COMPETENCY REQUIREMENTS – 2007 ETA

Fiber Optics Technician – FOT

1.0 PRINCIPLES OF FIBER OPTIC TRANSMISSION

1.1 Describe the basic parts of a fiber optic link
1.2 Describe the basic operation of a transmitter
1.3 Describe the basic operation of a receiver
1.4 Explain Amplitude Modulation
1.5 Compare Digital data transmission with analog
1.6 Graphically explain how Analog to Digital Conversion (A/D) is accomplished
1.7 Graphically explain how Digital to Analog Conversion (D/A) circuitry works
1.8 Explain the difference between Pulse Coded Modulation and Amplitude modulation
1.9 List the benefits of Multiplexing signals
1.10 Explain the purpose of Decibels (dBs) and convert voltage and power levels to and from decibel equivalents
1.11 Explain how Optical Power is measured (dBm), express optical power levels in dbs and compare power gains and losses

2.0 BASIC PRINCIPLES OF LIGHT

2.1 Describe the Electromagnetic Spectrum and locate light frequencies within the spectrum in relation to communications frequencies
2.2 Convert various wavelengths to corresponding frequencies
2.3 Explain the theories of light particles and light waves
2.4 Describe how the Index of Refraction is calculated
2.5 Define Fresnel Reflection Loss
2.6 Explain the effects of Refraction and Snell's Law
2.7 Calculate the Index of Refraction in two different mediums

3.0 OPTICAL FIBER CONSTRUCTION AND THEORY

3.1 Name the materials out of which fiber optic cable core is manufactured
3.2 Describe the purpose of Cladding and how it is applied to the core of fiber optics cables
3.3 Name the materials from which the FO Coating is manufactured
3.4 Explain why Multimode fiber optics cable may be selected over singlemode
3.5 Describe Singlemode fiber optics cable and how it differs from multimode
3.6 List common classifications for fiber optics cable
3.7 Describe Refractive Index Profiles and their purpose
3.8 Describe the basics of Optical Fiber manufacturing

4.0 OPTICAL FIBER CHARACTERISTICS

4.1 Explain Modal Dispersion and its importance to fiber optics
4.2 Define Material Dispersion
4.3 List Bandwidth limitations for common communications cable types
4.4 Measure the Attenuation Loss in fiber optics cables
4.5 Demonstrate the effects of Microbending fiber cables

4.6 Define Macrobend and explain its importance in fiber cabling
4.7 Explain how the Numerical Aperture is arrived at in fiber connectors
4.8 Identify the 'Cone of Acceptance' as used in fiber cabling
4.9 Compare the Tensile Strength of fiber and other communications cables
4.10 Explain how to calculate Bend Radius limitations

5.0 ADVANTAGES OF FIBER OVER COPPER

5.1 List Bandwidth Limitations of various copper cables and fiber cables
5.2 Describe Attenuation in copper and fiber cables
5.3 Explain why Electromagnetic Immunity is superior in fiber cabling
5.4 List Weight differences for telephone, coaxial and fiber cables
5.5 Make a comparison between the size of fiber cable vs: copper types
5.6 Explain why fiber cables present less risks of Safety concerns than copper cabling
5.7 Compare Security features of fiber cabling vs: electromagnetic cables

6.0 FIBER OPTIC CABLES

6.1 Draw a cross section of a Fiber Optic Cable and explain the purposes of each segment
6.2 Explain why and where Loose Tube Cable is used
6.3 Describe Tight Buffered Fiber
6.4 Identify the Strength Member in a fiber cable
6.5 Specify the Cable Jacket Material used in common types of fiber cables
6.6 Define Duty Specification
6.7 Explain the differences between Simplex Cordage and duplex cordage
6.8 List locations where Duplex Cordage is preferred over Simplex
6.9 Define Distribution cable
6.10 Explain how and where Breakout cable is used
6.11 List reasons for utilizing Armored fiber cables
6.12 Explain what a Messenger cable is and how it is used
6.13 Describe Ribbon Cable
6.14 Explain what Hybrid cables are and where they are ordinarily used
6.15 Define Composite signals
6.16 Explain where the TIA/EIA-598 Color Code is used and how the colors are used to identify individual cables
6.17 Describe Cable Markings and how they are used
6.18 Define Tensile Strength of a fiber cable and explain the reasons an installer would need to know the strength of various cables
6.19 Describe the Dynamic Load of a fiber cable
6.20 Define Static Load as it refers to fiber cabling
6.21 Demonstrate the detrimental effects of exceeding minimum the Dynamic Bend Radius of a fiber cable
6.22 Define Static Bend Radius

7.0 SOURCES

7.1 Explain the Safety Classifications for light sources used in fiber communications
7.2 Describe the effects of Laser exposure to the human body
7.3 Explain the differences between Light-emitting Diodes and laser optics

