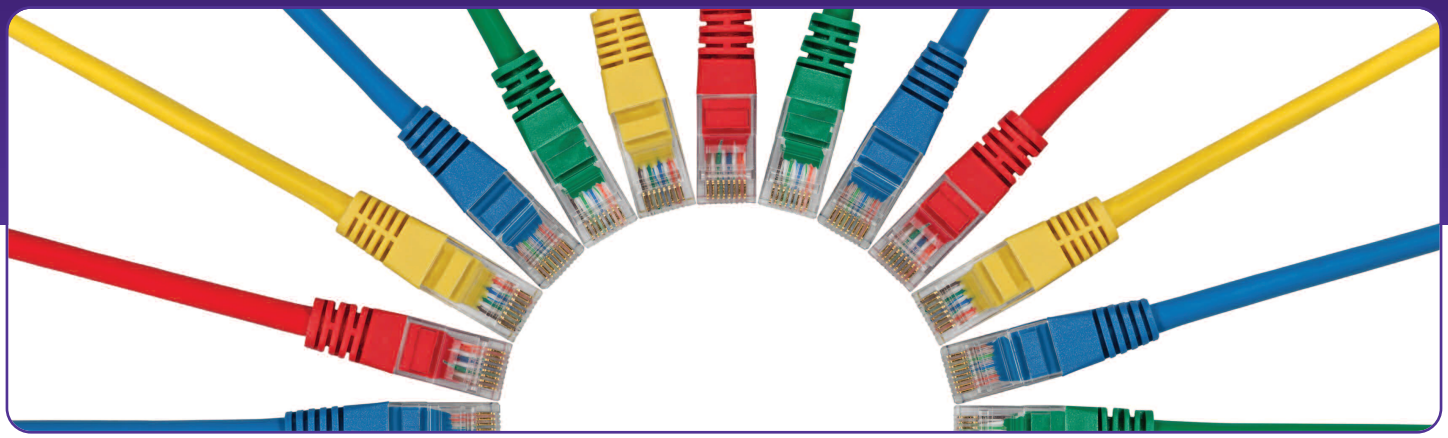
3667-02 Unit 101

Level 2 Award in Communications Cabling



Basic Principles of Communications Systems

This unit is concerned with safe working practices and the basic principles of communications systems. This is the core unit of the C&G 3667-02 qualification and must be completed in addition to one of the optional units of Unit 102, Unit 103 or Unit 104 to achieve the full Level 2 Award in Communications Cabling.

Outcome 1

Identify the safe working practices in communication systems

Underpinning knowledge

You will be able to:

- State the rules for safe working when undertaking installation including:
  1. Statutory requirements
  2. Working in confined spaces and
  3. Electrical safety
- State the rules for safe working when carrying out preparation in terms of
  1. Safe use of cutting and stripping tools
  2. Safe handling and containment of cleaning materials
  3. The disposal of waste material
- State the rules for safe working and any special precautions when splicing in terms of
  1. Identification of hazardous working conditions
  2. Selection and use of tools and materials
  3. The dangers of high voltage systems employed in fusion splicing machines
- State the rules for safe working and any special precautions to be observed when terminating the cables in terms of
  1. Identification of hazardous working conditions
  2. Correct and safe use of tools and equipment
  3. Correct waste disposal
  4. Storage of tools
  5. Safe working when handling cable
  6. Care in using chemicals for cleaning
  7. Care in use of resins and adhesives

Outcome 2

Describe the basic principles of communication systems

Underpinning knowledge

- S1 Units and symbols

You will be able to:

1. Identify basic SI Units
2. Identify names and symbols for preferred SI prefixes
3. Identify waves and wave motion
4. Define amplitude, wavelength (), frequency (f) and the unit of frequency (hertz)
5. State the relationship velocity, frequency and wavelength (v = f)
6. Define "efficiency" in terms of input and output energy

- Basic electricity (DC)

You will be able to:

1. Recognise the international standard symbols for electrical components
2. State the effects of an electrical current
3. Distinguish between electrical conductors and insulators
4. State the S1 units of current (ampere), potential difference (volt) and resistance (ohm)
5. State Ohm's law and use the law to solve simple electrical circuit problems

