National Unit Specification: general information

UNIT Computing**:** Computer Networking Fundamentals (SCQF level 5)

CODE F1KH 11

SUMMARY

The overall aim of this Unit is to enable candidates to set-up a small computer network. Candidates will also be required to apply an appropriate methodology and select tools to test and troubleshoot a small network installation. The Unit will provide candidates with information about the different types and features of networking components and the physical network topologies used in industry. Candidates will be made aware of the need for standards and protocols in computer networks. The candidate will also be made aware of the Transmission Control Protocol/Internet Protocol (TCP/IP) networking model and its components. Throughout the Unit the candidate should be exposed to common networking terminology and concepts.

This Unit is suitable for candidates who have an interest in computer networks or who are undertaking a course of study in a computing related field.

OUTCOMES

1   Identify computer networking concepts and network components.
2   Plan and assemble a computer network using existing and manufactured components.
3   Configure and test a computer network.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, it would be beneficial if candidates possessed basic IT skills. This may be evidenced by possession of:

D01D 10   *Information Technology (Intermediate 1)*

or equivalent qualifications or experience.

National Unit Specification: general information (cont)

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CREDIT VALUE

1 credit at Intermediate 2 (6 SCQF credit points at SCQF level 5*)

SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.

CORE SKILLS

[This information will be provided by the Core Skills team to the Qualifications Manager]

National Unit Specification: statement of standards

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Identify computer networking concepts and network components.

Performance Criteria

(a)   Identify key computer networking concepts and terminology.
(b)   Identify common physical networking topologies and their features.
(c)   Identify a networking model and its components.
(d)   Identify types and features of network components.
(e)   Identify different types and uses of networking cables.

OUTCOME 2

Plan and assemble a computer network using existing and manufactured components.

Performance Criteria

(a)   Plan the physical layout and the equipment requirements of a small network.
(b)   Connect a cable to a patch panel and to a telecommunications outlet/connector and test it.
(c)   Test that network cables are operational for the network installation.
(d)   Assemble the computer network.

OUTCOME 3

Configure and test a computer network.

Performance Criteria

(a)   Configure a computer network using appropriate networking software.
(b)   Establish connections between the different computers on the network.
(c)   Transfer data between the different computers on the network.
(d)   Resolve network problems identified during the configuration and testing process.

National Unit Specification: statement of standards (cont)

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EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required that candidates have achieved all Outcomes and Performance Criteria.

Candidates are encouraged to use the Internet in any research etc, however, the evidence produced must be the candidate's own words. Assessors should assure themselves of the authenticity of candidate's evidence.

Written and/or oral recorded performance and product evidence is required which demonstrates that the candidate has achieved the requirements of all of the Outcomes and Performance Criteria. Evidence is required to demonstrate that candidates meet the requirements of all the Outcomes and Performance Criteria.

For Outcome 1 written and/or oral recorded evidence is required which demonstrates that the candidate has achieved the standard specified in the Outcome and Performance Criteria. The assessment will be supervised, controlled and under closed-book conditions and should last no more than 45 minutes. The instrument of assessment will provide opportunities for the Outcome to be fulfilled by means of sampling across the range of the content of Outcome 1. Where re-assessment is required it should contain a different sample from the range of mandatory content. Achievement can be decided by use of a cut-off score. Each sample must include the following:

♦   Identify at least **five** key computer networking concepts
♦   Identify at least **five** key terms used within computer networking
♦   Identify at least **two** common physical networking topologies and their features
♦   Identify at least **one** component and function of the Transmission Control Protocol/Internet Protocol (TCP/IP) networking model
♦   Identify at least **two** types and features of network components
♦   Identify at least **two** different types and uses of networking cables

For Outcomes 2 and 3 performance evidence supplemented by a candidate activity log and assessor observation checklist is required which demonstrates that the candidate has:

♦   created a small network of at least two computers
♦   configured and tested the network including the resolution of problems identified.

