Higher National Unit Specification

General information for centres

Unit title: Computer Hardware: Building a Network PC

Unit code: DH2W 35

Unit purpose: This Unit is designed to enable candidates to work effectively in a computer hardware technical support role. It prepares them for this task by ensuring they possess the underpinning knowledge required to understand the operation of modern personal computer hardware. Practical experience is then gained of designing and building a PC, including faultfinding and the installation and configuration of low-level software such as device drivers. It is primarily intended for candidates who expect to work in an IT support role, but is also relevant to all those on an IT programme of study who require a deeper or more practical understanding of computer hardware.

On completion of the Unit the candidate should be able to:

1. Describe the major sub-systems and operation of a modern personal computer.
2. Identify risks and use safe working practices.
3. Design and build a PC configuring hardware components and peripherals as required.
4. Research, design and configure a PC for Peer to Peer networking.

Credit value: 1 HN Credit at SCQF level 8: (8 SCQF credit points at SCQF level 8*)

**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.*

Recommended prior knowledge and skills: Access to this Unit will be at the discretion of the Centre, however, it is recommended that candidates should have a good working knowledge of personal computers and be capable of installing and configuring operating systems. This may be demonstrated by the possession of the following HN Unit DH2Y 34: *Computer Hardware: Installation and Maintenance*, HN Unit DH33 34: *Computer Operating Systems 1* or by significant previous experience of working with PCs at this level. Candidates would also benefit from knowledge of basic computer architecture, binary and hexadecimal number systems. This may be demonstrated by the possession of the HN Unit DH2T 34: *Computer Architecture 1* and/or DH2V 35: *Computer Architecture 2*. However, it is expected that a candidate is either studying this unit in conjunction with or following the completion of the HN Unit DH35 34: *Computing: Planning*.

General information for centres (cont)

Core skills: There may be opportunities to gather evidence towards core skills in this unit, although there is no automatic certification of core skills or core skill component.

Context for delivery: This Unit is included in the framework of a number of HNC and HND group awards. It is recommended that it should be taught and assessed within the context of the particular group award to which it contributes.

Assessment: Outcome 1 will be assessed by a number of multi-choice questions testing knowledge and/or skills. Outcome 2 is a series of extended-response questions to test candidates' understanding of safety and ESD issues, this task should be presented prior to any practical work being undertaken. Outcome 3 will contain a series of short assignments testing a candidate's investigative, design and practical abilities. Outcome 4 will consist of a short report on Peer to Peer networking for the chosen operating system, designing a suitable network solution. Implementing the network will involve a practical group activity.

Any assessment activity involving practical work should be carried out in supervised conditions sufficient to ensure the confidence in the authenticity of submissions and that a candidate is working within the correct health and safety guidelines.

Some of the evidence requirements may be produced using e-assessment. This may take the form of e-testing (for knowledge and understanding) and/or e-portfolios (for practical abilities). There is no requirement for you to seek prior approval if you wish to use e-assessment for either of these purposes so long as the normal standards for validity and reliability are observed. Please see the following SQA publications for further information on e-assessment: (1) "SQA Guidelines on Online Assessment for Further Education" (March 2003) and (2) "Assessment & Quality Assurance in Open & Distance Learning" (Feb. 2001).

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

- Multiple-choice
- Drag and drop
- Multiple response
- Mix and match
- A combination of both

It is expected that the questions will be of the multiple choice variety. Centres may consider the use of alternative questions types, particularly if using Computer Assisted Assessment approaches. However, care should be taken that the questions are valid and at an appropriate level. The use of simple true/false question responses is unlikely to achieve this.

General information for centres (cont)

Outcome 2 may be cross-referenced to Outcome 2 (knowledge/skills bullet point 3) in DH31 34 Computer Networks: Building Local Area Networks, or Outcome 4 (all knowledge/skills) in DH2Y 34 Computer Hardware: Installation and Maintenance. However, assessors should ensure all evidence requirements for this unit have been satisfied and re-assessment in this area should be carried out if necessary.