- Communication Systems

You will be able to:

1. State the meaning of "telecommunications"
2. Identify basic communication systems
3. Outline the basic principles of cable systems
4. State the sources of interface
5. List sources of distortion
6. Identify the properties of differing types of transmission links (channels)
7. Identify various methods of communicating over a channel
8. Identify types of information carried by communication systems
9. State the systems available for communication
10. Categorise signals into audio, video and data types
11. State the differences between analogue and digital signals
12. State the meaning of bandwidth
13. State the meaning of the baseband of complex signals
14. Recognise that analogue information may be converted to digital signals and vice versa
15. State that variation of the amplitude, frequency or phase of a carrier wave can be used to convey information
16. State the meaning of "gain" in communication systems
17. State the meaning of "attenuation" in communication systems
18. Explain why gain and attenuation are usually measured in decibels (dBs)
19. State the relationship for the power ratio expressed in dBs for a number of ratios and vice versa
20. Calculate in dBs the overall gain and/or attenuation of simple systems given the gain/attenuation of the individual stages
21. Explain the meaning of multiplexing in communication systems
22. State the advantages and disadvantages of optical fibre compared to copper

- Data Communication

You will be able to:

1. Explain the meaning of a network
2. State that data networks allow computers or other data terminals to exchange information
3. State the advantages of digital communication over analogue methods
4. Recognise that digital networks carry binary information
5. Distinguish between "bits" and "bytes"
6. State the meaning of bit error rate and give typical figures for copper and optical fibre
7. Explain that there are two methods of transporting data: serial and parallel
8. Explain the advantages and disadvantages of transmitting data by serial and parallel methods
9. Identify applications for serial data communication and parallel data communication
10. Explain why "modems" are required for computer communication over analogue lines
11. State that there are three main categories of computer networks
12. Identify the basic topologies of computer networks

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City & Guilds Approved Centre

3667-02 Unit 102

Level 2 Award in Communications Cabling

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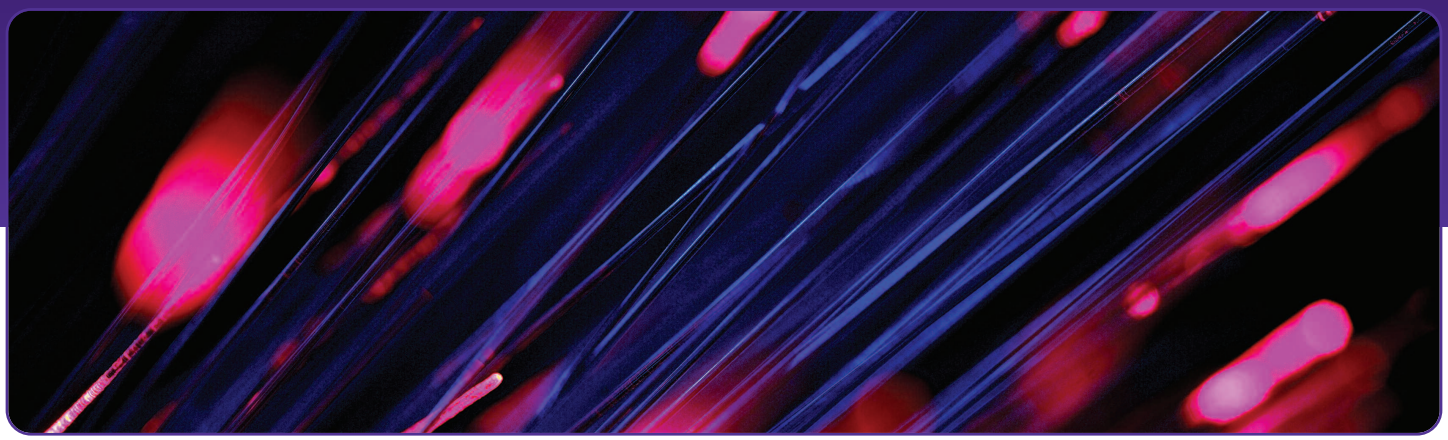

Fibre Optic Cabling in an Internal Environment

Local Area Networks, CCTV, Alarms and Security Systems This unit is concerned with the installation, splicing, connectorisation, termination and testing of fibre optic cable in a typical datacomms environment, characterised by low fibre count cables (typically less than 24 fibres) terminated in patch panels/equipment racks. This would usually take place in an indoor environment involving multimode and singlemode end-to-end cabling.

