

## Passive Optical Networks and Air Blown Fibre

For the award of this unit candidates must successfully complete the assessments for each of the listed outcomes. To demonstrate competence in this qualification, candidates must satisfy the performance requirements for each of the following outcomes:

- **Apply the appropriate Health and Safety regulations for the safe installation of equipment and networks elements.**
- **Describe and analyse the PON system within the telecommunications infrastructure for the distribution of Triple Play services.**
- **Plan the installation and testing of micro ducts within a blown fibre system.**
- **Explain the practical planning elements and best practice associated with the installation of Inside and Outside plant equipment.**
- **Prepare and Install Fibre Optic units**
- **Examine PON networks using suitable test equipment.**

### Course Content

#### **Outcome 1. Apply the appropriate Health and Safety regulations for the safe installation of equipment and networks elements.**

To achieve this outcome the candidate must demonstrate the ability to:

- Adhere to all relevant current legislation regarding Health and Safety to personnel involved in the installation of Central Office (CO) and site based equipment.
- Explain the necessity for the correct use, care, control and certification of tooling.
- Describe the hazards associated with the use of lasers and fibre optic cables.
- Work safely installing, commissioning and testing PON and Blown fibre equipment


### Underpinning Knowledge

- H&S Legislation
- Codes of Practice and Manufacturers Instructions
- Protective clothing and equipment
- Laser & Optical Fibre Safety Requirements

#### **Outcome 2. Describe and analyse the PON system within the telecommunications infrastructure for the distribution of Triple Play services.**

To achieve this outcome candidate must demonstrate the ability to:

- Differentiate between the 7 layers of the OSI model and identify their functions,
- Distinguish between GPON, EPON, BPON, APON and relate them to the ITU-T and IEEE standards.
- Describe typical PON topologies (Star, Ring and Bus)
- Describe the different transport paths in terms of FTTH, FTTB, FTTC, FTTCab
- Identify major equipment elements (OLT, ONT, POP, CO, OS)
- Define the PON wavelength division multiplexing structure and state the services carried on each wavelength.
- Carry out a PON link loss budget and corrective measures when out of budget.



## Underpinning Knowledge

### **a. PON Based Transport Network**

History of PON: Identify the functions of the 7 layer Open Systems Interconnection Basic Reference Model (OSI) and the communication layer.

### **b. Transport System**

Compare data rates and technologies that are used on the PON system.  
International Telecommunications Union-Telecommunications (ITU-T) Standards  
IEEE Standards  
Service types used on PON systems and associated wavelengths

### **c. Network Elements:**

Types of network elements, their configuration and connection to form a network.  
Types of PON equipment and their components.  
Outside plant equipment

### **d. Splitter Technology**

Types of splitters (1:2, 1:4, 1:8, 1:16, 1:32, 1:64), Split ratios and power loss, Planar and Fused-Biconic Taper (FBT), Active and Passive components  
Types of connector used on a PON system and their loss, Link loss budget analysis.

## **Outcome 3. Plan the installation and testing of micro ducts within a blown fibre system.**

To achieve this outcome the candidate must demonstrate the ability to:

- Observe safe practice in implementing the planning, installing and commissioning activities
- Identify the Health & Safety requirements outlined by equipment provider's specifications and documentation.
- Satisfy the objectives of each of the set assignments to implement the planning, installation and blowing of fibre units into blown fibre systems.
- Identify the factors successful completion of the blowing task.
- Carry out maintenance of the blowing equipment as required.

## Underpinning Knowledge

### **a. Planning;**

Practical planning elements and Health & Safety requirements at central Office and site level. Equipment provider's specifications and documentation.

### **b. Installation:**

Factors related to the layout and placement of equipment and micro ducts to manufactures specification and good practice. Necessity for checking completed work including Quality Assurance schedules and 'as built' diagrams.

## **Outcome 4. Explain the practical planning elements and best practice associated with the installation of Inside and Outside plant equipment.**

To achieve this outcome the candidate must demonstrate the ability to:

- Identify a range of micro ducts in respect of the size and construction of the ducting.

- Demonstrate skills and knowledge in the installation and fitting of blown fibre products in accordance with the set assessments.
- Construct a blown fibre infrastructure using suitable micro ducts and routing them according to design diagrams

### Underpinning Knowledge

#### **a. Micro duct construction**

Identify and explain the need for different types of size and construction for micro duct cables, select suitable products for the use in different areas and environments

#### **b. Installation and fitting of blown fibre products**

Using suitable products fit micro duct cables and configure the tubes in accordance with design plans.

#### **c. Construction of Air Blown Fibre (ABF) infrastructure**

Using suitable products construct a ABF infrastructure configuring the tubes in accordance with the outlined plans. Test the micro ducts and prepare the system for the blowing of fibre units.

### **Outcome 5. Prepare and Install Fibre Optic Cables**

To achieve this outcome the candidate must demonstrate the ability to:

- Specify the hazards associated with optical fibres and the safety precautions to be observed.
- Identify the construction and characteristics of common fibre optic cables.
- Select and demonstrate the correct use of cable cutting and stripping tools
- Join single mode fibres in cable joint housing using fusion splicing.
- Terminate cables with connections or pigtails and inspect end-face condition.
- Use appropriate test equipment for measurements with cables such as continuity, cable tracing, OTDR and bit error rate.

### Underpinning Knowledge

#### **a. Cables, construction and characteristics**

Construction and characteristics of common outdoor and indoor optical fibre cables.

Perform splicing and terminations on fibre optic cables.

Perform measurement tests on cables.

#### **b. Test Equipment**

PON enable Optical Time Domain Reflectometer, Continuity & Cable Tracing and PON Power Meter

### **Outcome 6. Examine PON networks using suitable test equipment.**

To achieve this outcome the candidate must demonstrate the ability to:

- State the types of test equipment needed to test and commission a PON system
- List the tests required at installation of a PON system
  - Bidirectional Optical Return Loss (ORL)
  - Bidirectional end-to-end loss measurement
  - Bidirectional end-to-end link characterisation
- List service activation tests and expected power levels for each class of service

### Underpinning Knowledge

#### **a. Test equipment**

End to end optical return loss testers, end to end optical loss testers, link characterisation using PON enabled OTDR



**b. Testing Methodology**

Bidirectional Optical Return Loss (ORL) Bidirectional end-to-end loss measurement  
Bidirectional end-to-end link characterisation

**c. Service Activation Testing**

Optical power measurements of all wavelengths utilising PON optical power meters.  
Network fault diagnosis procedures and testing.

**Duration: 2 days**