0	10:00	20:00	00:00	00:00	30:00
Module 7: Work Safety Practices with Fiber Optics	10:00	20:00	00:00	00:00	30:00
TEL/N9111: Follow sustainability practices in telecom cabling operations NOS Version No.: 1.0 NSQF Level: 4.0	10:00	20:00	00:00	00:00	30:00
Module 8: Sustainability Practices in Telecom Cabling Operations	10:00	20:00	00:00	00:00	30:00
DGT/VSQ/N0101: Employability Skills (30 Hours) NOS Version No.: 1.0 NSQF Level: 2	30:00	00:00	00:00	00:00	30:00
Module 9: Employability Skills (30 Hours)	30:00	00:00	00:00	00:00	30:00
Total Duration	150:00	180:00	120:00	00:00	450:00

Module Details

Module 1: Introduction to the sector and the job role of a Fiber to-the Home (FTTH/X) Installer

Mapped to TEL/N4143, v1.0

Terminal Outcomes:

- Explain the importance of Telecom Sector.
- Discuss the role and responsibilities of a Fiber to-the Home (FTTH/X) Installer.

Duration (in hours): 05:00	Duration (in hours): 00:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
• Explain the significance of the telecom sector in modern communication and economic development. • Elucidate the key skills and technical expertise required for a Fiber-to-the-Home (FTTH/X) Installer. • Describe the challenges faced in the installation and maintenance of FTTH/X networks. • Determine the impact of fiber optic technology on internet speed and connectivity. • Discuss the role and responsibilities of a Fiber to-the Home (FTTH/X) Installer.	
Classroom Aids	
Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films	
Tools, Equipment and Other Requirements	
Nil	

Module 2: Pre-Installation and Installation Techniques

Mapped to TEL/N4143, v1.0

Terminal Outcomes:

- Explain the importance of pre-installation checks and processes in fiber optic network deployment.
- Describe the procedure and key considerations for direct buried installation of fiber optic cables.
- Elucidate the steps involved in underground (duct) installation and its advantages over other methods.
- Discuss the challenges and best practices associated with aerial installation of fiber optic cables.

Duration (in hours): 10:00	Duration (in hours): 20:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
• Explain the key characteristics of fiber cables such as bend-insensitive, ribbon fibers, and high-fiber-count cables. • Discuss the regulatory and compliance considerations for optical fiber installations, including environmental impact and safety standards. • Describe different splicing methods like fusion splicing, mass splicing, and mechanical splicing. • Elucidate the termination techniques for connectors and pigtails. • Discuss the cable pulling, blowing, and routing methods used in fiber optic installations. • Describe advanced installation techniques, such as micro-trenching, air-blown fibers, and robotic pulling. • Discuss the principles of wind-loading analysis and mitigation techniques for aerial installations. • Elucidate the applicable sustainability practices, including eco-friendly installations, reinstatements, and e-waste management. • Explain the escalation protocols for incidents and challenges that arise during fiber optic installations. • Discuss the concepts and applications of micro-trenching and air-blown fiber	• Demonstrate how to conduct pre-deployment surveys, including GIS route mapping and FTTx architecture compliance. • Show how to perform optical cable pre-tests using OTDR and AI tools to ensure network readiness. • Demonstrate how to ensure cable compliance with standards, and verify pulling tension, bend radius, and cable diameter. • Show how to use duct preparation tools, clean with compressed air/vacuum systems, and perform trench reinstatements using eco-friendly materials. • Demonstrate how to ensure compliance with permissions, local laws, and environmental guidelines. • Show how to select cable types based on site/environmental factors and perform trenching with minimal impact. • Demonstrate how to apply armor bonding and grounding practices, ensuring proper cable laying and marker placement. • Show how to use automated cable pulling tools and execute cable blowing with AI monitoring for optimization. • Demonstrate how to test duct suitability and perform figure-8 cable coiling to prevent damage.

techniques in high-density urban installations.	• Show how to integrate ducts with proper sealing for scalability and durability. • Demonstrate how to handle ADSS cables with tension control tools and survey aerial infrastructure with drones. • Show how to install messenger strands and aerial cables safely using lift buckets. • Demonstrate how to conduct wind-loading analysis and implement mitigation techniques.
Classroom Aids	
Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films	
Tools, Equipment and Other Requirements	
Cable Blowing Machines, Protection Sleeves, Fiber Stripper, OTDR, Different Types of Fiber Cables (Aerial, Buried and Underground), Drum Flanges, Personal Protection Equipment: Safety Glasses, Head Protection, Warning Signs and Tapes	

Module 3: FTTx Applications and Network Planning

Mapped to TEL/N4143, v1.0

Terminal Outcomes:

- Describe the different FTTx solutions, including FTTN, FTTC, and FTTB, and their specific use cases.
- Elucidate the critical factors to consider during network planning and design for FTTx deployments.

