National Unit Specification: general information

UNIT Computer Networking (Higher)

NUMBER DF30 12

COURSE Computing (Higher)

SUMMARY
This Unit is designed to develop knowledge and understanding of the principles of networking and practical skills related to networking through the use of contemporary hardware and software. This knowledge, understanding and practical skills may then be applied by the candidate to solve practical problems related to networking. It is designed for candidates undertaking the Higher Computing Course, but is also suitable for anyone wishing to extend and deepen their experience of computer networking beyond Intermediate 2 level.

OUTCOMES
1. Demonstrate knowledge and understanding of a range of facts, ideas and terminology relevant to the principles, features and purposes of networking.
2. Demonstrate practical skills in the context of networking using contemporary hardware and software.

RECOMMENDED ENTRY
While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following, or equivalent:

- Intermediate 2 Computer Networking Unit
- Intermediate 2 Computing
- Standard Grade Computing Studies at Credit level

Administrative Information

Superclass: CB

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Version: 01

National Unit Specification: general information (cont)

UNIT Computer Networking (Higher)

CREDIT VALUE
1 credit at Higher (6 SCQF credit points at SCQF level 6*).

**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

There is no automatic certification of Core Skills or Core Skill components in this Unit.

National Unit Specification: statement of standards

UNIT Computer Networking (Higher)

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

Demonstrate knowledge and understanding of a range of facts, ideas and terminology relevant to the principles, features and purposes of networking.

Performance Criteria

a) A range of computing terminology is used appropriately.
b) Descriptions and explanations are related to practical and familiar contexts.
c) Conclusions, predictions and generalisations are made from knowledge and understanding.

Evidence Requirements

Written or oral evidence that the candidate can describe and explain the principles, features and purposes of networking correctly. Evidence should be obtained using questions in a closed book test, under supervision, lasting no more than 45 minutes. The test must sample content (see Computing (Higher) Course content) in each of the following areas:

- network applications
- network security
- data transmission
- network protocols

(The content statements are also reproduced for convenience as a table in the support notes for this Unit).

The standard to be applied is illustrated in the National Assessment Bank items available for this Unit. If a centre wishes to design its own assessments for this Unit, they should be of a comparable standard.

National Unit Specification: statement of standards (cont)

UNIT Computer Networking (Higher)

OUTCOME 2
Demonstrate practical skills in the context of networking using contemporary hardware and software.

Performance Criteria
a) A range of appropriate hardware is used effectively and efficiently.
b) An appropriate range of features of software is used effectively and efficiently.
c) Practical tasks are planned and organised with minimal guidance.
d) Practical tasks are undertaken in an appropriate range of familiar contexts.

Evidence Requirements
Observation checklist showing that the candidate has demonstrated practical skills at an appropriate level in **three** of the following contexts:

- designing and setting up a simple network that allows resource sharing between at least two computer systems
- allocating an IP address
- creation of user accounts on a simple local area network
- creation of a simple web page using HTML

Hard copy evidence should be provided for **one** of these activities.

These practical skills may all be demonstrated in a single extended task, or in a number of smaller tasks.

The practical skills should be demonstrated in the context and at a level defined by the content statements (see Higher Course content).

The candidate will be allowed access to books, notes and online help while completing the tasks.

(The content statements are also reproduced for convenience as a table in the support notes for this Unit).

The standard to be applied is illustrated in the National Assessment Bank items available for this Unit. If a centre wishes to design its own assessments for this Unit, they should be of a comparable standard.

National Unit Specification: support notes

UNIT Computer Networking (Higher)

This part of the Unit Specification is offered as guidance.

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 content for this Unit is detailed below (and also in the National Course Specifications: Course details.)

Content statements in the left–hand column describe the content covered in the corresponding Unit at Intermediate 2 level, and are included here to clarify the context for the new learning for this Unit. They indicate the prior learning required by the candidate before undertaking new learning within this Unit.

Content in the right hand column is the new content for this Unit.

Content Statements: Network protocols	
Intermediate 2	Higher
	Name and description of the seven layers of the OSI model.
	Brief explanation of the purpose of common protocols (TELNET, HTTP, FTP, SMTP).
	Description of an IP address: ♦ structure — 4 octets ♦ classes — ABCD ♦ limitations
Brief description of the need for Name services (name resolution).	Description of Name services (name resolution); DNS (domain names, host name resolution).