Outcome 1

Work safely with optical fibres in an internal environment

Practical activities

You will:

- Conduct a risk assessment prior to installation of optical fibres in an internal environment
- Work safely when installing, splicing, terminating and testing optical fibre in an internal environment

Underpinning knowledge

You will be able to:

- State the rules for safe working when undertaking the installation of fibre cables
- State the rules for safe working with fibre cables when carrying out preparation
- State the rules for safe working and any special precautions when splicing
- State the rules for safe working and any special precautions to be observed when terminating fibres onto connectors
- State the rules for safe working and any special precautions to be observed when testing

Outcome 2

Follow recommended installation procedures

Practical activities

You will:

- Check cable and components before installation
- Ensure that specified cable laying procedures are followed
- Test laid cable before jointing/termination

Underpinning knowledge

You will be able to:

- State the use of fibre optics in LANs
- Identify multimode optical fibres as graded index (GI) and singlemode G652 as step index
- Distinguish types of optical fibre
- State fibre specifications and parameters
- State the recommended fibre and cable inspection test methods and documentation
- Identify the component parts of an optical fibre used in communication systems
- State the use of the components
- Explain the use of installation equipment
- State the requirements for checking cable and components in accordance with relevant European Standards
- State the methods and means to follow work plans and instructions
- State the rules for undertaking cable installation and fibre management
- State the methods of testing laid cable before jointing/termination

Outcome 3

Prepare fibre optic cable for fibre connectorisation and splicing

Practical activities

You will:

- Prepare cable for connectorisation and splicing
- Prepare coated fibre for connectorisation and splicing

Underpinning knowledge

You will be able to:

- State the characteristics of cables as indoor/outdoor/universal
- State the basic constructional features of fibre optic cable and coatings
- Select and use cable cutting and stripping tools
- State the purpose and use of fibre cleaning materials and the techniques involved
- State the rules and any special precautions to be observed when carrying out preparation

Outcome 4

Splice together optical fibres

Practical activities

You will:

- Prepare bare fibre for splicing
- Splice fibres using fusion splicing techniques
- Splice fibres using mechanical splice techniques

Underpinning knowledge

You will be able to:

- Explain the benefits and criteria for using the main splice methods
- State the working principles of splicing
- Explain how to use fibre cleaving tools and the fibre preparation techniques
- State the possible causes of faults in cleaving
- Identify splice equipment according to range and application
- Identify mechanical splices, accessories and splice protection housings
- Identify splice protection systems for working within patch panels
- Identify splice management, protection systems and procedures for working with low fibre count cables within a patch panel
- Identify potential problems when undertaking splicing and describe possible causes
- State the performance requirements of splices according to European Standards
- State the rules and any special precautions for splicing

Outcome 5

Terminate fibre optic cables by fitting connectors

Practical activities

You will:

- Fit a variety of fibre optic connector styles, including straight tip (ST), subscriber connector (SC) and small form factor (SFF) to fibre optic cables, using at least four different termination technologies from epoxy and polish, anaerobic adhesive, pre-glued, pre-polished and crimped

Underpinning knowledge

You will be able to:

- State the types and uses of common connectors for appropriate termination methods
- Identify termination tools and materials
- State the fitting procedures for connectors
- State the possible causes of common faults intermination
- State the performance tests for termination

Outcome 6

Test fibre optic links

Practical activities

You will:

- Test fibre continuity using a visible light source
- Measure the insertion loss using an infrared light and power meter
- Test link performance using Optical Time Domain Reflectometer (OTDR) techniques

Underpinning knowledge

You will be able to:

- Explain how to perform loss calculations
- State the range of test methods and the purpose of testing to measure cable performance
- State the use and principle of operation of test equipment
- Explain how to use insertion loss testing equipment and procedures to measure connector insertion loss and cabling system losses
- Explain how to apply and operate an OTDR
- State the procedures for testing in accordance with relevant standards and test conditions
- Explain how to apply and operate test equipment to prevent source of error
- Explain the results and recognise acceptable link and component performance with reference to relevant specification and record the results on appropriate documentation