Duration (in hours): 05:00	Duration (in hours): 20:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
• Explain the modern applications of fiber optics, such as smart cities, 5G, telemedicine, and high-bandwidth entertainment. • Elucidate the advances in high-capacity networks, AI-driven optimization, sustainable deployment, and fiber network cybersecurity. • Describe the principles of FTTx architectures, including FTTN, FTTC, FTTB, and FTTH, and their impact on deployment. • Discuss the network planning and design principles, including selection of architecture (PON, GPON), infrastructure, and cabling types. • Explain the use of GIS tools for mapping fiber infrastructure, route planning, and network asset tracking. • Discuss the tools and technologies used for testing cables, real-time fault detection, and predictive maintenance in fiber networks. • Elucidate the role of automation and smart tools in testing and diagnostics in fiber optic networks. • Describe the methods for integrating ONTs, OLTs, and IoT devices into FTTx networks. • Discuss the applicable industry standards and guidelines issued by TRAI, Broadband Forum, etc.	• Demonstrate how to install fiber for FTTx variations, including FTTN, FTTC, FTTB, and FTTH. • Show how to deploy and configure pre-connectorized optical cables, micro-trenching, and micro-ducts for high-density urban applications. • Demonstrate how to integrate network components like ONTs, OLTs, splitters, and IoT devices for smart home and enterprise networks. • Show how to ensure seamless splicing and terminations for FTTx networks using precision splicing tools. • Demonstrate how to apply network planning and design principles, including the selection of the right architecture (PON, GPON) for deployment based on site needs. • Show how to determine infrastructure requirements, such as conduit paths, fiber type, and distribution points, ensuring optimal resource use. • Demonstrate how to ensure alignment with regulatory and compliance requirements for FTTH network design. • Show how to select appropriate equipment and materials for scalability and future upgrades.
Classroom Aids	
Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films	

Tools, Equipment and Other Requirements

Cable Blowing Machines, Protection Sleeves, Fiber Stripper, OTDR, Different Types of Fiber Cables (Aerial, Buried and Underground), Drum Flanges, Personal Protection Equipment: Safety Glasses, Head Protection, Warning Signs and Tapes

Module 4: Splicing Optical Fiber

Mapped to TEL/N6400, v7.0

Terminal Outcomes:

- Explain how to check the availability of tools, spares, and advanced equipment for fiber optic installations.
- Describe the process of preparing cables for splicing in new installations.
- Discuss how to maintain and troubleshoot laid Optical Fiber Cables (OFCs).
- Elucidate the steps involved in performing advanced splicing operations with automation and precision.
- Describe how to utilize advanced fiber testing tools and document the results.
- Explain the specialized splicing techniques used for micro and nano fibers.

Duration (in hours): 30:00	Duration (in hours): 60:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
• Explain the structure, types, and materials of optical fibers, including core, cladding, and jacket properties, as well as the optical properties like attenuation, dispersion, and wavelength. • Discuss the basic physics of light transmission in optical fibers and how it relates to signal performance. • Elucidate the different splicing techniques (mechanical, fusion, twist, etc.), their applications, and best practices for minimizing splice loss and ensuring joint durability. • Describe the tools and equipment used for splicing, including fusion splicers, inspection tools, smart cleavers, and safety equipment, along with the proper handling of splicing consumables. • Explain the advanced characteristics of optical fibers and the features and functions of advanced splicing machines and testing equipment. • Discuss the techniques for splicing in challenging environments like outdoor, submarine, or underground networks, and how to mitigate environmental effects on fiber and splice joints. • Describe the use of fiber pigtailed, connectorized fiber, routing inside junction	• Demonstrate how to check the availability and functionality of advanced optical testing tools such as OTDR, power meter, OSA, CD analyzer, and PMD analyzer. • Show how to check for availability and manage advanced splicing tools, including automated splicers, robotic arms, cleavers, and inspection tools. • Demonstrate how to manage splicing consumables like joint kits, connectors, heat shrink sleeves, and fiber optic enclosures. • Show how to ensure that splicing machines and testing equipment are calibrated and updated to meet precision standards, and coordinate repair or replacement of faulty tools. • Demonstrate how to locate and identify fibers for splicing using automated mapping tools and network plans, while checking for physical damage with advanced inspection tools. • Show how to prepare optical fibers for splicing by removing jackets, cleaning cores with automated systems, and securing cables within bend radius and stress limits. • Demonstrate how to install joint closures, splitters, and pigtailed with weatherproofing, route connectorized fibers, and document compliance with network plans.

