INFORMATION SYSTEMS
(Higher)

Second Edition – published 2006

NOTE OF CHANGES TO ARRANGEMENTS
SECOND EDITION PUBLISHED NOVEMBER 2006

COURSE TITLE: INFORMATION SYSTEMS

COURSE NUMBER: C216 12

National Course Specification

Course Details   No changes

National Unit Specification(s):

DM4C 11 Using Information (Higher)   Core skills statement amended to reflect core skill information in this Unit.

National Course Specification

INFORMATION SYSTEMS (Higher)

COURSE CODE   C216 12

COURSE STRUCTURE
This Course has two mandatory Units and one optional Unit:

Mandatory Units:

Unit Title	Credit and Duration
DM4C 12 Using Information (H)	1 credit (40 hours)
DM4K 12 Relational Database Systems (H)	1 credit (40 hours)

Optional Units — one selected from:

Unit Title	Credit and Duration
DM4D 12 Applied Multimedia (H)	1 credit (40 hours)
DM4H 12 Expert Systems (H)	1 credit (40 hours)
DM4F 12 The Internet (H)	1 credit (40 hours)

All Courses include 40 hours over and above the 120 hours for the Units. This may be used for induction, extending the range of learning and teaching approaches, support, consolidation, integration of learning and preparation for external assessment.

RECOMMENDED ENTRY
While entry is at the discretion of the centre, candidates will normally be expected to have attained one of the following (or equivalent experience):
♦   Intermediate 2 Information Systems
♦   Standard Grade Computing Studies at Credit level

PROGRESSION
This Course or its Units may provide progression in the following way:
♦   progression to Advanced Higher Information Systems
♦   exit to higher education programmes in Information Systems and related subjects

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National Course Specification: (cont)

INFORMATION SYSTEMS (Higher)

CORE SKILLS

This Course gives automatic certification of the following:

Complete Core Skills for the Course   Information Technology H

Additional Core Skill components for the Course   Critical Thinking   H
                                                        Planning and Organising H

CREDIT VALUE

The Higher Information Systems Course is allocated 24 SCQF credit points at SCQF level 6.

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

National Course Specification: Course details

INFORMATION SYSTEMS (Higher)

RATIONALE

Information and its associated technologies are having an ever increasing role in many aspects of modern life affecting work, home and leisure activities. This is recognised in the inclusion of information technology as a Core Skill within many contemporary qualifications and a centre piece to numerous activities. Technological developments in hardware and software permit a wide range of data types to be stored and processed in digital form to provide useful information. Such information is used extensively by individuals and organisations when making decisions and is becoming increasingly integrated into everyday practice and thinking across many disciplines.

Developments in communication technologies and the Internet have ensured that information is widely accessible. Such developments are themselves generating demand for further access to information. This inclusiveness has led to the development of an e-culture relying on information systems. In parallel with these developments has come the recognition of the need to adopt a systematic approach to using information and working with information systems. For example, disciplined approaches to the provision of information to meet user requirements have long been recognised and are well established in database design. Methodical approaches should be underpinned by technical considerations in collecting, storing, processing and communicating data in a meaningful form.

Information is a vital resource to the requirements of individuals and organisations and, as such, is worthy of detailed study and lifelong learning. The Information Systems Courses offer a progressive study from Intermediate 2, through Higher, to Advanced Higher, building on the generic skills offered within the SQA framework (Intermediate 1 and Standard Grade Computing Studies), and other awarding bodies. The Courses examines what is meant by information, how that information is produced, what purpose it serves, and, what value the information has. The Courses develop candidates' database and information skills and allow them to focus on specific aspects of Information Systems such as the Internet, Multimedia and Expert Systems.

The development of the candidate's knowledge and understanding of contemporary database systems and information skills is of primary importance, so these are the basis of the two mandatory Units in all Information Systems Courses. The Courses also focus on the value and characteristics of information in a variety of contexts, including personal, professional and educational applications. Information Systems is more than using computing tools: it develops candidate fluency and literacy in areas of critical skills, understanding of concepts, problem solving abilities, and the use of vast amounts of information with analytical skill.

Underlying the study of Information Systems are a number of **unifying themes** which will be developed and exemplified throughout the Units of the Course.
These themes are:
♦ the characteristics of information
♦ information in decision making
♦ an ethos of practical problem solving
♦ technological developments in information systems
♦ social, professional, ethical and legal implications associated with information systems

AIMS
♦ to provide candidates with knowledge and understanding of Information Systems
♦ to develop candidates skill in the process of systems analysis and design

National Course Specification: Course details (cont)

INFORMATION SYSTEMS (Higher)

RATIONALE (cont)

♦ to develop critical skills, practical problem solving abilities and analytical skills in the use of a range of Information Systems
♦ to develop an awareness of modern trends in Information Systems
♦ to foster an appreciation and awareness of the social, professional, ethical, and legal implications of Information Systems
♦ to foster an appreciation of the value of information as a resource
♦ to foster the use of Information Systems and associated technologies

The knowledge and skills gained as part of this Course should enable the candidate to play a full and active role within the e-culture of the information society.