Higher National Unit specification: statement of standards

Unit title: Computer Hardware: Building a Network PC

Unit code: DH2W 35

The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Describe the major sub-systems components and operation of a modern personal computer

Knowledge and/or skills

- Types, characteristics and compatibility issues of motherboards, cases and power supplies
- Types and functions of motherboard components and interface connectors
- Operation and interfacing of input/output devices
- Operation and interfacing of storage devices
- Installation requirements for expansion interface cards

Evidence requirements

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis (see below). Each candidate will need evidence to show that s/he can define the types, operation and functional characteristics of **three** from the five major sub-systems detailed above.

- Types and characteristics of motherboards, cases and power supplies
  Defines the main characteristics of and differences between main types of motherboards, cases and power supplies, (eg AT, ATX). These must include board and case layout, mounting methods, interface connections exposed or cabled to the back panel, front panel connections, power connectors and PSU capabilities, (eg hard/soft-switched, suspend and awaken capabilities with ACPI and APM, power good indication).
- Types and functions of motherboard components and interface connectors
  Defines all the main functional elements and components commonly found on a motherboard, including CPU, memory, (eg ROM, DRAM, cache), battery, crystals, at least three common expansion bus connectors, (eg ISA, EISA, PCI, AGP), main chipsets, at least three common integrated interface and peripheral chipsets, circuitry and connectors, (eg Serial and parallel ports, IDE, FDC, sound, video, keyboard controller). For each element, its function and the type of physical components used to implement it must be covered.

Higher National Unit specification: statement of standards (cont)

Unit title: Computer Hardware: Building a Network PC

- Operation and interfacing of input/output devices
  Defines the function and physical implementation of standard PC I/O devices, (eg AT and PS/2 keyboard, serial and PS/2 mouse, VGA, USB). This should include device and interface functions as well as types of physical connectors and cabling required.
- Operation and interfacing of storage devices
  Defines the function and interfacing of typical storage devices. The function of at least two different common types of storage device should be covered, (eg hard disk, CD-ROM, CD-RW, DVD, ZIP, floppy, USB storage devices). At least two common interfaces should be covered, (eg EIDE, SCSI, floppy) including device identification and cabling.
- Installation requirements for expansion interface cards
  Defines the basic installation requirements for expansion interfaces (I/O address, IRQ and DMA assignments) and consequences of mis-configuration. At least one difference in configuration requirements for different expansion bus types should also be covered, (eg Plug and Play operation with PCI).

In order to ensure that candidates will not be able to foresee what items they will be questioned about, a different sample of **three** of the five knowledge items is required each time the Outcome is assessed. Evidence for all the knowledge and/or skills in this Outcome will be assessed using 20 multiple-choice questions. Each of the **three** bulleted points sampled for assessment must be covered **at least four** times in the assessment. The sample of the Knowledge and Skills areas must change on **each** assessment occasion. Candidates should not know in advance the items on which they will be assessed and the questions presented must change on **each** assessment occasion.

Assessment must be undertaken in supervised conditions and is closed book. A candidate should complete this assessment within one hour. Candidates may not bring to the assessment event any notes, textbooks, handouts or other material.

Candidates must answer at least 60% of the questions correctly.

Assessment guidelines

There is an opportunity for a candidate to be assessed on-line subject to meeting the prescribed assessment conditions.