boxes, and the various fiber jointing techniques. • Explain the role of AI-powered tools for fault detection, predictive maintenance, and optimization in fiber networks. • Discuss the integration of splicing tasks with IoT-enabled smart network management systems and the principles of cloud-based systems for remote monitoring, reporting, and troubleshooting. • Describe the regulatory compliance practices for optical fiber installation and maintenance, and how they affect network planning and design. • Elucidate the advanced fusion splicing process, including fiber preparation, splicing machine operation, and ribbon fiber splicing techniques. • Discuss the proper use of splice closures (heat shrink vs. cold shrink) and sealing techniques for weatherproofing in various environments. • Explain the techniques and applications of crimp splicing, particularly in hybrid networks. • Describe the basics of AI-driven predictive maintenance tools used to monitor and optimize fiber networks.	• Show how to identify fiber faults using OTDR, robotic arms, OFIs, and smart cleavers for maintenance in challenging environments. • Demonstrate how to coordinate with NOC for outage windows, perform fault inspections for microbends and environmental wear, clean fibers, replace damaged sections, re-splice fibers, and ensure proper weatherproofing of cables. • Demonstrate how to operate fusion splicing machines with automation to minimize errors, and perform various splicing methods (mechanical, fusion, ribbon, etc.) for different applications. • Show how to ensure splice quality using real-time diagnostics, precision cleavers, and advanced imaging tools, while sealing splices with heat-shrink or cold-shrink closures for protection. • Demonstrate how to perform micro and nano fiber splicing using specialized tools and document splicing details digitally. • Show how to use AI-enabled OTDR for fault detection and accurate loss measurement, and test signal quality with tools like OSA, CD analyzer, and PMD analyzer. • Demonstrate how to verify performance KPIs, generate automated reports for monitoring and compliance, and maintain documentation for network optimization.
Classroom Aids	
Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films	
Tools, Equipment and Other Requirements	
Cleaver, Mechanical and Fusion Splicing Kit, Protection Sleeves, Fiber Stripper, Fiber Reinforced Plaster and Jointing, Optical Test Equipment - OTDR And Power Meter, Personal Protection Equipment: Safety Glasses, Head Protection, Warning Signs and Tapes	

Module 5: Installation of Passive FTTH/X Components

Mapped to TEL/N4200, v6.0

Terminal Outcomes:

- Explain the process of installing passive FTTH/X components like splitters and their role in fiber networks.
- Describe the steps involved in performing terminal connections, including single incoming and multiple outgoing configurations.
- Determine the methods for conducting power and insertion loss tests to ensure optimal network performance.
- Discuss the fundamentals of GPON technologies, loss budgets, and advanced transmission mechanisms in fiber networks.

Duration (in hours): 40:00	Duration (in hours): 20:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
• Explain Passive Optical Networks (PONs) like GPON, EPON, and Next-Gen PON. • Describe the fundamentals of GPON technology, including its architecture, components, and benefits. • Discuss the roles of key GPON components such as ONTs, OLTs, and splitters in network deployment. • Elucidate Outside Plant (OSP) considerations, including routing, environmental factors, and secure installation practices. • Explain advanced transmission mechanisms like WDM and TDMA, their functions, and deployment considerations. • Determine loss budget concepts, calculation methods, and best design practices for minimizing optical losses. • Describe power testing techniques, including insertion loss, reflection testing, and network performance validation. • Discuss fiber management practices, including slack management, connector polishing, and scalability considerations. • Explain emerging tools and equipment for fiber installation and diagnostics, such as AI-enabled OTDRs and advanced OLTs.	• Demonstrate how to identify and assess passive components, including PLC and FBT splitters, for different deployment environments. • Show how to install wall-mount and rack-mount splitters (e.g., 1x8, 1x16, 1x32) using precision tools and equipment. • Demonstrate how to ensure compatibility of splitters with GPON, XG-PON, and NG-PON2 technologies. • Show how to check installation sites for optimal placement, minimizing signal loss and complying with building standards. • Demonstrate how to configure splitters for Wavelength Division Multiplexing (WDM) and Time Division Multiple Access (TDMA) technologies. • Show how to identify and organize feeder and distribution cables/pigtails for efficient routing and minimal signal interference. • Demonstrate how to use advanced connectors (e.g., SC, LC, APC) to establish secure, loss-free fiber connections. • Show how to apply fiber management techniques to ensure organized, secure, and scalable installations. • Demonstrate how to perform final connector polishing to maximize optical clarity and reduce insertion loss.

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| <ul style="list-style-type: none"> • Describe safety protocols for handling optical fibers, tools, and testing equipment, including PPE usage. • Explain best practices for documenting installation processes, loss budgets, tests, and troubleshooting results. • Discuss the basics of Wavelength Division Multiplexing (WDM) and its role in fiber networks, including coherent optics in high-speed data transmission. | <ul style="list-style-type: none"> • Show how to conduct insertion loss and reflection testing using advanced OLTS and OTDR equipment. • Demonstrate how to measure power output at distribution ports using precision power meters. • Show how to validate network performance parameters for compliance with GPON and NG-PON2 standards. • Demonstrate how to analyze and calculate loss budgets, considering WDM and TDMA technologies, to ensure network compliance. • Show how to install and configure passive components compatible with advanced GPON, XG-PON, and NG-PON2 networks. • Demonstrate how to configure splitters based on the role of broadcast technologies in GPON deployments. • Show how to use AI-enabled diagnostic tools for real-time fault detection, insertion loss tracking, and troubleshooting. • Demonstrate how to analyze the impact of components (e.g., splitters, connectors) on loss budgets and optimize designs using best practices. • Show how to validate and configure advanced transmission mechanisms like WDM and TDMA for optimized bandwidth utilization. |
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Classroom Aids

Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films

Tools, Equipment and Other Requirements

Optical Power Meter, Fiber Optic Test Source, OLTS, Optical Splitters, Personal Protection Equipment: Safety Glasses, Head Protection, Rubber Gloves, Safety Footwear, Warning Signs and Tapes, Fire Extinguisher and First Aid Kit

Module 6: In-building FTTH/X cabling

Mapped to TEL/N4201, v5.0

Terminal Outcomes:

- Explain the process of cable installation through cable trays in both horizontal and vertical orientations.
- Describe the key steps involved in cable installation through conduits.
- Discuss the challenges and best practices for cable installation through false ceilings.
- Elucidate the termination process at ONT and TO in fiber-optic networks.
- Determine the essential requirements for IoT and Smart Home Network readiness.
- Explain the procedures and considerations for FTTH GPON customer installation.
- Describe the components and functionalities of Triple-Play Services, including High-Speed Internet, VoIP, and IPTV.
- Discuss the cybersecurity considerations in FTTH/X installations to ensure data protection and network security.
- Elucidate the concept of the Internet of Everything (IoE) and its impact on modern digital ecosystems.

Duration (in hours): 10:00	Duration (in hours): 20:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
• Explain the types and characteristics of fiber optic cables, including bend radius, tensile strength, and fusion splicing techniques. • Discuss the role of fiber networks in supporting cloud gaming, ultra-low latency applications like High-Frequency Trading (HFT), and Industry 4.0 applications such as automation, robotics, and real-time data monitoring in smart manufacturing. • Elucidate the IoT and IoE device types, their connectivity requirements, and network configurations, and the role of FTTH in IoE. • Describe the key FTTH GPON components, their functions, and GPON technology including splitters, ONT configuration, and VLAN management. • Explain the basics of network security, including encryption protocols, firewalls, access control mechanisms, and cybersecurity considerations in FTTH networks. • Discuss the tools for fiber installation (e.g., fish tape, splicing machines, OTDR, VFL) and the techniques to measure signal loss and maintain network performance.	• Demonstrate how to check the site as per the building layout plan, identify the cabling path from the outdoor fiber landing point to the ONT installation point, and determine horizontal and vertical cable lengths, considering slack for maintenance and future upgrades. • Show how to check load compliance of cable trays, ensure compatibility with existing services like power and data cables, and lay fiber along tray tracks using proper pulling techniques, ensuring no damage to the cable jacket or core. • Demonstrate how to secure fibers in the trays, maintaining proper slack and tension to avoid over-tensioning in vertical runs and ensure proper grounding of metallic trays in line with safety standards. • Demonstrate how to pull fiber through conduits using appropriate tools, secure excess fiber (minimum of 3 meters) at termination points for maintenance purposes and inspect conduit integrity to prevent electromagnetic interference or mechanical damage.