National Unit Specification: support notes (cont)

UNIT Computer Networking (Higher)

Content Statements: Network applications	
Intermediate 2	Higher
Description of services provided by the Internet: World Wide Web, electronic mail and file transfer.	
Explanation of the structure of: ♦ *an e-mail address* ♦ *a URL (uniform resource locator)*	
Description of a web page as a text document with hyperlinks.	Description of a web page using HTML tags (start, header, body, title, style, font size, alignment, section headers).
Explanation of the purpose of a browser. Brief description of the functions of a browser (access the www, provide facilities including file transfer and e-mail).	
Description of browsers and microbrowsers for use with wireless data (WAP).	Explanation of the advantages and disadvantages of browsers and microbrowsers for use with wireless data (WAP). Description of a web page using WML tags (wireless markup language).
Description of hyperlinks, search engines and navigation.	Description of the methods used by search engines to build its indexes (spiders, meta-search engines).
Description of a situation when an ISP (Internet service provider) is required. Explanation of the purpose of an ISP.	
Description of e-commerce: the use of the Internet in conducting business and providing a service (e-government, e-business, e-marketing and e-sales).	Description of the advantages of e-commerce. Implication of fraud in e-sales payment and how it is overcome.
Description of current converging technologies in the home (home appliances with built in additional functionality such as internal and external communication capability.)	Description of the social implications of networks; information rich and information poor, the family, the community and employment.
Description of the main implications for business and education of the growth of network technology and the Internet.	Description of the ethical implications of networks; personal privacy and censorship.
Description of main features of the Regulation of Investigatory Powers Act 2000.	Description of the implications of the Regulation of Investigatory Powers Act 2000.
Description of appropriate code of conduct in the use of e-mail and Internet.	

National Unit Specification: support notes (cont)

UNIT Computer Networking (Higher)

Content Statements: Network security	
Intermediate 2	Higher
Description of security measures: ♦ *physical* ♦ *software — password and user ID*	Description of security measures: ♦ user access rights to data — file and folder permissions ♦ user access rights to hardware
Brief explanation of the use and advantages of encryption.	Description of computer and network security requirements (confidentiality, data integrity and availability). Description of threats to network security in terms of passive (monitoring of transmission) and active (modification of the data stream or the creation of a false stream) attacks.
	Description of the denial of service attack: ♦ effect: disruption or denial of services to legitimate users ♦ costs of attack: system downtime, lost revenue and labour involved in identifying and reacting to an attack ♦ intent: malicious, personal or political ♦ types of attacks: bandwidth consumption, resource starvation, programming flaws and routing and DNS attacks
Explanation of the need for filtering Internet contents in education, home and commercial companies.	Comparison of Internet content filtering methods: firewalls, Internet filtering software and walled gardens.
	Description of how a firewall can protect a LAN with an Internet connection from outside attacks.
Description of potential threats to networks; ♦ *node failure* ♦ *software failure* ♦ *channel failure* *Description of the need for a backup strategy.*	Description of disaster avoidance: ♦ use of anti-virus software ♦ use of fault tolerance components ♦ use of uninterrupted power supply. ♦ regular maintenance Description of backup strategy: ♦ backup server ♦ mirror disks ♦ tape ♦ backup schedule

National Unit Specification: support notes (cont)

UNIT Computer Networking (Higher)

Content Statements: Data transmission	
Intermediate 2	Higher
Description of the three types of transmission; unicast, broadcast and multicast.	Description of synchronous and asynchronous data transmission.
Description of the dual use made of networks in voice and data transmission.	Description of error checking in data transmission (parity and CRC).
	Description of the process of transmitting data over a network using TCP/IP.
	Description of CSMA/CD and its implications for network performance.
	Description of network switching (circuit and packet switching) and its implications for network performance.
Description of modern wireless communication methods: ♦ *wireless personal area network (WPAN)* ♦ *wireless LAN* ♦ *wireless WAN*	Description of the application of modern wireless communication methods: ♦ WPAN — connect mobile phones, mobile computers and other portable handheld devices ♦ wireless LAN — connecting a mobile LAN ♦ wireless WAN — connection in rural and heavily built-up areas
Description of the types of connections to the Internet (dialup modem, ADSL, cable modem, leased line and ISDN). *Explanation of the term broadband.*	Description of the speed and bandwidth of the types of Internet connections (dialup, cable modem, leased line, ISDN and ADSL). Explanation of which type of connection would be most appropriate in a given context.
Description of the additional hardware requirements for a wireless LAN (receiver, transmitter and wireless NIC).	Description of function of network interface card. Explanation for the need of a MAC address when transmitting data over a network.