If a centre is presenting this assessment on-line the following assessment methods, where appropriate, may be selected –

- Multiple-choice
- Drag and drop
- Multiple response
- Mix and match
- A combination of both

Higher National Unit specification: statement of standards (cont)

Unit title: Computer Hardware: Building a Network PC

Outcome 2

Identify risks and use safe working practices

Knowledge and/or skills

- Fire hazards and precautions
- Electrical hazards and the effects of electric shocks
- Function of fuses and Residual Current Devices
- PAT regulations
- Effects of ESD
- Anti-static precautions and safety hazards
- LSZH sheathing cable protection

Evidence requirements

Health and Safety risks and requirements relating to electrical and cabling work must be described and good working practices explained and demonstrated by the assessor. This must include risks to self and others from electric shock, Portable Appliance Testing regulations, Electro Static Damage and bond resistance testing. Issues surrounding cabling fire risks and the use of LSZH sheathing must be explained. Candidates must be encouraged to work safely at all times, to identify workplace risks and respond appropriately by changing working practices and minimising and reporting hazards.

The candidate must demonstrate awareness of risks to Health and Safety and of ESD damage to equipment, and the ability to minimise risk to self, others and equipment at all times. Awareness will be evidenced by the candidate answering **all** extended response questions. Each candidate should certify that safe working practices have been explained and demonstrated to him/her. As a simple safety precaution, this practice is also recommended as a prerequisite for any candidate attempting practical work.

Evidence of all knowledge and skills in this outcome should be assessed within 15 extended response questions. There should be two questions covering each bullet point with the exception of bullet point two (which will be three).

Assessment must be undertaken in supervised conditions and is closed book. A candidate should complete this assessment within two hours. Candidates may not bring to the assessment event any notes, textbooks, handouts or other material.

Candidates must answer ALL questions correctly. Candidates need not be re-assessed on questions they have previously completed successfully.

Higher National Unit specification: statement of standards (cont)

Unit title: Computer Hardware: Building a Network PC

Assessment guidelines

This Outcome and Evidence Requirements are identical to those for Outcome 4*, [CH2Y 34] Computer Hardware: Installation and Maintenance* and Outcome 2, bullet point 3 *[DH31 34] Computer Networks: Building Local Area Networks* – see note under **Assessment** on page 3.

Outcome 3

Design and build a PC configuring hardware components and peripherals as required

Knowledge and/or skills

- Investigate compatibility issues of CPU, Motherboard and Cases/PSU's
- Design and specify PC hardware and choose operating system
- Build and test PC
- Install and configure operating system
- Install and configure software drivers where required

Evidence requirements
Candidates will submit evidence to satisfy this Outcome in the form of two short reports for the first two areas of work and at least one completed practical activity log for each of the latter three areas of work, to the standards detailed below. The PC to be built and tested should use materials available in the centre (it does not need to match the PC design specification in the report). Practical activity logs should be based on a pro-forma given to candidates, but must as a minimum be properly titled with the candidate's name and date, and signed by the assessor confirming that each task is the candidate's own work. Each Log should record –

- A brief outline of the task presented
- Outline notes of all work carried out
- Note of problems (if any) encountered and their solutions
- Testing carried out
- Any relevant sketch diagrams, (eg component locations, connector orientations, jumper settings)

A candidate's response can be judged to be satisfactory where the log evidence provided is sufficient to meet the requirements for each item as follows:

Higher National Unit specification: statement of standards (cont)

Unit title: Computer Hardware: Building a Network PC

♦ Investigate compatibility issues of CPU, Motherboard and Cases/PSU's

Investigate the current technologies and compatibility issues for CPU, Motherboard and Cases/PSU's. Check compatibility of hardware with chosen operating system. (eg type of CPU connection to motherboard socket or slot, type of motherboard AT or ATX will affect which type of case chosen and also what type of PSU to be used). Also manufacturer of CPU, Intel, AMD or other, will have compatibility issues with motherboard types.

