



Institute of IT Training
Accredited e-Learning Provider



Course: FTTX - Fibre in the local loop

About this course:

This e-learning course from **PTT** describes the access networks that employ optical fibre to increase the bandwidth available to residential and business customers. The provision of a passive optical network allows more customers to access a triple-play service offering high speed Internet access, multiple interactive TV channels and a telephone service.

The course consists of four modules each ending with on-screen assessments:

- 1: Fibre in the access network
- 2: Passive optical network systems
- 3: BPON and GPON system
- 4: EPON systems

Who will benefit from studying this course:

This course is designed for study by those who are, or intend to be, involved in the planning, installation, provisioning or maintenance of passive optical networks.

It is suggested that those requiring just an appreciation of the benefits and features of the various types of passive optical network should study the first two modules of the course while those requiring a more in-depth understanding should study all four modules.

Course prerequisites:

A basic understanding of optical fibre principles, packet switching and time division multiplexing. It is suggested that the **PTT** e-learning courses Optlink A: "Optical fibre principles" and TransNet A: "Introduction to wide area networks" are studied before attempting this course.

For those who intend to study the fourth module: "Transporting traffic in an EPON system", an understanding of the operation of Ethernet LANs would be advantageous. It is suggested, therefore, that the **PTT** suite of LanNet courses covering Ethernet LANs is studied before attempting the fourth module.

Related PTT courses:

TransNet H: "DSL services" – describes the techniques that provide broadband access over copper wires.

MediaNet B: "Voice over IP" – describes the techniques that provide a telephony service over IP-based networks.

MediaNet E: "Video over IP" – describes the techniques and systems that provide an interactive television service (IPTV) over IP-based networks.

Course content:

Module 1: Fibre in the access network

Module Aim: To introduce the benefits, basic principles of operation and structures of the various forms of passive optical network (PON).

Objectives: By the end of the module, a trainee will be able to:

- Describe the structure and bandwidth limitations of a conventional access network employing copper-wire pairs.
- Explain that the provision of triple-play services requires that customers have access to more bandwidth.
- Indicate the distance limitations of DSL technologies and explain how the use of fibre can provide more bandwidth to customers over a greater distance.
- Explain the cost benefits of a point to multipoint PON.
- Describe the role of the basic components of a PON.
- Describe the characteristics of optical splitters and their use as T and Star couplers.
- Explain how the use of wavelength division multiplexing (WDM) allows a single fibre to carry traffic in both directions.
- Explain how a single fibre can carry traffic downstream to many customers by using time division multiplexing (TDM) techniques.
- Explain how customers can share access to the PON by using time division multiple access (TDMA) techniques.
- Describe and compare the structures and benefits of various configurations of a PON including fibre to the home (FTTH), fibre to the node (FTTN) and fibre to the cabinet (FTTC).

Module 2: Passive optical network systems

Module Aim: To introduce and compare the service features of various types of passive optical network (PON), and the equipment employed in FTTC and FTTH configurations.

Objectives: By the end of the module, a trainee will be able to:

- Explain that standards have been developed for several types of PON and name the organisations that have published recommendations for Broadband PONs (BPON), Gigabit PON (GPON) and Ethernet PON (EPON).
- Explain the need to automatically determine the distance of a customer's premises from the local exchange and describe the purpose of equalisation delay.
- Describe the benefits and basic principles of dynamic bandwidth allocation.
- Describe the role of the various types of equipments in a fibre to the cabinet (FTTC) configuration including optical line terminal (OLT), optical network unit (ONU).
- Describe the role of the various types of equipments in a fibre to the home (FTTH) configuration including OLT and optical network terminal (ONT).
- Describe the role of the various customer premises equipment (CPE) needed for a triple-play service (telephony, TV and Internet access).
- Describe and compare the various methods of distributing a triple-play service in a customer's premises inc. Cat 5 cabling, Powerline, HomePNA and Wifi.
- Describe and compare the service features and capabilities of BPONs, GPONs and EPONs.

Module 3: BPON and GPON systems

Module Aim: To describe the protocols and techniques used to transport various types of traffic over BPON and GPON systems.

Objectives: By the end of the module, a trainee will be able to:

- Summarise the role of the various protocols used at the data link layer by BPON, GPON and EPON systems.
- Describe the basic frame structure of signals transmitted over a BPON with reference to how traffic from various sources is identified and how overhead information is carried.
- Describe the role of Physical Layer Operations and Maintenance (PLOAM) messages in BPONs and GPONs.
- Explain the concept of a Transmission Container (T-CONT) with reference to providing a differentiated service in BPONs and GPONs.
- Explain that a T-CONT can be allocated one of several Classes of Service each suited to a particular type of traffic.

- Describe the basic frame structure of signals transmitted over a GPON with reference to how different traffic formats can be carried within the same frame.
- Explain how the concept of GPON ports allows traffic from different sources to be identified and describe the relationship between ports and T-CONTs.
- Describe how reports from an Optical Network Unit (ONU) can be used to determine how much bandwidth should be allocated to individual T-CONTs.
- Describe the process of activating a newly attached ONU in a GPON.

Module 4: EPON systems

Module Aim: To describe the protocols and techniques used in an EPON to transport traffic of various types over the passive optical network (PON).

Objectives: By the end of the module, a trainee will be able to:

- Explain that the EPON standards were developed to reduce the complexity of passive optical networks and reduce system costs.
- Explain the differences between a conventional Ethernet local area network (LAN) and a PON with reference to peer to peer communication.
- Explain the concept and purpose of logical links (LL) in an EPON.
- Explain the relationship between an LL Identifier (LLID) and a MAC address.
- Describe how the The Multipoint Control Protocol (MPCP) is used to discover newly attached Optical Network Units (ONU) and control logical link bandwidth allocation.
- Explain why bandwidth is normally allocated to an EPON ONU not its individual traffic streams.
- Explain the limitations of assigning a single LLID to an ONU and describe methods of offering a differentiated service in an EPON including the use of Virtual LAN (VLAN) identities.

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