7.4 List the common Wavelengths used in fiber communications and the advantages and disadvantages of each
7.5 Measure the Output Power of a light generator
7.6 Define Spectral Width of the output of a light generator
7.7 Compare the Speed of Operation of one light source vs: another
7.8 Compare Ease of Operation of the types of light sources commonly used in fiber signal generation
7.9 Present historical data and future estimates for the Lifetime of fiber cables and fiber light generators
7.10 Compare the Source Characteristics of LEDs and Lasers

8.0 DETECTORS

8.1 Describe the optical and electrical theory of operation of Photodiode
8.2 Compare Common Detector designs
8.3 Explain the use for PIN Photodiodes and theory of operation
8.4 Describe the action of an Avalanche Photodiode (APD)
8.5 Locate the Performance Characteristic – Responsivity specifications for various optical detectors
8.6 Explain Bit Error Rate (BER) and how it is utilized in fiber optics communications equipment

9.0 CONNECTORS

9.1 Identify TIA/EIA 568-A Standard Connector Types
9.2 List Connector Requirements for various types
9.3 Describe Ferrule Materials used with fiber optics connectors
9.4 Explain Intrinsic Factors applicable to fiber connectors
9.5 Explain Extrinsic Factors
9.6 Measure Interconnection Losses using common measuring equipment
9.7 Measure Return Reflections in a completed cable
9.8 Define PC Finish
9.9 Explain APC Finish
9.10 Describe how and where Pigtails are used in fiber cabling
9.11 Demonstrate the proper use of Anaerobic Epoxy
9.12 Explain how and where UV Epoxy is used
9.13 Demonstrate the use of 2-Part Epoxy
9.14 Describe Pre-Load Epoxy
9.15 Explain why and where Epoxyless Connectors are best used
9.16 Demonstrate proper Fiber Preparation techniques
9.17 Properly assemble and connect common types of connectors
9.18 List steps taken to properly perform a Visual Inspection of a cable
9.19 List ways to properly care for Fiber Optic Connectors
9.20 Explain and demonstrate TIA/EIA 568-A Performance Testing

10.0 PASSIVE COMPONENTS

10.1 Explain the uses and benefits as well as disadvantages of using fiber optics cable couplers

10.2 Describe where a Tee Coupler is used
10.3 Describe where a Star Coupler is used
10.4 Explain the operation of a Reflective Star Coupler
10.5 Define Transmissive Star Coupler
10.6 Explain modulation and how Wavelength Division Multiplexing (WDM) is used in fiber cable signal distribution systems
10.7 Explain the difference between Dense Wavelength Division Multiplexing (DWDM) and WDM

11.0 TYPES OF SPLICING

11.1 Mechanical Splicing:

11.1.1 Explain the differences between Intrinsic Factors and extrinsic factors when splicing fiber cables
11.1.2 List Extrinsic Factors important in fiber splicing
11.1.3 Demonstrate correct Fiber Preparation
11.1.4 Define Index Matching Gel
11.1.5 Explain Performance Characteristics of different gel compositions
11.1.6 Perform TIA/EIA 568-A Performance Testing procedures

11.2 Fusion Splicing:

11.2.1 List Fusion Splice Requirements
11.2.2 Demonstrate proper Fiber Preparation
11.2.3 Explain the use of the Splice Closure
11.2.4 Perform TIA/EIA 568-A Performance Testing of the fusion splice

12.0 CABLE INSTALLATION AND HARDWARE

12.1 Explain Dynamic Tensile Loading
12.2 Explain Static Tensile Loading
12.3 Compare the Dynamic Bend Radius minimums for common fiber cables
12.4 Describe the effects of exceeding Static Bend Radius minimums
12.5 Demonstrate proper use of Pulling Tape
12.6 Define Pulling Grip
12.7 Explain where Conduit should be Installed to enclose fiber cables
12.8 Describe the requirements for Tray and Duct Installation of fiber cabling
12.9 Explain the National Electric Code (Article 770) rules

13.0 FIBER OPTIC LINK

13.1 List the consideration for Basic fiber optics System Design
13.2 Prepare a Basic Optical Link Power Budget

14.0 OPTICAL FIBER MEASUREMENT AND TESTING

14.1 Explain fiber optics cable Measurement Standards
14.2 Demonstrate the proper use of Optical Loss Test Sets
14.3 List common Fiber Optic Sources (FOS)
14.4 Demonstrate proper and safe use of the Fiber Optic Light Meter (FOM)

14.5 Locate a fault using an Optical Time Domain Reflectometer (OTDR) and point out the aberrations in the display presentation and describe their likely causes
14.6 Describe the Fiber Identifier

15.0 LINK AND CABLE TESTING

15.1 FOS/FOM Link Testing
15.2 FOS/FOM Patch Cable Testing
15.3 OTDR Loss per Unit Length Testing
15.4 OTDR Connector and Splice Evaluation
15.5 OTDR Fault Location
15.6 Acceptance Testing Documentation

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