

# Certified Optical Network Engineer Core Networks (CONE)

## Course Duration

5 Days



## Course Summary

On this Certified Optical Network Engineer training programme you'll learn how next generation optical networks can be engineered to use the power of light to meet the challenging demands of telecoms systems today. You'll learn about the clever things that can be done with light to deliver higher data rates over longer distances at lower cost than ever before. You'll also appreciate the supporting role played by recent advances in electronic communications technology in overcoming some of the impairments inherent in using existing infrastructure.



## Course Objectives

At the end of this course you will be able to:

- ⦿ design optical networks that give the best price/performance ratio
- ⦿ specify key parameters of optical systems
- ⦿ identify issues with existing infrastructure and how to cope with them
- ⦿ discuss the key issues knowledgeably with suppliers, customers and colleagues
- ⦿ work decide which technologies are best suited to your requirements
- ⦿ control the deployment of optical networks

## Is this course for you?

The demands being made of telecoms systems today are challenging! Networks need to deliver exponential growth in capacity, ubiquitous coverage, total security, five-nines reliability, instantaneous flexibility and they mustn't cost the earth, in more ways than one.

If you are a fibre network engineer or manager, then a grasp of some of the individual technology offerings is no longer enough, you need to be able to see the big picture to truly understand the impact of the different approaches to building and operating Next Generation Optical Networks.

This is an advanced level course, so some background in fibre optics & comms systems is recommended..

## Why train with OTT?

- ⦿ clear explanations, delivered in plain English will help you understand concepts that underpin modern optical networks
- ⦿ come to terms with the key technologies free of any vendor bias, spin or marketing hype
- ⦿ review all of the issues so that you get the full picture of optical networking
- ⦿ use case studies and assignments to apply your learning to real world scenarios
- ⦿ learn directly from Richard Ednay, UK Principal Expert on IEC fibre optic systems working group and contributor to ITU-T Study Group 15 on fibre optic systems
- ⦿ gain Certified Optical Network Engineer status to demonstrate your knowledge and

## COURSE CONTENTS

continued overleaf

### BECOMING A CERTIFIED OPTICAL NETWORK ENGINEER

Optical networks  
Certification  
Standards  
Structure & assessment

### EXPECTATIONS & CHALLENGES

What do we mean by communications?  
Expectations  
Developments  
Challenges  
Solutions



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# Certified Optical Network Engineer

## Core Networks (CONE)

### UNDERSTANDING LIGHT

#### CHARACTERISTICS OF LIGHT

What is light?  
Electromagnetic spectrum  
Wavelengths & frequencies  
Wave properties of light  
Interferometry  
Singlemode as a waveguide  
Chromatic dispersion  
Polarisation mode dispersion

#### USING LIGHT TO TRANSFER INFORMATION

Modulation formats  
Generating optical signals  
Detecting optical signals  
Modulation formats

#### MULTIPLEXING

Wavelength division multiplexing  
DWDM Channel spacing  
DWDM Wavelength range  
Issues with more DWDM channels

### COMPONENTS

#### OPTICAL FIBRES

What is light?  
The Electromagnetic Spectrum  
Wavelengths & frequencies  
Multimode & singlemode fibres  
Attenuation  
Chromatic dispersion  
Polarisation mode dispersion  
Fibre types

#### PASSIVE OPTICAL COMPONENTS

Splices & Connectors  
Attenuators: Fixed  
Passive power control devices  
Optical isolators  
Couplers & splitters  
WDM, CWM, DWDM  
Circulators, Filters, Gratings  
Optical add-drop multiplexers

#### ACTIVE OPTICAL DEVICES

Light sources  
Transceiver modules  
Receivers (detectors)  
Attenuators: Variable  
Dynamic channel equalisers  
Channel monitors

### SYSTEM PERFORMANCE

#### SYSTEMS PERFORMANCE

Satisfactory communications  
Measurements of signal quality

#### OPTICAL SIGNAL IMPAIRMENTS

Impairments  
Degradation function

#### OPTICAL SIGNAL IMPROVEMENTS

Power penalties  
Statistical vs deterministic performance  
Forward error correction  
Electronic dispersion compensation

### MANAGING POWER LEVELS

#### POWER LEVELS IN BASIC SYSTEMS

How long is long haul?  
Cabling losses  
Transmitting power levels  
Receiver power levels

#### POWER LEVELS IN NGONS

Spectral attenuation  
Interface definitions  
Transmitting power levels  
Receiver performance  
Too much power in fibre

#### OPTICAL AMPLIFIERS

Benefits & drawbacks  
Types & configurations  
Operational characteristics  
Overcoming limitations  
As broadband light sources  
Raman amplification  
Semiconductor optical  
Planar optical waveguide  
Standards & developments

#### NON-LINEAR EFFECTS IN OPTICAL FIBRES

Basics of optical non-linearities  
Scattering effects  
Kerr Effects

### MANAGING DISPERSION

#### CHROMATIC DISPERSION

What is it & what causes it  
Dispersion characteristics  
System dispersion factors  
Dispersion limited systems

### CD MANAGEMENT: OPTICAL

Optical vs Electronic  
Dispersion compensating fibres  
DCM performance examples  
Dispersion compensating gratings  
Dynamic dispersion compensation  
Dispersion accommodation

#### PMD

Polarisation in fibres  
Polarisation in other components  
PMD & system performance  
Second order PMD  
Dynamics of PMD

#### PMD MANAGEMENT

Strategic issues  
PMD compensators

### OPTICAL NETWORKS

#### PHOTONIC NETWORKS

Photonic network technologies  
Multiplexing  
ADMs, OADMs, ROADMs  
Switching & Routing  
Optical (3R) Regeneration  
Digital optical networks

#### ROADMs

Subsystems/network element  
Wavelength selective switch (WSS)  
Enabling technologies  
Next Generation ROADMs

#### MODELLING SOFTWARE

What can be modelled?  
System performance

### PRACTICAL IMPLEMENTATION

#### EQUIPMENT CONFIGURATION

Optical Network Elements  
selection & specification  
Equipment configuration  
Case study: BOM & costings

#### UPGRADING NETWORKS

Preparation  
Fibre characterisation

#### MAINTENANCE

Network management  
Performance & security monitoring  
Preventative maintenance  
Emergency repair strategies

#### ASSESSMENT & EXAM

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