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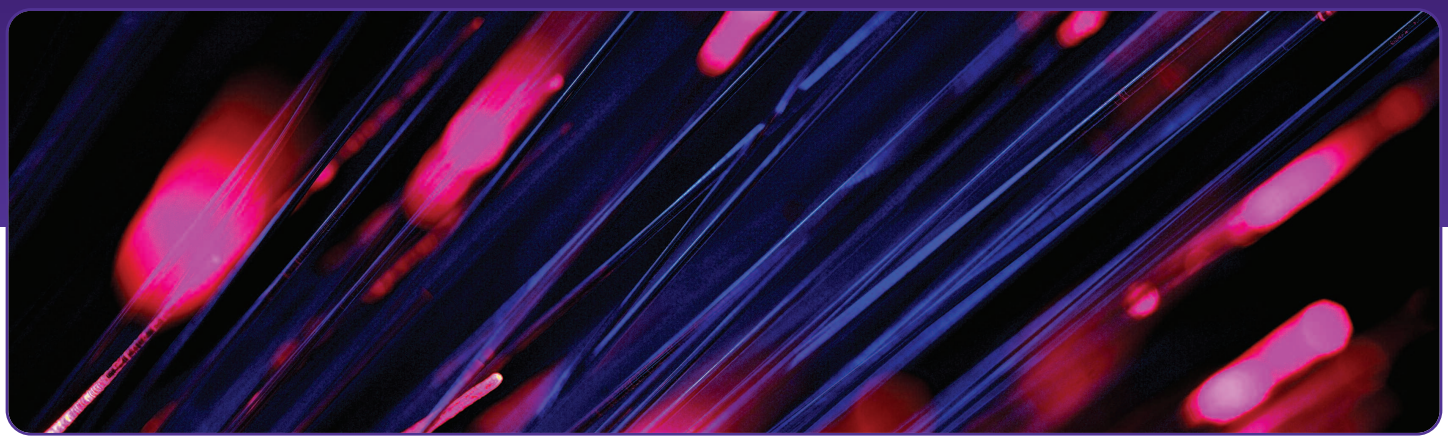
3667-02 Unit 103

Level 2 Award in Communications Cabling



Fibre Optic Cabling in an External Environment

This unit is concerned with the installation, splicing, termination and testing of fibre optic cables, typically a multi-element, singlemode fibre cable of at least 24 fibres, used in an external environment with applications in Long Haul Telecommunications, Wide and Metropolitan Area Networks, Railway Signalling, Motorway Signage, City CCTV Networks and Traffic Control Systems.

Outcome 1

Work safely with optical fibres in an external environment

Practical activities

You will:

- Conduct a risk assessment prior to installation of optical fibres in an external environment
- Work safely when installing, splicing, terminating and testing optical fibre in an external environment

Underpinning knowledge

You will be able to:

- State the rules for safe working when undertaking the installation
- State the rules for safe working with fibre cables when carrying out preparation
- State the rules for safe working and any special precautions when splicing
- State the rules for safe working and any special precautions to be observed when testing

Outcome 2

Follow recommended installation procedures

Practical activities

You will:

- Check cable and components before installation
- Check that correct cable laying procedures are followed
- Test laid cable before jointing/termination

Underpinning knowledge

You will be able to:

- State the use of fibre optics in the communications network
- State the singlemode optical fibre types
- State fibre specifications and parameters
- State the fibre and cable inspection test methods and documentation
- State the use of the components
- Explain the use of installation equipment
- State the requirements for checking cable and components in accordance with relevant European Standards
- State the methods and means to follow work plans and instructions
- State the rules for undertaking cable installation and fibre management
- State the methods of testing laid cable before jointing/termination

Outcome 3

Prepare fibre optic cable for fibre splicing

Practical activities

You will:

- Prepare cable for splicing
- Prepare coated fibre for splicing

Underpinning knowledge

You will be able to:

- Identify the characteristics of cables as indoor/outdoor/universal
- State the basic constructional features of singlemode fibre cable and coatings
- Select and use cable cutting and stripping tools
- State the purpose and use of fibre cleaning materials and the techniques involved
- State the rules and any special precautions to be observed when carrying out preparation

Outcome 4

Joint fibre optic cables by splicing

Practical activities

You will:

- Set up working environment for outdoor cable jointing
- Prepare bare fibre for splicing
- Splice fibres using fusion splicing techniques
- Splice fibres using mechanical splice techniques
- Organise cables, tubes and fibres into joint housing
- Seal joint enclosure using a shrink down

Underpinning knowledge

You will be able to:

- State the requirements for a cable joining environment
- State the working principles of splicing
- Explain how to use fibre cleaving tools and the fibre preparation techniques
- State the possible causes of faults in cleaving
- Identify splice equipment according to range and application
- Identify mechanical splices, accessories and splice protection housings
- Identify potential problems when undertaking splicing and describe possible causes
- Describe the use of splice management and protection systems and procedures for working with multi element cables containing at least 24 fibres within a joint housing
- State the sealing and cable retention methods for joint closure systems
- State the rules and special precautions for splicing

Outcome 5

Terminate fibre optic cable by splicing on pre-terminated pigtails

Practical activities

You will:

- Set up work environment for cable termination
- Organise cables, tubes and fibres into Optical Distribution Frame (ODF)
- Prepare bare fibre for splicing
- Prepare secondary coated fibre for splicing
- Splice fibres using fusion splice techniques

Underpinning knowledge

You will be able to:

- State a range of connectors suitable for a telecomms environment
- State the requirements for efficient and effective cable termination
- State the working principles of splicing
- Explain how to use fibre cleaving tools and the correct fibre preparation techniques
- State the possible causes of faults in cleaving
- Identify splice equipment according to range and application
- State the use of a variety of mechanical splices, accessories and splice protection housings
- State the use of splice management and protection systems and procedures for working with multi element cables containing at least 24 fibres within an ODF

Outcome 6

Test fibre optic links

Practical activities

You will:

- Test fibre continuity using a visible light source
- Measure the insertion loss using an infrared light and power meter
- Test link performance using Optical Time Domain Reflectometer (OTDR) techniques

Underpinning knowledge

You will be able to:

- State the range of test methods and the purpose of testing to measure cable performance
- State the use and principles of operation of test equipment
- State the use of testing equipment and procedures
- State the application and operation of an OTDR
- State the procedures for testing in accordance with relevant European

Standards and test conditions

- Explain how to apply and operate test equipment to prevent sources of error
- Explain the results and recognise acceptable link and component performance with reference to relevant specification and record the results on appropriate documentation.

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3667-02 Unit 104

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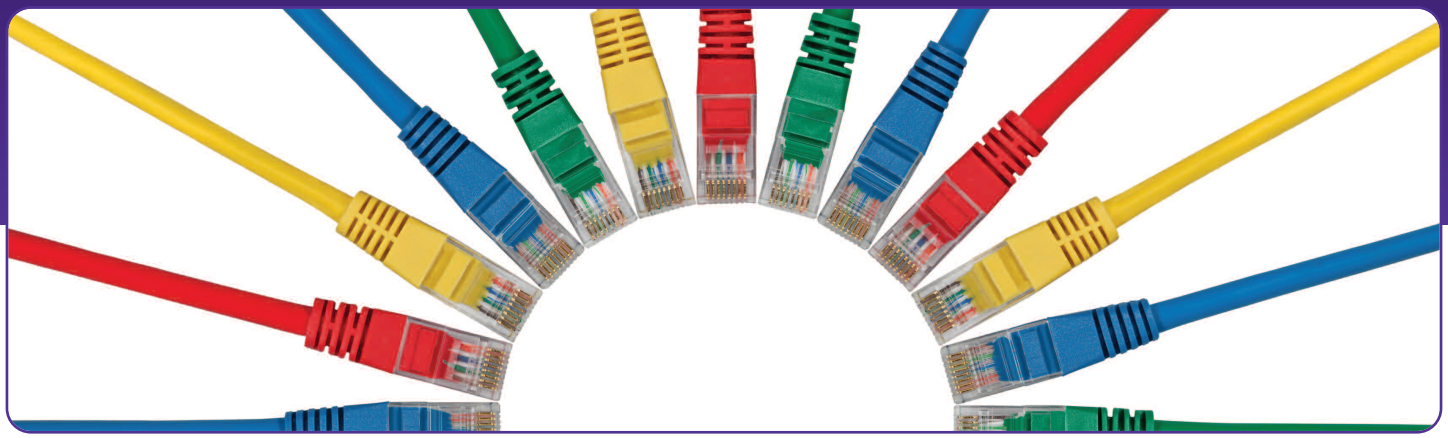