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| <ul style="list-style-type: none"> • Describe the Triple-Play service requirements (internet, voice, video) and their impact on network infrastructure, and how to optimize Quality of Service (QoS) parameters, such as latency, jitter, and throughput. • Discuss future trends in IoT, innovations in smart home technologies, and the impact of these developments on triple-play services. • Describe Safety, Health, and Environmental (SHE) and occupational health and safety (OHS) regulations for fiber installations. • Elucidate the documentation requirements for installation, testing, and cybersecurity compliance. • Explain the role of AI-driven network management and automation tools for monitoring fiber performance and diagnosing faults remotely. | <ul style="list-style-type: none"> • Show how to ensure proper sealing of conduits to avoid dust, moisture, or pest intrusion. • Demonstrate how to install cables through false ceilings using the figure-8 method to prevent tangling or cable stress, secure cables in conduits above false ceilings to prevent dislodgement and ensure slack management. • Show how to ensure accessibility for future maintenance by marking cable routes clearly. • Demonstrate how to terminate and connectorize fiber at the ONT, ensuring signal integrity and minimal loss, power up and configure the ONT for operational readiness, and conduct live fiber testing using tools like Visual Fault Locator (VFL) and power meters to confirm signal integrity. • Show how to validate ONT connectivity to IoT devices and smart home systems, ensuring proper data throughput. • Demonstrate how to determine IoT device connectivity requirements such as bandwidth and latency, install network elements or CPEs for IoT devices, and configure ONTs to support IoT devices like smart thermostats, cameras, and voice assistants. • Show how to test IoT device compatibility with installed FTTH networks to ensure seamless integration and coordinate with customers for specific IoT device setups and provide technical guidance. • Demonstrate how to check and prepare customer premises for installing Customer Premises Equipment (CPE), follow GPON installation procedures ensuring correct splitter connections and fiber termination, and conduct comprehensive tests for connectivity and data speeds at the customer's end using tools like OTDR and fiber testers. • Show how to troubleshoot network issues related to CPE, resolve common complaints related to fiber connectivity, signal loss, and ONT/router configurations, and provide basic troubleshooting training to customers, |
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	explaining technical details in easy terms and addressing their concerns. • Show how to determine the infrastructure requirements for Triple-Play services, configure ONT settings to enable these services, and test High-Speed Internet, VoIP, and IPTV services for Quality of Service (QoS) parameters like latency, jitter, and packet loss. • Demonstrate how to coordinate with service providers to address issues with VoIP call quality, IPTV buffering, or internet speeds. • Show how to identify potential cybersecurity vulnerabilities in FTTH installations and mitigate risks using secure installation practices, configure ONTs with secure settings including password protection, encryption protocols, and firewalls, and conduct penetration tests to identify potential security risks and validate network integrity. • Demonstrate how to provide customers with guidelines for maintaining network security, including password updates and device firmware updates. • Show how to identify the scope of IoE and its impact on FTTH network design and installation, integrate IoE-compatible devices into the FTTH network ensuring seamless communication between devices, and follow future trends in IoE while identifying scalable network solutions for customers. • Demonstrate how to optimize FTTH installations for emerging IoE applications, ensuring minimal latency and maximum reliability.
Classroom Aids	
Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films	
Tools, Equipment and Other Requirements	
Fiber Cables, Fish Tape, ONT, Cable Trays, VFL, Fiber Detection Meter, Personal Protection Equipment: Safety Glasses, Head Protection, Rubber Gloves, Safety Footwear, Warning Signs and Tapes, Fire Extinguisher and First Aid Kit	

Module 7: Work Safety Practices with Fiber Optics

Mapped to TEL/N4131, v5.0

Terminal Outcomes:

- Explain the safety practices for working with fiber optics during FTTH/X installations.
- Discuss the industry standards and guidelines for fiber optic installations and their role in ensuring safety and quality.

Duration (in hours): 10:00	Duration (in hours): 20:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
• Explain the construction of fiber optics and methods for protecting fibers from environmental damage. • Describe the required PPE for fiber optic installations, including safety glasses, cut-resistant gloves, and other protective gear. • Elucidate the benefits of using PPE, including safety, injury prevention, and compliance with occupational safety regulations. • Discuss the safety features, limitations, and maintenance protocols for protective equipment used in fiber optic installations. • Explain the laser safety guidelines, including risk levels of various laser classes used in fiber optics. • Describe the hazards associated with optical fibers, such as microshards and laser exposure, and safe disposal practices. • Discuss the layout of associated services in the work area (gas pipelines, electrical cables, etc.) and how to avoid consequential damage during FTTH installation. • Describe the key industry standards and guidelines for fiber optic installations (e.g., ANSI/TIA, ITU-T, ISO). • Explain compliance requirements for environmental regulations and e-waste management in FTTH installations. • Determine the contact details of government agencies and regulatory bodies responsible for safety, health, and security. • Explain the importance of maintaining accurate and timely documentation to	• Demonstrate appropriate eye-safety measures when working with laser-emitting devices like ONTs and splicing equipment. • Show how to safely handle bare fiber, broken ends, and scraps, ensuring proper disposal to prevent injury. • Demonstrate fire safety practices when using high-voltage arc fusion splicers and other heating tools. • Show how to adhere to electrical safety norms when working with fiber cables alongside electrical cables and active power sources. • Demonstrate proper handling of Class 1M and higher laser devices used in FTTH networks, following laser safety rules. • Show how to use and maintain appropriate safety gear, such as gloves, boots, and protective eyewear. • Demonstrate adherence to industry standards and guidelines, such as ANSI Z136.2 for laser safety and ISO standards for fiber optic installations. • Show how to maintain health and safety records accurately, including incident reports and compliance checklists. • Demonstrate how to identify and mitigate hazards associated with installation sites, such as confined spaces, sharp edges, and high temperatures. • Show how to safely handle pre-terminated fiber assemblies and connectors to prevent contamination or damage.