♦ Design and specify PC hardware and choose operating system

The candidate will design and specify all hardware and that will be used on the PC system this will include at least the following:

- **CPU** – model, manufacturer, speed and cache
- **Motherboard** – model, manufacturer, form factor and onboard devices (eg video, sound, I/O connections, USB connections, firewire, networking or modem)
- **RAM** – type and size in Kb (eg SDRam, DDRam and size in Kb)
- Case/PSU – type of case, compatibility and the PSU's wattage and number of connectors
- **Storage** – types of storage devices, model, manufacturer, capacity, speed and interfacing of each (eg hard disk drive(s), floppy drive(s), ZIP drive(s) or other storage medium)
- **Optical Drives** – CDRom, CD-RW, DVD or DVD-RW, model, manufacturer, specifications, speed and interfacing specifications
- **Video** – model, manufacturer, onboard memory, speed and interface specifications (if not inbuilt on motherboard)
- **Sound** – model, manufacturer, compatibility and interface specifications (if not inbuilt on motherboard)
- **Networking** (required) - model, manufacturer, type and standard (if not inbuilt on motherboard)
- **Modem** – model, manufacturer, standards (V90, voice, fax etc), speed in Kbps (if not inbuilt on motherboard)
- **Monitor** – model, manufacturer, viewable area, type of monitor (CRT, TFT etc) resolutions supported and Dpi
- **Keyboard and mouse** – make, manufacturer and type of keyboard and mouse and connection types (Din, P/S2,USB or wireless)
- **Operating System** – manufacturer, name and version

The above hardware and software should be designed in a balanced way making sure that the hardware is compatible with the operating systems (Most manufacturers of operating systems have web sites which list compatible hardware). This assessment is not about designing the most expensive high spec PC (although costs are very time relevant, the budget should allow candidates to specify a mid-range PC system). The candidate must consider what performance he/she can get to suit his/her needs and at what cost.

Higher National Unit specification: statement of standards (cont)

Unit title: Computer Hardware: Building a Network PC

♦ Build and test PC

The candidate will build the PC with consideration of ESD and health and safety issues. Once built the assessor should inspect the PC before switching on. The system should pass POST and give confirmation beep. If BIOS error messages or beeps occur, basic fault finding routines should be employed until the PC does pass POST. A sensible approach to fault finding is important, least invasive first (eg check BIOS settings, connections, RAM seated properly, etc, before changing the motherboard).

♦ Install and configure operating system

The candidate will install the chosen operating system onto the PC. This will involve preparing the storage media and following the installation instructions and menus to complete the operating system setup. Once the operating system is installed the system should be fully checked to ensure correct configuration

♦ Install and configure software drivers where required

The candidate may have to install certain device drivers (eg modem, sound or video) depending on the operating system chosen. Configuration and startup files may have to be altered by the candidate.

The assessor must endorse each practical activity log to confirm whether the candidate uses safe working practices.

Assessment is open book under supervised conditions. Assessors should assure themselves of the authenticity of each candidate's submission.

Assessment guidelines

Candidates who have access to a suitable workplace can base their assessment work on suitable installation and fault-finding situations drawn from their place of work.

Where a workplace situation is used, care should be taken to ensure that it would provide candidates with sufficient opportunity to meet the evidence requirements of the Unit. It may be appropriate for the assessor concerned to ensure beforehand that a particular workplace will allow candidates to generate sufficient and suitable evidence.

Outcome 4

Research, design and configure a PC for Peer to Peer networking

Knowledge and/or skills

♦ Investigate chosen operating system Peer to Peer networking capabilities
♦ Design and specify hardware and networking protocols to be used
♦ Configure, connect and test network

Higher National Unit specification: statement of standards (cont)

Unit title: Computer Hardware: Building a Network PC

Evidence requirements

Candidates will submit evidence to satisfy this Outcome in the form of a single short report for the first two areas of work, completed on an individual basis. A completed practical activity log to the standards detailed below will assess the third area of work. At this level, it is expected that candidates will be working in a group (ideally two), they should work independently from the assessor.

