Systems & Network Training

# Essential DWDM

A 2 day training course

Save on expenses. This course is also available on your premises.

## Description

A concise overview of Wave Division Multiplexing (WDM) with both Coarse Wave Division Multiplexing (CWDM) and Dense Wave Division Multiplexing (DWDM) being covered. The course starts with a review of the relevant elements of fibre transmission and multiplexing before then studying WDM components and architectures. Reliability, resilience and management are then followed by WDM services and futures.

## Key outcomes

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

- ✔ Compare CWDM and DWDM.
- ✔ Explain the benefits of WDM.
- ✔ Describe Dispersion and four way mixing.
- ✔ Describe the different WDM equipment components.
- ✔ Describe different WDM architectures.
- ✔ Explain How DWDM works.

## Training approach

This structured course uses Instructor Led Training to provide the best possible learning experience. Small class sizes ensure students benefit from our engaging and interactive style of teaching with delegates encouraged to ask questions throughout the course. Quizzes follow each major section allowing checking of learning.

## Details

**Who will benefit?**
Anyone working with CWDM/DWDM.

**Prerequisites**
Introduction to Telecommunications.

**Duration:** 2 days

**Customer rating** ★★★★★

| Generic training | Small class sizes | Hands On training | Our courseware | Customise your course |
|---|---|---|---|---|
| Generic training compliments product specific courses covering the complete picture of all relevant devices including the protocols "on the wire". | We limit our maximum class size to 8 delegates; often we have less than this. This ensures optimal interactivity between delegates and instructor. | The majority of our courses use hands on sessions to reinforce the theory. | We write our own courses; courseware does not just consist of slides and our slides are diagrams not bullet point text. | Please contact us if you would like a course to be customised to meet your specific requirements. Have the course your way. |
| "*Friendly environment with expert teaching that teaches the why before the how.*"<br>G.C. Fasthosts | *"Excellent course. The small class size was a great benefit..."*<br>M.B. IBM | *"Not many courses have practice added to it. Normally just the theoretical stuff is covered."*<br>J.W. Vodafone | *"Comprehensive materials that made the course easy to follow and will be used as a reference point."*<br>V.B. Rockwell Collins | *"I was very impressed by the combination of practical and theory. Very informative. Friendly approachable environment, lots of hands on."*<br>S.R. Qinetiq |

# Essential DWDM

## Course content

**Fibre communications review**

Optical transmission, Fibre characteristics, Fibre component parts. Multi Mode Fibre (MMF). Single Mode Fibre (SMF). Fibre connections. Lasers. Attenuations, dispersion, optical signal noise ratios (OSNR) and their effects. Channel Spacing and Signal Direction. Limiting factors to single wavelength.

**WDM overview**

Multiplexing, TDM, WDM benefits. WDM standards. CWDM vs. DWDM. Four Wave Mixing (FWM). Impact and countermeasures to FWM on WDM.

**CWDM**

ITU G.694.2, channels, channel spacing.

**DWDM**

ITU G.694.1, channels, channel spacing.

**WDM Equipment Components**

Equipment components and building blocks.

Optical Terminal Multiplexers (OTM). Optical Add/ Drop Multiplexers (OADM). Adding versus dropping. Optical Amplifiers. Erbium Doped Fibre Amplifiers (EDFA). Transponders and Combiners. WDM/DWDM Hubs. Optical and Electrical Cross Connects (OXCs/ DXCs). Types of Cross Connects (Transparent/ Opaque). Advantages and disadvantages of various Optical cross connects.

**WDM Architectures**

WDM network sections. Point-to-Point, Optical switches, mesh, ring and star topology. Example of combined WDM and other technology network. Wavelength converting transponders, 1R, 2R, 3R.

**Protection for WDM**

Sub 50ms failover. Equipment protection. Card protection. Y cable, Splitter protection. Far end laser control. Line protection. OMSP 1+1, OMSP 1:1, OMSP 1: N. Self healing optical ring. Sub Network Connection Protection (SNCP). Automatically Switched Optical Networks (ASON).

**WDM Management Options**

In band management. Out of band management. The Optical Supervisory Channel (OSC). OSC capabilities.

**WDM services**

WDM Access. Bit rates, Transparent Networks. Modulation, DQPSK. SDH over WDM. Migrating from SDH to DWDM. Ethernet over WDM, IP over WDM.

**Optical Transport Networks**

G.709, “digital wrapper”, Optical Channel Payload Unit (OPU), Optical Channel Transport Unit ( OTU), Optical Channel Data Unit (ODU). OTU1, OTU2, OTU3, OTU4.

**WDM Futures**

All optical amplification, Raman amplification, distributed, lumped. Bit rates. Solitons. Coherent technologies.