The Course is designed to build on prior learning at Intermediate 2 and Standard Grade Credit level (or their equivalents) and to provide progression to Advanced Higher Information Systems and to degree Courses in Information Systems and related subjects.

National Course Specification: Course details (cont)

INFORMATION SYSTEMS (Higher)

COURSE CONTENT

The Course is made up of two mandatory Units, *Using Information* and *Relational Database Systems*, and a choice of one from three optional Units.

The *Using Information* Unit develops an understanding of information, what it is, how it is used, how it is stored and when it is appropriate to use it. It builds on the foundations laid down in the corresponding Unit at Intermediate 2 level, and in Standard Grade Computing Studies, or other equivalent experience. The *Relational Database Systems* Unit develops the candidate's knowledge and skills in using and creating databases. Because Information Systems is such a wide and rapidly developing field of study, a choice of three optional Units is offered, each one allowing the candidate to relate their learning in the mandatory Units to a contemporary aspect of Information Technology — *Applied Multimedia, Expert Systems* and *The Internet*.

To ensure consistency of terminology, the meanings of the technical terms used throughout this documentation (including the Unit Specifications) were taken from the British Computer Society's publication *A Glossary of Computing Terms*, 10th edition, pub. Addison-Wesley, 2002. This glossary of terms will be used as a reference for all internal and external assessments, and its use is encouraged in all teaching and learning activities.

The Unit Specifications have been fully developed and proved detailed support notes to assist assessors in their understanding of Outcomes and Performance Criteria. The detailed content for each Unit is provided in the form of a table in the content/context section of each Unit Specification.

National Course Specification: Course details (cont)

INFORMATION SYSTEMS (Higher)

Content statements

The following pages of content statements describe in detail the knowledge and understanding which a candidate should be able to demonstrate in the external Course assessments, which will sample across these content statements. In order to achieve a Course award, candidates must also demonstrate an appropriate level of problem solving skills (application, analysis, synthesis and evaluation) based on these content statements.

This table defines the terms 'knowledge and understanding' and 'problem solving' as used in these arrangements in terms of the terminology used in Bloom's Taxonomy of Learning:

Arrangements	Bloom's Classification	Typical skills/words
Knowledge and Understanding	*Knowledge*	*recall of information (list, state, define, label, describe, name, identify)*
	Comprehension	*interpreting information in own words, grasping meaning (interpret, explain, discuss, predict, summarise, classify)*
Problem Solving	*Application*	*application to new situations (apply, demonstrate, show, relate, explain)*
	Analysis	*identification of patterns, recognising relationships (analyse, arrange, order, explain, connect, infer, compare, categorise)*
	Synthesis	*generalise, create new ideas, bring together from different sources, draw conclusions, predict (integrate, modify, design, compose, plan, arrange)*
	Evaluation	*make judgements, assess ideas, compare ideas, evaluate data (judge, evaluate, recommend, justify)*

Throughout the Course, candidates should be made aware of common hardware and software problems and should be able to resolve common problems as they occur.

National Course Specification: Course details (cont)

Higher Information Systems: Using Information (mandatory Unit)

The candidate must demonstrate knowledge and understanding, practical skills and problem solving based on the following content statements:

Data and Information
♦ Explanations and descriptions of the following terms in the context of an information system, and the relationships between them: data (raw facts and figures), information (processed data with structure, organisation, context or meaning) knowledge (derived from information).
♦ Description and exemplification of metadata (data describing data).
♦ Categorisation of information in terms of its source (primary, secondary, internal, external), nature (formal, informal, quantitative, qualitative), level (strategic, tactical, operational), time (historic, present, future), frequency (continuous, hourly, daily, monthly, annually), use (planning, control, decision making), form (written, aural, visual) and type (detailed, sampled, aggregated).
♦ Identification and description of the characteristics which affect the quality of information, in terms of its: relevance (or appropriateness), accuracy, completeness, reliability (or objectivity), timing, level of detail (or conciseness), presentation and availability.
♦ Understanding of the relationship between the characteristics of information and its value, and of the distinction between its cost and value.