Practical activity logs must be based on a pro-forma given to candidates, and must as a minimum be properly titled with the candidate's name and date, signed by the assessor confirming that each task is the candidate's own work. Each Log should record –

- A brief outline of the task presented
- Outline notes of all work carried out
- Note of problems (if any) encountered and their solutions
- Testing carried out
- Any relevant sketch diagrams

A candidate's response can be judged to be satisfactory where the log evidence provided is sufficient to meet the requirements for each item.

Assessment is open book under supervised conditions. Assessors should assure themselves of the authenticity of each candidate's submission.

Assessment guidelines

Candidates who have access to a suitable workplace can base their assessment work on suitable installation and fault-finding situations drawn from their place of work.

Where a workplace situation is used, care should be taken to ensure that it would provide candidates with sufficient opportunity to meet the evidence requirements of the Unit. It may be appropriate for the assessor concerned to ensure beforehand that a particular workplace will allow candidates to generate sufficient and suitable evidence.

The Peer to Peer networking does not have to involve accessing the internet. It is sufficient to have PC's to be able to share files through the network system. The candidates have scope on the type of interconnection used.

Administrative Information

Unit code: DH2W 35

Unit title: Computer Hardware: Building a Network PC

Superclass category: CA

Date of publication: August 2004

Version: 01

Source: SQA

Higher National Unit specification: support notes

Unit title: Computer Hardware: Building a Network PC

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

It is essential that candidates are made aware from the outset of the health and safety risks to themselves and others which can arise in working with electrical equipment. The risks to equipment from ESD should also be explained, and safe working practices explained and demonstrated which balance these two problems. This is particularly important as candidates will be working in an anti-static environment and using anti-static equipment, which significantly increase health and safety risks if improperly used. It is recommended that candidates should not be permitted to work on live or exposed equipment until they have acknowledged in writing that they have received adequate safety training and have satisfied the requirements of the assessment covering this topic. **The importance of strict adherence to safe working practices should be stressed throughout the programme of study.**

It is appreciated that there will not be time during the delivery of this Unit to present a comprehensive fault-finding methodology, or to give candidates extensive experience of the rich variety of complex faults found in the real world. However, Centres should identify the importance of effective fault analysis and resolution in commercial and professional practice, and base delivery of this Unit around basic fault-finding principles and strategies to reinforce this. It is suggested that the teaching of fault-finding should focus on a logical analysis of presenting symptoms to identify as quickly as possible the faulty sub-system. Candidates should then be encouraged to develop a logical strategy for resolving faults using a combination of simplification and a prioritised procedure based on "most likely, least invasive" down to "least likely, most invasive" possibilities.
For example, a floppy disk fault such as "Seek Error" can reasonably be attributed to the floppy disk sub-system. An appropriate, ordered analysis of possible failure modes to form the basis of a procedure might be:

1. Software configuration. Device driver (if relevant) or BIOS setup – is wrong floppy drive type set?
2. Simple external hardware fault – dirty drive heads? Try cleaning them.
3. Internal hardware fault likely – need to open case. Could be:
   (a) Cable or connector fault – check power and data cables, and if no obvious problem then replace each in turn.
   (b) Floppy drive fault – check and if no obvious problem (eg incorrect jumper setting) then replace drive.
   (c) Controller interface fault – replace controller/motherboard

Higher National Unit specification: support notes (cont)

Unit title: Computer Hardware: Building a Network PC

Guidance on the delivery and assessment of this Unit

This Unit is likely to form part of a group award which is primarily designed to provide candidates with technical or professional knowledge and skills related to a specific occupational area. It does require a significant level of prior competence from candidates, and so should be delivered towards the end of a group award rather than as an initial Unit.

