



FTTx for Installers & Technicians

Detailed Course Outline

This four-day course includes one day of classroom learning and three days of hands-on labs exercises focused on specific fiber optic outside plant disciplines. Developed as the “next level” of training, this class teaches more advanced knowledge and skills to students that have already had formal introductory classes or several years of experience working with fiber optics.

The course material is designed for advancing a technician’s fiber installation skills and technology knowledge. This includes introductory content for FTTx and xWDM systems as well as OSP skills like emergency restoration and fiber characterization.

Prerequisites: Requires basic knowledge of fiber optic theory and terminology, as well as field experience, or formal training such as the Fiber Optics 1-2-3 course or an equivalent.

Certifications and Credits: ETA Fiber Optics Technician—Outside Plant (FOT-OSP) Certification
BICSI Continuing Education Credits
Light Brigade Certificate of Completion

Introduction

- Basic fiber optic terminology
- FTTx optical fiber transmission systems
- Typical transmission rates
- Fiber optic symbols
- Why use fiber optics?
- Fiber optic standards
- Brief history of fiber optics

FTTx PON Methodology

- Basic FTTx terminology
- Passive optical networks (PON)
- Fiber to the home
- Fiber to the business/building
- POLAN
- Fiber to the curb
- IP video delivery
- Active Ethernet
- TDM and TDMA
- Broadband PON (B-PON)
- Asynchronous transfer mode (ATM)
- Ethernet PON
- Gigabit PON (G-PON)
- 10G-PON
- 10 Gigabit EPON
- RF video overlay
- Radio frequency over glass
- WDM-PON

Topologies

- Network topologies
- Physical topologies
- Point-to-point topology
- Star topology
- Reach extender
- Route redundancy
- Ring topology
- Mesh topology
- Bus topology

ODN and OSP

- ODN capabilities
- Outside plant cable management
- Drop terminators
- Cable and fiber management

Fiber Theory

- Attenuation
- Fresnel reflection
- Refraction
- Numerical aperture
- Intrinsic and extrinsic losses
- The electromagnetic spectrum
- Lightwave transmission
- Mode field diameter
- Dispersion (pulse spreading)

Fiber

- FTTx fiber optic specifications
- Single-mode optical fiber types
- Fiber optic color coding
- Ribbon fibers

Cable

- Optical cable for FTTx
- FTTx distribution and drop cables
- Outside plant cables
- High fiber count cables
- Aerial fiber optic cables
- Indoor/outdoor cables
- Plenum and riser cables
- Low smoke zero halogen
- Distribution cables
- Fiber optic cable cordage
- Fiber and buffer color codes

Connectors

- Extrinsic splice and connection attenuation
- Fiber optic connector polishes
- Common FTTx connectors
- Small form factor LC connectors
- Multifiber connectors
- Field terminable FTTH connectors
- Hardened connectors
- Connector inspection and cleaning
- Terminators and attenuators
- Single-mode field connectorization issues

Splicing

- Traditional splice scenarios
- Drop cable splicing
- Good splice requirements
- Fiber cleaving
- Fusion, ribbon, and pigtail splicing
- Protecting the splice
- Mechanical splices

Fiber and Cable Management

- Panels, closures and cabinets
- Fiber optic interconnect hardware
- Splice tray recommendations
- FTTx OSP cable management products
- Cabinets for active Ethernet
- Network access points
- Slack storage
- Vaults and handholes

- Indoor slack storage methods
- Underground cable storage
- Aerial cable storage products
- Hardened connector slack storage

Passive Devices

- Fiber transition to the network
- Planar lightwave circuits
- Fused biconical taper splitters
- Splitter challenges and scenarios
- Tap splitters
- WDMs and PON systems
- Optical bands and windows
- Wavelength allocations
- Multiplexing and demultiplexing
- Filters and gratings
- Types of WDMs
- PON configurations for WDM
- RF video overlay
- Diplexers, triplexers, and quadplexers
- Coarse, dense, and wide WDM

Active Devices

- Fiber optic transmitters
- Distributed feedback lasers
- Fabry-Perot lasers
- Fiber optic receivers
- Photo diodes
- Erbium-doped fiber amplifiers
- Reflection issues
- Optical return loss and the ODN

OLTs and ONTs

- Optical line terminals
- ONT, NT and ONU
- UPS and battery backup systems

Loss Budgets

- Designing FTTx systems
- Writing OSP specifications
- Loss budgets for FTTx networks
- Safety margins
- “Not to exceed” charts for single-mode
- Active Ethernet specifications
- PON loss budgets
- G-PON specifications
- G-PON power levels
- Ethernet specifications
- RFoG and tapered loss budgets

Installation

- FTTx cable installation
- Cable handling
- Underground installation techniques
- Conduit and duct installation
- Cable pulling methods
- Tension monitoring
- High air speed blown
- Air blown fiber
- Aerial installation techniques
- Mid-span (express) entries
- Cable installation products
- FTTB installation techniques
- MDUs and MTUs
- Telecommunications rooms
- Get cabling to each user
- Termination techniques
- ONTs and access points
- Installation inspection reports

Testing

- Testing active Ethernet and PON systems
- Initial installation testing
- “Not to exceed” values
- OTDR testing
- Dynamic range
- Deadzone
- OTDR signatures
- Key points to understanding IOR
- Post-installation testing with the OTDR
- Testing drop cables

- Reflection testing
- Measuring reflectance with a deadzone box
- Optical loss testing
- Insertion loss method
- Visual laser testing requirements
- Visual inspection

Maintenance

- Typical causes of failure
- System related problems
- Eye diagrams
- Types of fiber optic damage
- Typical cable system faults
- Equipment used in the restoration role
- Emergency restoration kit requirements
- Aerial restoration
- Outside plant restorations
- The need for slack cable
- Effective maintenance postures
- Post-restoration recommendations

Safety

- Fiber optic safety concerns
- Visual safety
- Laser safety
- Personal protective equipment
- Chemical safety
- Work area safety
- Installation practices

Wrap-up and Review

Hands-on Skills Learning

Cable Management

- Cable preparation
- Mid-entry practices
- Closure preparation
- Panel dressing
- Splitter installation
- Splice tray fiber routing

Splicing

- Strip and cleave processes
- Inline and pigtail splicing
- FTTx splicing
- Fixed V-groove splicers
- Core alignment splicers

OTDR Testing

- OTDR use in FTTx installations
- FTTx OTDR signatures
- Measuring reflectance
- Testing splitters

Optical Loss Testing

- FTTx test equipment
- Testing OLT/ONT power levels
- Test points in FTTx installations
- Upstream/downstream testing
- Troubleshooting
- FTTx documentation