Copper Cabling in an Internal Environment

This unit is concerned with the safe installation, procedures and testing of copper communication cables. With the phenomenal growth of Data Communications and the Internet, there is a real requirement for trained technicians who can install and test data networks for a wide range of applications. Utilising our LIVE Ethernet and LAN/WAN simulators, we bring the reality of the working environment into the classroom. This course gives you all the skills you need to install and test copper based communications cables.

Outcome 1

Work safely with copper cabling in an internal environment

Practical activities

You will:

- Conduct a risk assessment prior to installation of copper cables in an internal environment
- Work safely when installing, terminating and testing copper cables in an internal environment

Underpinning knowledge

You will be able to:

- State the rules for safe working with copper cabling when undertaking installation
- State the rules for safe working with copper cabling when carrying out preparation
- State the rules for safe working in terms of electrical safety
- State the safe use of battery/electrically powered test equipment and power leads

Outcome 2

Understand basic electrical theory and safety with reference to data communications cabling

Practical activities

You will:

- Use a multi-meter to measure voltage and resistance

Underpinning knowledge

You will be able to:

- State the materials that make up electrical conductors and insulators
- Explain capacitance and inductance and their relationship to an electrical cable
- Identify analogue and digital signals
- Identify SI measurement prefixes
- Describe the relationship between MHz and Mbits
- Explain return loss, equal level far end cross talk (ELFEXT), powersum calculations, delay skew, propagation delay, attenuation-tocrosstalk ratio (ACR), length, attenuation, near end cross talk (NEXT), wire map, dc loop resistance, normal velocity of propagation (NVP) and bandwidth
- State the effect of copper cable signalling
- State the rules for copper cable installation and management

Outcome 3

Install copper communication cabling, following recommended installation procedures in accordance with current applicable standards

Practical activities

You will:

- Check cable and components before installation
- Undertake a site survey prior to commencing work
- Check that correct cable laying procedures are followed

Underpinning knowledge

You will be able to:

- State the various cable topologies available for the installation of copper cables
- State the different cable types available for use in copper networks
- State the relevant classes, standards and categories of cabling
- State the installation techniques
- State the rules and any special precautions to be observed when carrying out installation

Outcome 4

Terminate copper communication cabling

Practical activities

You will:

- Terminate connectors in accordance with manufacturer's recommendations and correctly mount connectors into communications panels, wall and floor boxes, cabinets and frames

Underpinning knowledge

You will be able to:

- Explain how to use cable preparation and termination tools
- State how to terminate registered jack (RJ) 45 connectors from at least three vendors on to UTP and FTP cabling
- State the method of termination RJ 11/line jack unit (LJU) or other relevant connectors to telephone cable
- State how to terminate Cat 5e patch leads
- State insulation displacement contact (IDC) methods of terminating multi-core copper cables within wiring systems and 110 block wiring systems
- State the rules and any special precautions for termination
- Describe how to terminate co-axial cable with Bayonet N Connectors (BNC)

Outcome 5

Test FTP, UTP and multi-core copper links

Practical activities

You will:

- Test FTP and UTP copper cable permanent links
- Test a multi-core cable installation
- Test installations to relevant performance standards
- Test a telephone cabling system

Underpinning knowledge

You will be able to:

- Explain the importance of testing cabling plant installations
- State the applications of national and international wiring standards
- Describe the cabling topology
- Explain the application and use of continuity and loop testing equipment
- Explain split pairs, transposed/crossed pairs, reversed pairs and mixed pairs
- State the correct methods of measuring NEXT from both ends of the cable, ACR, return loss (dB), cable length, (dc) resistance (Ohms), propagation delay, cable attenuation, delay skew, wire maps, FEXT and ELFEXT and powersum calculations
- State the

