

# VIavi

## Certified Fiber Characterization Engineer (CFCE) Program

### Synopsis

This engineer certification program begins with the foundation of basic fiber optic fundamentals and the recommended fiber inspection and cleaning techniques. Participants then learn about the fiber optic tests that are required to prove that advanced fiber infrastructures can support high data rate applications (10Gb/s, 40Gb/s, 100Gb/s) as well as extended wavelength range operation for DWDM and CWDM systems. Participants will apply the full power of modern multi-purpose test platforms to carry out these tests including bi-directional OTDR testing, chromatic dispersion, Polarization Mode Dispersion (PMD), and spectral attenuation. Confidence will be gained in the ability to process the results swiftly and efficiently using test report software to provide full system documentation and in assessing link performance against application support criteria. Learning is reinforced with hands-on exercises and the CFCE exam, requiring successful completion in order to receive a CFCE certificate.

### Prerequisites

Participants should possess a basic understanding of telecommunications and fiber optic transmission principles and environments.

### Who Should Attend

Technicians, engineers, and anyone responsible for performing fiber characterization tests when installing and troubleshooting fiber optic networks and who desire to become a Certified Fiber Characterization Engineer (CFCE).

### Course Number

TT-CFCE

### Delivery Method

Instructor-Led at Customer Site or Viavi site (for open enrollment)

### Course Length

5 Days

### Language of Instruction

English



## Course Goals

Upon completion of this course, participants will be able to:

- Explain the significance of modern fiber specifications including G.652.A, B, C, & D, G.655.x & G.656
- Appreciate the characteristics of the infrastructure that can impair system performance
- Perform proper cleaning and inspection techniques of fiber end-faces on jumpers, optical test equipment, and optical patch panels
- Design and plan test programs to meet customer and operational requirements
- Understand test specifications and describe the purpose of OTDR & OSA testing
- Analyze OTDR traces & event tables and OSA scans & tables
- Understand what chromatic dispersion is and how it is measured
- Understand what PMD is and how it can be measured
- Perform full fiber characterization on installed fiber systems
- Interpret the results of fiber characterization and map against application support criteria

## Course Outline

### Welcome and Introduction

- Orientation
- Course Goals

### Intro to Fiber Characterization

- What is Fiber Characterization?
- Why? When? How?
- Standards

### Characteristics of Light

- What is light?
- Electromagnetic Spectrum
- Wavelengths and Frequencies
- Interferometry
- Singlemode as waveguide
- Speed of light
- Chromatic Dispersion
- Polarization Mode Dispersion

### Optical Fibers

- Fiber structure
- How light travels along fiber
- Multimode and Singlemode
- Fiber for telecom networks
- Evolution of standards

### Inspecting and Cleaning Connectors

- Why do we inspect and clean?
- Cleaning equipment & technology
- Connector inspection equipment
- Inspection pass/fail criteria

### Insertion Loss and Spectral Attenuation Measurements

- Continuity checking
- Optical power and loss budgets
- Insertion loss measurements
- Spectral attenuation
- Live fiber identifiers

### Return Loss Measurements

- Definitions
- Performance requirements
- How is return loss measured?

### OTDR Introduction

- What is OTDR testing?
- Why do it?
- OTDR features & principles
- Inside an OTDR

### OTDR Capabilities

- Distance measurements
- Fiber loss measurements
- Splice loss measurements
- Connector losses
- Link return loss

### OTDR Limitations

- Dynamic range
- Dead zone
- Resolution

### OTDR Test Configurations

- Cable on a drum
- Installed cable before termination
- Connectorized systems

### OTDR Issues

- Poor launch conditions
- Interfacing with bare fibers
- Ghosts
- Fiber mismatches
- Saturation

### Using the OTDR

- Step by step guide
- Manipulating the trace

- Measurement parameters

### **Working Efficiently**

- File naming conventions
- Auto-saving traces
- Multiple wavelength testing
- Templates and markers
- Automatic configurations
- Script facilities
- Bi-directional measurement

### **OTDR Trace Analysis**

- What information do we want?
- Analysis of a single trace
- Multiple wavelength traces
- Analysis of multiple
- Bi-directional analysis

### **Using OTDR Software**

- Types of software
- Example report generation

### **OTDR Documentation**

- Measurement reporting

### **Testing Complex Networks**

- Branching systems
- Testing through splitters
- Testing through WDMs
- Testing amplified systems

### **Optical Spectrum Analysis**

- OSA functions & applications
- OSAs and DWDM systems
- OSAs and amplified performance

- OSAs and optical components
- OSAs and fiber non-linear effects
- OSAs and fiber characterization

### **Dispersion Measurements**

- When do need to measure?
- Specifications
- Analysis of results

### **Chromatic Dispersion (CD)**

- What is it?
- What causes it?

### **CD Measurement Methods**

- Standards: ITU, IEC, EIA/TIA
- Group delay and dispersion
- OTDR based time of flight
- Photon counting time of flight
- Phase shift techniques
- Differential phase shift technique
- Ongoing developments

### **Practical Exercises**

- G.652 & G.655 systems
- Time of flight (OTDR)
- DCMs

### **Polarization Mode Dispersion (PMD)**

- Polarization in fiber
- Polarization in other system components
- PMD and system performance
- Second order PMD

- Dynamics of PMD

### **PMD Measurement Techniques**

- Interferometric
- Polarimetric
- Fixed-analyzer
- WSOSOPA
- Interpreting test results

### **PMD Measurement Issues**

- What are we testing and why?
- Factors affecting choice of measurement technique
- Specification of test parameters
- PMD Summary

### **PMD Measurement Exercises**

- Low PMD fiber mode coupling
- PMD fiber no mode coupling
- High PMD fiber system

### **Link Acceptance and Application Support Criteria**

- Fiber Distances
- Cabling losses
- Reflections
- CD
- PMD
- Extended wavelength requirements

### **CFCE Exercises and Exam**

- Practical assessment
- Exam



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