ensure compliance with industry and organizational standards. • Discuss the procedures for conducting periodic audits to ensure adherence to safety standards. • Describe the manufacturer's MSDS for safe handling of fiber optic materials and chemicals. • Discuss legislative requirements and organizational procedures for health, safety, and security, and the roles and responsibilities of individuals. • Identify different types of health and safety hazards in FTTH/X installation sites. • Explain the limits of personal responsibility for dealing with hazards and escalating critical issues. • Describe the procedures for handling emergency situations, including accidental fiber cuts and exposure to high voltage. • Discuss the importance of maintaining high standards of health, safety, and security in fiber optic installations. • Elucidate the implications of non-compliance with health, safety, and security protocols on individuals and organizations.	• Demonstrate safe cable routing techniques to avoid damage to existing infrastructure, such as gas pipelines, electrical cables, and water pipelines. • Show how to comply with national and international guidelines for fiber optic installations, such as TIA/EIA-568, ITU-T standards, and BICSI guidelines. • Demonstrate compliance with regulatory and environmental norms related to FTTH/X deployment, including e-waste management. • Show how to identify and report non-compliance issues or deviations from industry standards to the supervisor.
Classroom Aids	
Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films	
Tools, Equipment and Other Requirements	
Personal Protection Equipment: Safety Glasses, Head Protection, Rubber Gloves, Safety Footwear, Warning Signs and Tapes, Fire Extinguisher and First Aid Kit	

Module 8: Sustainability Practices in Telecom Cabling Operations

Mapped to TEL/N9111, v1.0

Terminal Outcomes:

- Identify recyclable, reusable, and hazardous materials in fiber optic installations and explain how to categorize them.
- Describe the waste management, recycling, and disposal protocols for materials used in fiber optic installations.
- Explain how to optimize material and energy usage during cabling work in fiber optic installations.
- Discuss the environmental and regulatory standards that must be complied with during fiber optic installations.

Duration (in hours): 10:00	Duration (in hours): 20:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
• Explain organizational policies on sustainability, waste reduction, and material reuse in telecom infrastructure projects. • Describe the procedures for recycling, hazardous waste handling, and safe disposal of telecom-related materials. • Discuss the importance of sustainability in long-term infrastructure planning and the environmental impact of telecom waste. • Elucidate the classification of materials used in optical fiber cabling, including recyclable, reusable, and hazardous components. • Explain standard waste management procedures for telecom operations, including segregation, labeling, and disposal methods. • Describe methods to reduce material wastage, such as accurate measurements, careful handling of fiber optic cables, and optimized trenching techniques. • Discuss the environmental hazards associated with improper disposal of optical fibers, batteries, and chemical adhesives. • Explain the regulations and compliance requirements for hazardous material disposal under national and international environmental laws. • Elucidate energy-efficient work practices, including low-power tools, optimized route planning, and reduced excavation techniques.	• Demonstrate how to identify, segregate, and store materials used in cabling operations, including recyclable, reusable, and hazardous materials, ensuring compliance with safety and waste management procedures. • Show how to follow SOPs for safe handling, disposal, and documentation of non-recyclable and hazardous materials, including fiber shards, cable sheaths, and chemical adhesives. • Demonstrate how to ensure proper labeling, safe storage, and disposal of hazardous waste to prevent contamination or accidents. • Show how to minimize waste by reducing excess material use, reusing components, and optimizing cabling work through accurate measurements and efficient layout designs. • Demonstrate how to maintain clean, organized work sites to prevent environmental contamination, promote safety, and comply with environmental guidelines. • Show how to use energy-efficient tools and machinery and ensure proper maintenance of cabling tools and equipment to reduce material consumption and unnecessary repairs. • Demonstrate how to coordinate and dispose of waste materials at designated collection points and report any violations or environmental hazards.

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| <ul style="list-style-type: none"> Describe the importance of proper record-keeping for disposal and recycling to ensure compliance and accountability. | <ul style="list-style-type: none"> Show how to use and promote eco-friendly materials, such as low-impact protective coatings and biodegradable packaging. Demonstrate how to follow national and local environmental regulations, workplace policies, and sustainability practices related to telecom cabling operations. Show how to maintain accurate documentation of sustainability activities, including logs of disposed and recycled materials, to meet regulatory and audit requirements. Demonstrate how to conduct periodic self-audits and educate team members on best practices for sustainability, waste segregation, and responsible energy consumption. Show how to report violations of environmental policies, hazardous material spills, or unsafe disposal practices to the designated supervisor or regulatory body. |
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Classroom Aids

Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films

Tools, Equipment and Other Requirements

Waste Segregation Bins, Optical Fiber Disposal Unit, Environmental Compliance Documentation System, Personal Protection Equipment: Safety Glasses, Head Protection, Rubber Gloves, Safety Footwear, Warning Signs and Tapes, Fire Extinguisher and First Aid Kit

Module 9: Employability Skills (30 Hours)

Mapped to DGT/VSQ/N0101, v1.0

Duration: 30:00 Hours

Key Learning Outcomes

Introduction to Employability Skills Duration: 1 Hour

After completing this programme, participants will be able to:

1. Discuss the importance of Employability Skills in meeting the job requirements

Constitutional values - Citizenship Duration: 1 Hour

2. Explain constitutional values, civic rights, duties, citizenship, responsibility towards society etc. that are required to be followed to become a responsible citizen.
3. Show how to practice different environmentally sustainable practices

Becoming a Professional in the 21st Century Duration: 1 Hour

4. Discuss 21st-century skills.
5. Display a positive attitude, self-motivation, problem-solving, time management skills and continuous learning mindset in different situations.