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Entrance Technician (ICND1)

Cisco Certified Prerequisites

The knowledge and skills that a learner must have before attending this course are as follows:

- Basic computer literacy
- Basic Internet usage skills
- Basic Microsoft Windows navigation skills
- Basic e-mail usage skills

Course Content

Interconnecting Cisco Networking Devices Part 1 focuses on providing the skills and knowledge necessary to implement and support a small switched and routed network. For the purpose of this course, a small network is defined as 1 to 20 hosts connected to a single switch, with the switch running a single VLAN (VLAN1). The switch is also connected to a router providing a routed link (Routing Information Protocol [RIP] and default) to a simulated Internet and corporate office. ICND1 works from the bottom up, providing knowledge and skills as they are needed. The course starts with an introduction to networks. It then introduces host-to-host communications using TCP / IP. Next, Layer 2 devices (switches) are introduced into the network. Next, Layer 3 devices (routers) are introduced into the network. The introduction of Layer 3 devices leads to the use of WANs and routing to connect the site to the Internet and corporate sites.

Course Objectives

Upon completing this course, the learner will be able to meet these overall objectives:

- Describe how networks function, identifying major components, function of network components, and the OSI reference model
- Using the host-to-host packet delivery process, describe issues related to increasing traffic on an Ethernet LAN and identify switched LAN technology solutions to Ethernet networking issues
- Describe the reasons for extending the reach of a LAN and the methods that can be used, with a focus on RF wireless access
- Describe the reasons for connecting networks with routers and how routed networks transmit data through networks using TCP / IP
- Describe the function of WANs, the major devices of WANs, and configure PPP encapsulation, static and dynamic routing, PAT, and RIP routing
- Use the command-line interface to discover neighbours on the network and manage the router start up and configuration

Course Outline

Course Introduction

- Module 1: Building a Simple Network
- Module 2: Ethernet LANs
- Module 3: WLANs
- Module 4: LAN Connections
- Module 5: WAN Connections
- Module 6: Network Environment Management Capstone Lab: Network Environment Management Lab Guide

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Network Associate (ICND2)

Cisco Certified Prerequisites

The knowledge and skills that a learner must have before attending this course are as follows:

- Basic computer literacy
- Basic Microsoft Windows navigation skills
- Basic Internet usage skills
- Basic e-mail usage skills
- Skills and knowledge equivalent to those learned in Interconnecting Cisco Networking Devices Part 1 (ICND1)

Course Content

Interconnecting Cisco Networking Devices Part 2 (ICND2) v1.1 is an instructor-led course. This five-day course focuses on using Cisco Catalyst switches and Cisco routers that are connected in LANs and WANs typically found at medium-sized network sites. Upon completing this training course, you should be able to configure, verify, and troubleshoot the various Cisco networking devices in a small network environment.

Course Objectives

Upon completing this course, the learner will be able to meet these overall objectives:

- Review how to configure and troubleshoot a small network.
- Expand the switched network from a small LAN to a medium-sized LAN with multiple switches, supporting VLANs, trunking, and spanning tree.
- Describe routing concepts as they apply to a medium-sized network and discuss considerations when implementing routing on the network.
- Configure, verify, and troubleshoot OSPF
- Configure, verify, and troubleshoot EIGRP
- Determine how to apply ACLs based on network requirements, and to configure, verify, and troubleshoot ACLs on a medium-sized network.
- Describe when to use NAT or PAT on a medium-sized network and configure NAT or PAT on routers
- Identify and implement the appropriate WAN technology based on network requirements.

Course Outline

Course Introduction

Course Introduction

- Module 1: Small Network Implementation
- Module 2: Medium-Sized Switched Network Construction
- Module 3: Medium-Sized Routed Network Construction
- Module 4: Single-Area OSPF Implementation
- Module 5: EIGRP Implementation
- Module 6: Access Control Lists
- Module 7: Address Space Management
- Module 8: LAN Extension into a WAN

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