Course Catalog
2012-2013

DWDM

CSLiT

.....Connecting Technology

Dense Wave Division Multiplexing (DWDM)

Dense Wavelength Division Multiplexing (DWDM) is a key component of the world's communications infrastructure. The tremendous growth in telecommunications services is possible today in part through optical networks, where DWDM systems allow much greater bandwidth over existing optical systems. For anyone involved with telecommunication and information technology, understanding this technology is a critical requirement.

Course Objectives

By the end of the course delegates will be able to:

- Understand the basics of optical communications
- Understand the basics of DWDM
- Explain basic DWDM Network Designs and Engineering
- Learn how to analyze optical links based on power budget
- Classify and design DWDM networks based on size and performance

Learn how to utilize different parameters in DWDM networks and optical systems

Who Should Attend

This course is designed to provide a general overview for strategic or technical managers, consultants, communications professionals, software engineers, system engineers, network professionals, marketing and sales professional, IT professionals, and others who plan on using, evaluating, designing or working with SONET/SDH, D/WDM and optical networks.

Course Prerequisites

Introduction to Telecommunications or an understanding of Telecommunications technology

Course Duration

30 Hours, 10 Classes, 3 Hours per class

Course Details

Lesson 01: Overview of SDH/SONET

- The OSI Model
- SDH/SONET Standards
- Multiplexing Structure and bit rates
- Paths/Lines and Sections
- The SDH/SONET Network Sections
- Regenerator and Multiplex Section Overheads
- STM – N Section Overhead
- Data Communications Network (DCN)

Lesson 02: Introduction to Optical Networking

- Fiber Optics
- Fiber Losses
- Dispersion in Fiber
- Nonlinearities
- Window of Operations
- Fiber Types
- Optical amplifiers
- Light sources and transmitters
- Photodiodes and receivers
- Optical communication systems
- The Physics of Optical components
- Light-Matter and Light-Matter-Light

Lesson 03: Common Single Mode Fiber Types

- Standard Single Mode Fiber
- Dispersion Shifted Fiber (DSF)
- Dispersion-compensating fiber (DCF)
- Non-Zero Dispersion Shifted Fiber (NZ-DSF
- Positive Dispersion SMF
- Dispersion Compensation Unit (DCU)

Lesson 04: Introduction to DWDM

- Optical Networking and DWDM
- Optical Network Breakthroughs
- Special Fibers
- S, C and L Bands
- Optical Components
- Optical Spectral Filters and Gratings
- Optical Demultiplexers
- The Erbium-Doped Fiber Amplifier (EDFA)
- The Tunable Laser Diode Operating at 1550 nm
- In-Fiber Bragg Grating
- Light Sources
- Optical Cross-Connects
- Optical Add-Drop Multiplexers
- DWDM and SONET

Lesson 05: DWDM Components and Architecture

- DWDM Anatomy
- DWDM Impairments
- Multiwavelength Transmitters
- Multichannel Receivers
- DWDM Optical Amplifiers
- Wavelength Converters
- Modal Effects
- Scattering Effects
- Miscellaneous Effects

Lesson 06: DWDM Impairments

- Spectrum
- Availability, Occupancy, Efficiency
- Bandwidth & Distance Limitations
- Noise, Dispersion, Non-linearities

Lesson 07: Wavelength Adaptation

- Wavelength Adapter (or transponder)
- Wavelength Converter
- Precision Wavelength Transmitters (ITU wavelength)

Lesson 07: Basic DWDM Optical Components and Elements

- Optical Filters
- Optical Couplers
- Optical Power Attenuators
- Polarizer and Rotators
- Optical Isolators and Circulators
- Optical Multiplexers and Demultiplexers
- Optical Cross Connects (OCXs)
- Optical Add Drop Multiplexers
- Optical Equalizers
- Light Sources
- Laser Beams
- Modulators
- Photodetectors and Receivers
- Optical Amplifiers
- Wavelength Convertors
- Optical Phase-Locked Loops
- Ring Resonators
- Optical Attenuators
- Optical SNR

Lesson 08: DWDM Mux and Demux

- Channel spacing of 100GHz and 50GHz
- DWDM Demux
- Mux / Demux Technology
- Thin film filters
- Fiber Bragg gratings
- Diffraction gratings
- Arrayed waveguide gratings
- Fused bionic tapered devices
- Inter-leaver devices

Course Details

Lesson 09: Common Amplifier Types

- A Typical Optical Amplifier
- Doped Fiber Amplifiers
- Erbium Doped Fiber Amplifiers (EDFA)
- Raman Fiber Amplifiers
- Semiconductor Optical Amplifiers (SOA)

Lesson 10: Networking with DWDM

- Optical Systems and Components Analysis
- Optical Transmitters: Lasers
- Modulation: Direct and External
- Optical Receivers: Photodetecters
- Couplers and Circulators
- Cavities and Filter
- Complex Components: Transponders
- Optical Switches
- Mechanical Switches
- Acousto-Optical Switches
- Micro-mechanical switches (MEMS)
- Electro-Optical and Thermo-Optical Switches
- Bubble Technology
- Liquid Crystal Switches
- Hologram-based Switches
- Factors That Affect System Design
- Effect of Chromatic Dispersion

Lesson 11: DWDM Span Engineering

- Engineering a DWDM link
- Power Budget Design
- What are the factors?
- Digital Modulation Formats
- Fiber Impairments
- Loss
- Dispersion
- Nonlinear Effects (SPM, XPM, FWM, Raman)

Polarization Dependent Effects (PDL and PMD)

Lesson 12: DWDM Testing, Measurements and OAM&P

- Component conformance tests
- Parameter tests on optical fibers
- System installation tests
- System optimization tests
- System acceptance tests

Lesson 13: Transportation of other technologies over WDM

- WDM Access
- Transparent Networks
- SDH/SONET over WDM
- IP over WDM
- ATM over WDM

Lesson 14: Current and Ongoing Development in WDM

- The current development within WDM
- MPLS
- The developments happening in Fiber

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