

TCD: Next generation access networks

Online course specification

Target audience:

This course is designed for technicians and engineers involved in the design, commissioning and maintenance of copper and optical fibre based access networks.

Course aim:

This course describes the capabilities, components and operation of the next generation fixed line access networks that will meet the demand for very high capacity broadband connections to online services in the coming years.

Course level: Intermediate

An explanation of PTT course levels is given at the end of this document

Pre-requisites:

An appreciation of the basic principles of transmitting signals over copper wires and optical fibre. The PTT online course "Transmission fundamentals" will provide the information you need.

Course structure:

The course consists of the following 4 modules:

1. Existing access networks
2. Next generation DSL
3. G.fast installation and services
4. Next generation PONs

Module 1: Existing access networks

Module aim: To review the basic infrastructure and capabilities of existing access networks as well as their limitations.

After completing this module, a trainee will be able to:

- describe how a telephone service and Internet access can be provided over the same pair of wires.
- compare the characteristics, capabilities and applications of the various versions of ADSL.
- describe the role of the various components of a passive optical network (PON).
- describe and compare the capabilities and characteristics of GPON and EPON systems.
- describe the various applications of passive optical networks including FTTH, FTTB, and FTTC services.
- describe and compare the capabilities and applications of the various Very High speed DSL (VDSL) profiles.
- describe the various ways of giving competitors access to an incumbent's access network as required by national regulators.
- describe the capabilities and components of a cable TV system with particular reference to the provision of a broadband service.

Module 2: Next generation DSL

Module aim: To introduce the techniques that allow copper wire connections to provide data transfer rates that are comparable with the performance provided by existing fibre to the home services.

After completing this module, a trainee will be able to:

- describe the role of a dynamic spectrum management (DSM) system with reference to the levels of DSM.
- describe the role of vectoring with reference to the conditions necessary to adequately reduce crosstalk between lines carrying VDSL2 broadband signals.
- describe the principles of operation and capabilities of G.fast broadband connections over copper wires.
- describe the role of the various components of a fibre to the distribution point (FTTdp) system.
- give examples of the applications of FTTdp including providing backhaul connections in a mobile radio access network.
- describe the capabilities of next generation cable TV systems with reference to DOCSIS 3.0 and 3.1.

Module 3: G.fast installation and services

Module aim: to consider the issues relating to providing a G.fast service including the compatibility of G.fast with existing services.

After completing this module, a trainee will be able to:

- describe the role and features of G.fast distribution point units (DPUs) and G.fast customer equipment with reference to reverse powering.
- describe two methods of providing a telephone service on a line carrying a G.fast signal.
- explain that G.fast was designed to allow a “self-install” service.
- describe how disruption to a broadband service can be minimised when upgrading from a VDSL service to a G.fast service.
- describe the measures that have to be taken to allow lines carrying VDSL signals and those carrying G.fast signals to co-exist.
- explain that a line carrying a G.fast signal can cause disruption to FM radio reception and describe how such interference can be avoided.
- explain a possible migration strategy from VDSL broadband, through G.fast to fibre to the home.

Module 4: Next generation PONs

Module aim: To explore the capabilities and applications of second and third generation passive optical networks with reference to their compatibility with older systems.

After completing this module, a trainee will be able to:

- describe the capabilities and the role of the components of an XG-PON system.
- explain that a GPON system and an XG-PON system can co-exist on the same physical infrastructure.
- describe the capabilities of a 10G EPON with reference to a choice between symmetric and asymmetric operation and its compatibility with 1G EPON.
- describe how a TWDM-PON can provide higher data transfer rates to more customers than even XG-PON.
- describe the importance of “colourless” ONTs and explain how this may be achieved.
- give examples of applications of TWDM-PON with particular reference to providing fronthaul and backhaul connections in an LTE mobile radio access network.
- explain that GPON, XG-PON and TWDM-PONs can share the same physical infrastructure.
- describe how passive optical networks may evolve with reference to the use of arrayed waveguide gratings and ring networks.

Course access requirements:

There are two versions of this course, one designed for access on a PC or laptop, the other designed for access on a tablet.

Computer version:

To access the course, a computer running a browser such as Google Chrome, Safari etc is required. The computer should have Internet access. A screen resolution of at least 1024x768 is necessary.

Tablet version:

This version of the course is designed for study on a tablet through the learntelecoms™ App which is available for Apple® iPad® and for Android™.

Minimum requirements:

learntelecoms App for Android: 7in tablet or larger with ARMv7 processor running Android 2.3 or higher.

learntelecoms App for iPad running iOS 6.1 or higher.

Learning facilities:

This online course employs interactive simulations, hypertext links to an online glossary and multiple-choice question sessions to fully involve the trainee in the learning experience. Each module provides revision links to previously studied, relevant topics. A record of progress and level of achievement is recorded for each trainee. Once studied as a structured, assessed course, the content can be browsed for revision or reference.

PTT course levels:

PTT online courses are categorised by one of three levels according to the depth of treatment they provide:

1. Introductory:

PTT Introductory courses are designed for those with no previous experience or knowledge of telecommunications. These courses provide an overview of telecommunications or discuss the fundamentals of electronic communications. The study of general science at secondary (high) school is a typical pre-requisite for PTT Introductory courses.

PTT Introductory courses are suitable for those joining the telecommunications sector particularly those in an apprenticeship programme.

2. Intermediate:

PTT Intermediate courses are designed for technicians and engineers requiring an understanding of a certain aspect of telecommunications. Those planning to study an Intermediate course should have an understanding of the basic principles of electronic communications.

The depth of treatment provided by Intermediate courses is typically equivalent to level 3 of a UK national vocational qualification (NVQ). PTT Intermediate courses can be used to support the attainment of a Communications Technology NVQ at level 3.

3. Advanced:

PTT Advanced courses are designed for those who require an in-depth treatment of a certain aspect of telecommunications. Such courses are suitable for system designers as well as those who will be responsible for the maintenance of the system described in the course.

Those planning to study a PTT Advanced course should have a background in telecommunications, and an understanding of telecommunications fundamentals and the principles of the type of telecommunications system described in the course.

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