The assessment for Outcomes 2 and 3 must be conducted under open-book, controlled and supervised conditions. The assessment may be conducted over an extended period of time rather than on a single assessment occasion.

The candidate activity log must demonstrate that the candidate has:

♦   safely connected the wires of one end of an unshielded twisted pair (UTP) cable to a patch panel and the wires on the other end to a telecommunications outlet/connector and tested it
♦   assembled the network using the equipment and cables to the layout described in the plan
♦   configured and tested a small network of at least two computers, including the correction and recording of at least two network problems
♦   established connection between computers and transferred data from one computer to another.

National Unit Specification: statement of standards (cont)

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The performance evidence for Outcome 2 and 3 will consist of an activity log of the candidate's activity. This activity log will provide a record of candidate activity during this Unit and also provide evidence that the candidate has satisfied all the Performance Criteria for Outcome 2.

The activity log will show that the candidate has completed all the tasks above with due regard to health and safety. An assessor must endorse each candidate activity log together with the candidate's name, their name, signature and date.

The assessor observation checklist will be used to record that all the tasks have been undertaken correctly by the candidate. An assessor must endorse each observation checklist with the candidate's name, their name, signature and date.

The Assessment Support Pack (ASP) for this Unit provides sample assessment material including an instrument of assessment for the knowledge, and a sample activity log and an assessor observation checklist. Centres wishing to develop their own assessments should refer to Assessment Support Pack to ensure a comparable standard.

National Unit Specification: support notes

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This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

The precise content of this Unit will change over time, as technology develops and new equipment is introduced.

The overall aim of this Unit is to enable candidates to set-up small computer networks. The Unit will provide candidates with information about the different types and features of networking equipment, cabling and the physical network topologies. The candidate will also be made aware of the TCP/IP networking model and its components. Throughout the Unit the candidate should be exposed to common networking terminology and concepts.

Outcome 1

This Outcome relates to identifying key networking terminology and networking hardware and media. The candidate should be made aware of common physical network topologies and their features. The candidate will have to recognise the TCP/IP networking model and its components.

The candidate will be required to know network concepts and terminology including Local Area Network (LAN), Wide Area Network (WAN), Wireless Local Area Network (WLAN), Network Interface Card (NIC) including wireless NICs, topology, bandwidth, attenuation, peer-to-peer network, client/server network, protocol, MAC (Media Access Control) Address, IP (Internet Protocol) Address and Protocol Data Units (PDUs). Candidates will be required to recognise the PDU used by the appropriate network device (routers use packets, bridges and switches use frames, and hubs and repeaters use bits). Candidates will also have to be aware of physical (MAC) and logical (IP) addressing and be able to identify each type.

The Outcome also involves the identification and recognition of common physical networking topologies including bus, star, ring, hierarchical and mesh. Candidates will have to recognise each topology and their features as well as the advantages and disadvantages of using each topology.

When considering the TCP/IP networking model and its components, candidates will be required to recognise the components - Application, Transport, Internet and Network Access and be able to identify the general function of each layer/component. Candidates will also have to be aware of the reasons for the need for logical networking models.

The identification of the types and features of networking equipment will include: network cards (including wireless), repeaters, hubs, switches, bridges, routers, wireless access points, patch panels, telecommunication panels and tools such as wire crimpers, cable testers and punch down tools (also known as a Krone tool).

Candidates will be required to recognise types of cable and their use: copper coaxial cable (10Base2 and 10Base5), copper twisted pair cable (STP and UTP) and fibre-optic cable. Candidates will also be required to identify the type of connectors and terminations used by each type of cable.

National Unit Specification: support notes (cont)

UNIT Computing: Computer Networking Fundamentals (SCQF level 5)

Outcome 2

This Outcome relates to the planning for network installation, the preparation, creation and testing of network equipment and the assembly of a small computer network.

Planning of network installation including the choice of appropriate physical topology should be covered, and may include: drawing up of cut sheets and making decisions as to the placement of networking equipment and hosts and detailing the networking equipment required for the successful implementation of the network.