Basic English Skills Duration: 2 Hours

6. Use appropriate basic English sentences/phrases while speaking

Communication Skills Duration: 4 Hours

7. Demonstrate how to communicate in a well-mannered way with others.
8. Demonstrate working with others in a team

Diversity & Inclusion Duration: 1 Hour

9. Show how to conduct oneself appropriately with all genders and PwD
10. Discuss the significance of reporting sexual harassment issues in time

Financial and Legal Literacy Duration: 4 Hours

11. Discuss the significance of using financial products and services safely and securely.
12. Explain the importance of managing expenses, income, and savings.
13. Explain the significance of approaching the concerned authorities in time for any exploitation as per legal rights and laws

Essential Digital Skills Duration: 3 Hours

14. Show how to operate digital devices and use the associated applications and features, safely and securely
15. Discuss the significance of using the internet for browsing, and accessing social media platforms, safely and securely

Entrepreneurship Duration: 7 Hours

16. Discuss the need for identifying opportunities for potential business, sources for arranging money and potential legal and financial challenges

Customer Service Duration: 4 Hours

17. Differentiate between types of customers

18. Explain the significance of identifying customer needs and addressing them

19. Discuss the significance of maintaining hygiene and dressing appropriately

Getting ready for Apprenticeship & Jobs Duration: 2 Hours

20. Create a biodata

21. Use various sources to search and apply for jobs

22. Discuss the significance of dressing up neatly and maintaining hygiene for an interview

23. Discuss how to search and register for apprenticeship opportunities

Module 10: On-the-Job Training

Mapped to Fiber to-the Home (FTTH/X) Installer

Mandatory Duration (in hours): 120:00	Recommended Duration (in hours): 00:00
Location: On-Site	
Terminal Outcomes • Demonstrate the importance of pre-installation checks and processes in fiber optic network deployment. • Show how to perform the procedure and key considerations for direct buried installation of fiber optic cables. • Demonstrate the steps involved in underground (duct) installation and explain its advantages over other methods. • Show how to address the challenges and apply best practices in aerial installation of fiber optic cables. • Demonstrate the different FTTx solutions (FTTN, FTTC, and FTTB) and their specific use cases. • Show how to plan and design FTTx deployments, considering the critical factors involved. • Demonstrate how to check the availability of tools, spares, and advanced equipment for fiber optic installations. • Show how to prepare cables for splicing in new installations. • Demonstrate how to maintain and troubleshoot laid Optical Fiber Cables (OFCs). • Show how to perform advanced splicing operations with automation and precision. • Demonstrate how to utilize advanced fiber testing tools and document the results. • Show how to apply specialized splicing techniques for micro and nano fibers. • Demonstrate the process of installing passive FTTH/X components like splitters and explain their role in fiber networks. • Show how to perform terminal connections, including single incoming and multiple outgoing configurations. • Demonstrate the methods for conducting power and insertion loss tests to ensure optimal network performance. • Show how to explain the fundamentals of GPON technologies, loss budgets, and advanced transmission mechanisms in fiber networks. • Demonstrate the process of cable installation through cable trays in both horizontal and vertical orientations. • Show how to carry out cable installation through conduits, including the key steps involved. • Demonstrate the challenges and best practices for cable installation through false ceilings. • Show how to handle the termination process at ONT and TO in fiber-optic networks. • Demonstrate the essential requirements for IoT and Smart Home Network readiness. • Show how to carry out FTTH GPON customer installation procedures and considerations.	

- Demonstrate the components and functionalities of Triple-Play Services, including High-Speed Internet, VoIP, and IPTV.
- Show how to address cybersecurity considerations in FTTH/X installations to ensure data protection and network security.
- Demonstrate the concept of the Internet of Everything (IoE) and its impact on modern digital ecosystems.

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialisation	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
Graduate	Electronics and Communication /Telecom/ Information Technology/ Computer Science and other relevant fields	5	Optical Fiber Domain			

Trainer Certification	
Domain Certification	Platform Certification
Certified for Job Role: “Fiber to-the Home (FTTH/X) Installer” mapped to QP: “TEL/Q4200, v4.0”. Minimum accepted score is 80%.	Recommended that the Trainer is certified for the Job Role: “Trainer (VET and Skills)”, mapped to the Qualification Pack: “MEP/Q2601, v3.0”. The minimum accepted score as per MEPSC guidelines is 80%.

Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training/Assessment Experience		Remarks
		Years	Specialization	Years	Specialization	
Graduate	Electronics and Communication /Telecom/ Information Technology/ Computer Science and other relevant fields	5	Optical Fiber Domain			

Assessor Certification	
Domain Certification	Platform Certification
Certified for Job Role: “Fiber to-the Home (FTTH/X) Installer” mapped to QP: “TEL/Q4200, v4.0”. Minimum accepted score is 80%.	Certified for the Job Role: “Assessor (VET and Skills)”, mapped to the Qualification Pack: “MEP/Q2701, v3.0”, with a minimum score of 80%.

Assessment Strategy

1. Assessment System Overview:

- Batches assigned to the assessment agencies for conducting the assessment on SDSM/SIP or email
- Assessment agencies send the assessment confirmation to VTP/TC looping SSC
- Assessment agency deploys the ToA certified Assessor for executing the assessment
- SSC monitors the assessment process & records

2. Testing Environment:

- Confirm that the centre is available at the same address as mentioned on SDMS or SIP
- Check the duration of the training.
- Check the Assessment Start and End time to be as 10 a.m. and 5 p.m.
- If the batch size is more than 30, then there should be 2 Assessors.
- Check that the allotted time to the candidates to complete Theory & Practical Assessment is correct.
- Check the mode of assessment—Online (TAB/Computer) or Offline (OMR/PP).
- Confirm the number of TABs on the ground are correct to execute the Assessment smoothly.
- Check the availability of the Lab Equipment for the particular Job Role.

3. Assessment Quality Assurance levels / Framework:

- Question papers created by the Subject Matter Experts (SME)
- Question papers created by the SME verified by the other subject Matter Experts
- Questions are mapped with NOS and PC
- Question papers are prepared considering that levels 1 to 3 are for the unskilled & semi-skilled individuals, and level 4 and above are for the skilled, supervisor & higher management
- Assessor must be ToA certified & trainer must be ToT Certified
- Assessment agency must follow the assessment guidelines to conduct the assessment

4. Types of evidence or evidence-gathering protocol:

- Time-stamped & geotagged reporting of the assessor from assessment location
- Center photographs with signboards and scheme specific branding
- Biometric or manual attendance sheet (stamped by TP) of the trainees during the training period
- Time-stamped & geotagged assessment (Theory + Viva + Practical) photographs & videos

5. Method of verification or validation:

- Surprise visit to the assessment location
- Random audit of the batch
- Random audit of any candidate

6. Method for assessment documentation, archiving, and access

- Hard copies of the documents are stored

- Soft copies of the documents & photographs of the assessment are uploaded / accessed from Cloud Storage
- Soft copies of the documents & photographs of the assessment are stored in the Hard Drives

The trainee will be tested for the acquired skill, knowledge and attitude through formative/summative assessment at the end of the course and as this NOS and MC is adopted across sectors and qualifications, the respective AB can conduct the assessments as per their requirements.

References

Glossary

Term	Description
Declarative Knowledge	Declarative knowledge refers to facts, concepts and principles that need to be known and/or understood in order to accomplish a task or to solve a problem.
Key Learning Outcome	Key learning outcome is the statement of what a learner needs to know, understand and be able to do in order to achieve the terminal outcomes. A set of key learning outcomes will make up the training outcomes. Training outcome is specified in terms of knowledge, understanding (theory) and skills (practical application).
OJT (M)	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on site
OJT (R)	On-the-job training (Recommended); trainees are recommended the specified hours of training on site
Procedural Knowledge	Procedural knowledge addresses how to do something, or how to perform a task. It is the ability to work, or produce a tangible work output by applying cognitive, affective, or psychomotor skills.
Training Outcome	Training outcome is a statement of what a learner will know, understand and be able to do it upon the completion of the training.
Terminal Outcome	Terminal outcome is a statement of what a learner will know, understand and be able to do upon the completion of a module. A set of terminal outcomes help to achieve the training outcome.

Acronyms and Abbreviations

Term	Description
NCVET	National Council for Vocational Education and Training
QP	Qualification Pack
MC	Model Curriculum
NSQF	National Skills Qualification Framework
NSQC	National Skills Qualification Committee
NOS	National Occupational Standards
NCO	National Classification of Occupations
ES	Employability Skills
TSSC	Telecom Sector Skill Council
TRAI	Telecom Regulatory Authority of India
FTTx	Fiber to the x
FTTN	Fiber to the Node
FTTC	Fiber to the Curb
FTTB	Fiber to the Building
PON	Passive Optical Network
GPON	Gigabit Passive Optical Network
OTDR	Optical Time Domain Reflectometer
OSA	Optical Spectrum Analyzer
CD	Chromatic Dispersion
PMD	Polarization Mode Dispersion
OFIs	Optical Fiber Installations
NOC	Network Operations Center
OSP	Outside Plant
WDM	Wavelength Division Multiplexing
TDMA	Time Division Multiple Access
ONT	Optical Network Terminal
VFL	Visual Fault Locator
CPE	Customer Premises Equipment