e-Quals Unit Syllabus

Level 3 Design and maintain ICT Networks software components

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City & Guilds
1 Giltspur Street
London EC1A 9DD
T +44 (0)20 7294 2800 **www.cityandguilds.com**
F +44 (0)20 7294 2400 **enquiry@cityandguilds.com**

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Unit 522 Design and maintain ICT Networks software components

Rationale

The aim of this unit is to enable candidates to develop the skills to specify data communication protocols and design and maintain network software components for different types of network.

Learning outcomes

There are **five** outcomes to this unit. The candidate will be able to:

Explain network concepts
Describe communication protocols
Describe software design concepts for networks
Explain protocol specification methods
Design software components

Guided learning hours

It is recommended that 60 hours should be allocated for this unit. This may be on a full time or part time basis.

Connections with other qualifications

This unit contributes towards the knowledge and understanding required for the following qualifications:

Outcome	This award contributes to the knowledge and understanding of the following elements of the NVQ(s)
3,4,5	*4234 City & Guilds NVQ* 311 Software development – component creation 3 307 Managing software development 3

Key Skills

This unit contributes towards the Key Skills in the following areas:

Communication	C3.2, C3.3
Application of Number	N1.1
Information technology	None
Working with others	None
Improving own learning	LP3.1, LP3.2, LP3.3
Problem solving	PS3.1, PS3.2, PS3.3

Assessment and grading

Assessment will be by means of a **set assignment** covering both practical activities and underpinning knowledge.

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Unit 522 Design and maintain ICT Networks software components

Outcome 1 Explain network concepts

Practical skills

The candidate will be able to:

1. interpret a:
   - routing table
   - node diagram

Underpinning knowledge

The candidate will be able to:

1. describe the term network and the advantages and disadvantages of networking computers including:
   - sharing information on the system
   - sharing hardware resources such as printers
   - sharing application software
   - e-mail communication between users
   - access to and use of the Internet/Intranet

1. explain the difference between a local area network (LAN) and a wide area network (WAN)

1. identify the main hardware components of a Network (eg servers, PCs, terminals and peripherals)

1. identify the main functions of the Network Operating System (eg administration,, share level security, user level security, hardware support and storage support)

1. identify the main functions of network connections (eg cabling, connectors, hubs, repeaters and network interface cards.

1. explain the difference between peer to peer (workgroup) networks and server based networks and the common terms used to describe then (eg servers (file, client/server, web, mail), clients, peers, workgroups, connection media, shared resources, operating systems, administration, security and central support systems)

1. identify bus, ring and star network topologies and the advantages and limitations of each

1. describe and distinguish between digital (ISBN) and analogue (PSTN) telephone line communication and the need for either a modem or ISBN adapter card

1. describe the role of various types of print server and the network printing process, including:
   - printer drivers
   - printer names
   - printer sharing software
   - page description languages
   - the print queue

1. describe the role of device drivers (eg network interface card, drive controller, mouse printer)

1. explain the purpose of Firewall software when connecting a LAN to an external network

1. explain the difference between centralised and distributed networks

1. describe error detection methods
   - CRC
   - checksum

1. explain simple encryption techniques which provide security for transmitted data
   - substitution
   - transposition
   - bit manipulation using logical operators

1. explain fixed routing techniques with reference to a routing table located on each mode of a network and a node diagram.

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Outcome 2 Describe communication protocols

Practical skills

The candidate will be able to:

1. interpret data communication protocol specifications.

Underpinning knowledge

The candidate will be able to:

1. identify and describe ASCII character codes used in data communication protocols:
   - SOH
   - NUL
   - STX
   - ETX
   - EOT
   - ENQ
   - ACK
   - NAK
   - SYN

1. describe data transmission formats:
   - serial and parallel data transmission
   - synchronous and asynchronous data transmission
   - simplex, half duplex and full duplex data transmission

1. explain the purpose and use of the protocol parameters for the following:
   - flow control
   - baud rate
   - error control
   - data bits
   - parity
   - stop bits

1. describe the importance of using international standards for data communications and the function of each of the OSI layers

1. describe the function and construction of data packets in a network, how they are handled in OSI layers and advantages of using packets to transmit data over a network

1. describe the functions of protocols and how they are handled in the OSI layered structure

1. describe and compare the TCP/IP NetBEUI and IPX/SPX protocols

1. explain the operation of a token ring with reference to protocols, token passing and packets

1. explain the operation of a bus network with reference to protocols, collision detection and packets.

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Outcome 3 Describe software design concepts for networks

Underpinning knowledge

The candidate will be able to:

1. list the factors that make data communications software different from other software (eg real time response requirements, lack of control over input timing, quantity of data transmitted, communication errors, computer or circuit failures)

1. explain that data communications software must provide message accountability to allow for recovery after a communication or hardware failure

1. list the message accountability actions to be performed for incoming data transmissions (eg logging as soon as a message is received, address checking, time tagging, format and content error checking, discard message and request retransmission if an error is found, sending acknowledgement after logging and checking, maintaining statistics on errors , stopping transmissions from terminals and lines that send an excessive number of errors)

1. list the message accountability actions to be performed for outgoing data transmissions (eg log at time of transmission, request acknowledgement and retransmit if acknowledgement is not received, provide a priority scheme to ensure that outgoing overloads are worked off in a rational manner, test the integrity of lines and terminals and maintain statistics on results, provide storage for messages that cannot be sent because of circuit or terminal errors)

1. explain that networks must be tested to ensure that they will cope with the volume of expected traffic (eg this could mean writing software to generate continuous messages across the network)..

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Outcome 4 Explain protocol specification methods

Practical skills

The candidate will be able to:

1. interpret
   - a State Transition Diagram (STD)
   - an Event-state table
   - a program design language.

Underpinning knowledge

The candidate will be able to:

1. explain that a protocol can be defined in terms of a finite-state machine that can at any instant of time be in one of a number of defined states (eg waiting to send a packet)

1. describe the operation of the Xmodem protocol for a serial link between two computers with reference to:
   - handshaking
   - packet contents
   - data communication control characters
   - error control
   - states
   - events
   - actions to be performed

1. explain that an STD provides a diagrammatical representation of the possible states, transitions and enabling events associated with a protocol

1. explain that a transition between states takes place as a result of an event occurring

1. explain that each entry in an Event-state table defines:
   - any condition that must be satisfied
   - the necessary action to be performed as a result of the event
   - the new state.

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Outcome 5 Design software components

Practical skills

The candidate will be able to:

1. produce diagrams for a given specification (eg State Transition Diagram, Event-state table, Node routing table)

2. produce program design language algorithms for software components

3. identify
   - variable names and data types
   - argument names and data types
   - return values and data types

4. verify that the design conforms to the specification.

Unit record sheet

Use this form to track your progress through this unit.

Tick the boxes when you have covered each outcome. When they are all ticked, you are ready to be assessed.

Outcome		✓	Date
1	**Explain network concepts**	☐	
2	**Describe communication protocols**	☐	
3	**Describe software design concepts for networks**	☐	
4	**Explain protocol specification methods**	☐	
5	**Design software components**	☐	

Candidate Signature ..... **Date** .....

City & Guilds Registration Number .....

Quality nominee (if sampled) ..... **Date** .....

Assessor Signature ..... **Date** .....

External Verifier Signature (if sampled) ..... **Date** .....

Centre Name ..... **Centre Number** .....

Published by City & Guilds
1 Giltspur Street
London
EC1A 9DD
T +44 (0)20 7294 2468
F +44 (0)20 7294 2400
www.cityandguilds.com
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