In testing of networking cables, candidates will test and connect wires to patch panels and telecommunications panels. Candidates should be allowed to practice making and testing cross-over, straight-through and console cables. Candidates should use appropriate labelling procedures for patch panels, telecommunication panels and cables.

The planning and assembly of the computer network will involve the candidate in choosing the equipment and cabling for a small network. The physical layout should also be considered in terms of the relative placement of the components.

Outcome 3

This Outcome relates to the configuration and testing of a small computer network. Candidates will use networking software to configure the computers on the network to meet the requirements of the network, eg peer to peer or client/server. Candidates should be encouraged to troubleshoot and repair faulty networks and keep accurate and up-to-date network records of the troubleshooting process. Problems encountered could include hardware, cabling or incorrect configuration.

Candidates will establish correct connections between the different computers on the network and test these by transferring data across the network. Candidates should test using key commands such as ping and ipconfig. The candidate should apply the 'divide and conquer' approach to fault finding and check for physical/hardware faults before moving on to check for logical/software faults.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

A practical hands-on approach to learning should be adopted to engage learners and exemplify key concepts. However, all practical activities should be underpinned with appropriate knowledge before candidates commence these activities.

It is recommended that candidates gain hands-on installation and configuration experience of at least one of each type of cabling and network components. While teaching will necessarily focus on specific products, the generic features of the hardware should be emphasised. Candidates could work together when practicing the assembling and testing of the small computer network.

It is strongly recommended that candidates develop an appropriate technical vocabulary in computer networking. Networking terminology and underpinning knowledge should be introduced and applied in a practical context throughout the Unit.

National Unit Specification: support notes (cont)

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The actual distribution of time between Outcomes is at the discretion of the centre. However, one possible distribution of time could be:

Outcome 1   8 hours
Outcome 2   24 hours
Outcome 3   8 hours

The use of simulation and/or virtual machines could be used effectively for teaching and assessment of parts of this Unit.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit candidates are required to identify faults, this may provide an opportunity for developing aspects of the Core Skill in Problem Solving. In addition, some opportunities may arise for candidates to work together as part of the learning process. These opportunities could allow candidates to develop aspects of the Core Skill of Working with Others.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

An integrative approach has been taken with the three Outcomes being assessed through two instruments of assessment. The first instrument of assessment covers Outcomes 1 and the second instrument of assessment relates to Outcomes 2 and 3.

The assessment for Outcome 1 could take the form of an objective test consisting of a suitable number and range of questions to cover all of the Performance Criteria. It is anticipated that this assessment will be carried out towards the end of the Unit to allow the candidate to consolidate the knowledge in a practical context. The assessment should be under supervised, controlled and closed-book conditions and should last no more than 45 minutes. The instrument of assessment will provide opportunities for the Outcome to be fulfilled by means of sampling across the range of the content of Outcome 1. Where re-assessment is required it should contain a different sample from the range of mandatory content. Achievement can be decided by use of a cut-off score.

If a centre is presenting Outcome 1 of these assessments on-line the following assessment methods, where appropriate, may be selected:

Multiple choice
Drag and drop
Multiple response
Mix and match
Or a combination of the above

Candidates should be given a project to build a functional computer network and this can integrate Outcomes 2 and 3. Candidates should maintain an activity log over an extended period of time.

National Unit Specification: support notes (cont)

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The activity log will provide evidence that the candidate correctly created the network cables and selected the correct hardware and software to set up a small network of at least two computers. The activity log will also provide evidence of network troubleshooting, including the correction and recording of network problems. The candidate's activity log and assessor's observation checklist must be authenticated by the assessor, who must confirm that these are an accurate record of candidate activity.

The Assessment Support Pack (ASP) for this Unit provides sample assessment material including an instrument of assessment for the knowledge, and a sample activity log and an assessor observation checklist. Centres wishing to develop their own assessments should refer to Assessment Support Pack to ensure a comparable standard.

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (**www.sqa.org.uk**).