Wherever possible, this Unit is non-specific about the details of technologies and devices used by the computer systems being studied. This has been done to try and future-proof the Unit, and avoid obsolescence in this rapidly evolving field. It is, however, important that candidates are exposed to a balanced range of both current and historical systems and components. **Lack of specificity should not be taken as an excuse to re-deploy obsolete or "scrap" equipment for hardware classes on the basis that it is more expendable without also providing a satisfactory range of modern components and devices to which candidates can progress once they are more proficient.** It is also important that candidates are exposed to a range of modern computing hardware - both teaching and assessment should for example include work on modern Apple Mac systems as well as just IBM-compatible PCs

Assessment of Outcome 1 will be carried out by one instrument of assessment which should be midway through or near the end of the delivery period for the Unit. It should be held in supervised conditions. Candidates may not bring with them any notes, textbooks, handouts or other material.

Outcome 2 should be introduced early in the delivery of the unit and before any practical work is carried out. The candidate must certify (by signature) that they fully understand the implications of health and safety within the context of delivery. In Outcome 3 candidates will submit evidence to satisfy this Outcome in the form of two short reports for the first two areas of work and at least one completed practical activity log for each of the latter three areas of work, to the standards detailed below. The PC to be built and tested should use materials available in the centre (it does not need to match the PC designed in the report). Outcome 4 is in the form of a single short report for the first two areas of work, completed on an individual basis. A completed practical activity log to the standards detailed will assess the third area of work. At this level, it is expected that candidates will be working in a group (ideally two), they should work independently from the assessor.

Open learning

If this Unit is delivered by open or distance learning methods, additional planning and resources may be required for candidate support, assessment and quality assurance.
A combination of new and traditional authentication tools may have to be devised for assessment and re-assessment purposes. For further information and advice, please see *Assessment and Quality Assurance for Open and Distance Learning* (SQA, February 2001 — publication code A1030).

Higher National Unit specification: support notes (cont)

Unit title: Computer Hardware: Building a Network PC

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, 2001).

General information for candidates

Unit title: Computer Hardware: Building a Network PC

This Unit is designed to enable you to work effectively in a computer hardware technical support role. It prepares you for this task by giving you the underpinning knowledge required to understand the operation of modern personal computer hardware at a sub-system level. On completion of the Unit you should be able to:

- Describe the major sub-systems and operation of a modern personal computer
- Identify risks and use safe working practices
- Design and build a PC configuring hardware components and peripherals as required
- Research, design and configure a PC for Peer to Peer networking

As the Unit progresses, you will be presented with information on the construction, components and operation of a personal computer and its main sub-systems including:

- Case and power supply
- Motherboard, CPU and memory
- Storage devices such as floppy and hard disk and CD-ROM
- Video display
- Input/output devices such as the keyboard and mouse
- Peripheral devices such as printers, scanners and modems

Each of these elements will be described in detail and you will be given the opportunity to install and configure such equipment in practical exercises.
To succeed in this Unit you must achieve a satisfactory level of performance in both written assessments covering the knowledge-based elements of the Unit and a set of practical tasks covering the practical installation, configuration and network implementation elements.

- The written assessment for outcomes 1 and 2 will be closed book, (ie you will not be permitted to consult notes, books or other material, and you may not communicate with any other candidate during the assessment).

Outcome 3 will be in the form of two short reports for the first two areas of work and at least one completed practical activity log for each of the latter three areas of work. The PC to be built and tested should use materials available in the centre (it does not need to match the PC design specification in the report). Practical activity logs will be based on a pro-forma given to candidates. Outcome 4 will be in the form of a single short report for the first two areas of work, completed on an individual basis and a completed practical activity log. At this level, it is expected that candidates will be working in a group (ideally two), they should work independently from the assessor.

General information for candidates (cont)

Unit title: Computer Hardware: Building a Network PC

You will produce evidence of the practical tasks by maintaining a log using pro-forma record sheets. You will receive more detailed guidance on the content, style and quality required for your log entries during your progress through the Unit. Your assessor will observe you carrying out the assessment tasks, and will certify on each of your logs that it is your own work, whether it is satisfactory and whether you have carried out the work properly with regard to Health and Safety requirements and you must certify (by signature) that you fully understand the implications of Health and Safety in this environment).