National Unit Specification: support notes (cont)

UNIT Computer Networking (Higher)

List of abbreviations :

Intermediate 2

ADSL	Asymmetric Digital Subscriber Line
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
LAN	Local Area Network
NIC	Network Interface Card
URL	Uniform Resource Locator
WAP	Wireless Application Protocol
WLAN	Wireless Local Area Network
WPAN	Wireless Personal Area Network
WWAN	Wireless Wide Area Network

Higher

ADSL	Asymmetric Digital Subscriber Line
CRC	Cyclic Redundancy Check
CSMA/CD	Carrier Sense Multiple Access Collision Detection
DNS	Domain Name System
FTP	File Transfer Protocol
HTML	HyperText Markup Language
HTTP	HyperText Transfer Protocol
ISDN	Integrated Services Digital Network
MAC	Media Access Control
TELNET	TCP/IP standard network virtual terminal protocol
WAP	Wireless Application Protocol
WML	Wireless Markup Language
WPAN	Wireless Personal Area Network
WAN	Wide Area Network

National Unit Specification: support notes (cont)

UNIT Computer Networking (Higher)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Candidates will require individual access to appropriate computer hardware and software throughout this Unit. While the learning may be achieved in the context of one computer system, candidates will benefit from having some experience of alternative operating systems.

The two Outcomes should be delivered in an integrated way rather than sequentially. For Outcome 2, the practical activities should be taught and used to illustrate and exemplify the knowledge and understanding required for Outcome 1.

Candidates who have completed the networking Unit at Intermediate 2 level should already have covered the content listed in the left–hand column of the content grids, but may need to revise this material before progressing to the right–hand column.

The amount of time spent on each area of content will vary depending on the teaching methodology used and the ability and prior experience of the candidates. However, the following times, and teaching order, are suggested as a rough guide:

network applications	10 hours
network security	12 hours
data transmission	8 hours
network protocols	6 hours

1½ hours should be set aside to:

- administer the Outcome 1 test
- gather evidence for Outcome 2

A further 2½ hours is allowed for remediation and re-assessment if required.

If the Unit is delivered as part of a Course, the Course documentation will provide further information on teaching and learning in a Course context, including the identification of a number of ‘themes’ to facilitate holistic learning across the Course.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

National Assessment Bank tests have been created specifically to assess Outcome 1 of the Unit. This assessment consists of a closed book test, and must be conducted under examination conditions. In order to gain success in this Outcome, the candidate must achieve at least the cut-off score for the test. If a centre wishes to design its own assessments for this Unit, they should be of a comparable standard.

Outcome 2 requires the candidate to demonstrate practical skills while using contemporary hardware and software. These practical skills may be demonstrated in a single extended task or a number of relatively small tasks, undertaken by the candidate during the teaching and learning activities of the Unit, rather than as separate formal assessment activities. The candidate will be allowed access to books, notes and on-line help while completing the task(s). The practical skills should be demonstrated in the context defined in the content statements (see Computing (Higher) Course content).

National Unit Specification: support notes (cont)

UNIT Computer Networking (Higher)

To gain success in this Outcome, the candidate must demonstrate practical skills at an appropriate level in **three** of the following contexts, as defined by the content statements (see Computing (Higher) Course content):

- designing and setting up a simple network that allows resource sharing between at least two computer systems
- allocating an IP address
- creation of user accounts on a simple local area network
- creation of a simple web page using HTML

Hard copy evidence should be provided for **one** of these activities. Note that this evidence need not be formal reports; it could consist of a printout or a screen shot from any of the practical activities.

A pro-forma observation checklist for Outcome 2 is provided in the National Assessment Bank materials.

All evidence must be retained by the centre. The assessment of this Unit is subject to moderation by SQA.

SPECIAL NEEDS

This Unit Specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering special alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, September, 2003).