Organisational Information Systems
♦ Definition, description and exemplification of data processing (DP) systems.
♦ Definition, description and exemplification of Management Information Systems (MIS): Decision Support Systems (DSS) and Executive Information Systems (EIS).
♦ Definition, description and exemplification of Expert Systems.
♦ Identification of organisational information system management strategies: network strategy, security strategy, backup strategy, upgrade strategy and software strategy.
♦ Description, exemplification and application of network strategy:
  – identification and description of network topologies, including LANs, WANs, distributed networks
  – identification and description of hardware, client/server, network adapter, structured cabling
  – identification and description of software, including network operating system, network accounts
  – description of audit and monitoring procedures and software
♦ Description, exemplification and application of security strategy:
  – distinction between security, integrity and privacy of data
  – description of the security risks to information systems, including viruses, hacking, denial of service
  – description and exemplification of policies and procedures for implementing data security, including codes of conduct, password guidelines
  – description and exemplification of methods of implementing data security, including virus protection, firewalls, encryption
  – description and exemplification of access rights on a network system
♦ Description, exemplification and application of backup strategy:
  – identification and description of archive, recovery and storage methods
  – description of a rotation method for regular back-up, in terms of frequency and version control

National Course Specification: Course details (cont)

Higher Information Systems: Using Information (mandatory Unit)

- ♦ Description, exemplification and application of upgrade strategy:
  - – understanding of the need for 'future proofing', and of difficulties regarding hardware and software compatibility
  - – understanding the requirement to maintain legacy systems, and of methods of doing so, including emulation
- ♦ Description, exemplification and application of software strategy:
  - – identification and description of criteria for evaluation of software, in terms of functionality, performance, usability, compatibility, data migration, reliability, resource requirements, portability and support
  - – description of the methods of providing training in using information systems software, including on-the-job training, in-house and external Courses
  - – identification and description of the means of obtaining user support, including manuals, online help/tutorials, help desk, newsgroups, and FAQs
  - – identification and description of the issues affecting decisions to upgrade software
- ♦ Descriptions of distributed databases; data warehouses and data mining within an organisation.

Information Management Software
- ♦ Identification, description and application of the following classes of software: word processing/desktop publishing (presenting information for print media); presentation/web authoring (presenting information for online media); spreadsheet (data handling); project management; personal information management.
- ♦ Description and exemplification of the main features of word processing/desktop publishing software, including: multi-page layout (including use of columns, header and footer, pagination), contents/index, incorporation of graphics with text wrapping, use of stylesheets to implement a 'house style', including selection of fonts (serif/sans-serif), use of colour formatting of text (font, size, style, alignment).
- ♦ Description and exemplification of the main features of presentation/web authoring software, including: structuring of pages/slides, incorporation of graphics and animation, consideration of presentational style including selection of fonts and use of colour, navigation including hyperlinks, home links and page transitions, use of templates/masters to implement 'house style'
- ♦ Description and exemplification of the main features of spreadsheet software, including: goal seeking/forecasting, lookup tables, advanced functions (nested if, count), use of macros.
- ♦ Description and exemplification of the main features of project management software, including: timelining, resource allocation, Gantt (and others) charts, optimisation and critical path analysis.
- ♦ Description and exemplification of the main features of personal information management software, including: communication, contacts, calendar, task lists.

Implications of ICT
- ♦ Description and exemplification of the social implications of ICT in the following contexts:
  - – globalisation and the impact of IS on business and societies
  - – the impact on business organisations of an IS driven business model
  - – e-commerce and the changing relationship between businesses and customers brought about by the internet
  - – the development of individuals' identities and persona when communicating on the internet
  - – the right to private communications across the internet
- ♦ Identification, description, application and implications of current legislation applying to information systems, including:

National Course Specification: Course details (cont)

Higher Information Systems: Using Information (mandatory Unit)

- Data Protection Act (1998): inadequacies of the 1984 Act; changes from the 1984 Act, including coverage of data in electronic transmission; requirement for prior consent of data subject; harmonization of EU Data Protection legislation; export of data; paper based records
- Copyright, Designs and Patents Act (1988): application of copyright to computer software, computer databases, web content, and digital media; software piracy
- Regulation of Investigatory Powers Act 2000 (including Lawful Business Practice regulations): purpose of the legislation, implications for electronic communication, monitoring of employees
- Freedom of Information (Scotland) Act (2002): organisations covered, right of access to information, exemptions
- Health & Safety regulations: employers' responsibilities

♦ Description and exemplification of the economic implications of ICT in terms of: the impact on business organisations in relation to competitive advantage, business costs including initial/running and investment cost.

♦ Description and exemplification of the ethical implications of ICT in terms of: censorship and freedom of speech, privacy and encryption, global citizenship.

National Course Specification: Course details (cont)

Higher Information Systems: Relational Database Systems (mandatory Unit)

The candidate must demonstrate knowledge and understanding, practical skills and problem solving based on the following content statements:

Database Fundamentals
♦ Description of need for and methods of achieving good database design, including consideration of the following: data duplication, data insertion, data deletion, data modification and problems associated with meaningful identifiers.

Entities and Data Relationships
♦ Description and exemplification of a data entity, in terms of the following attributes: name, multi-valued attributes, single valued attributes, data type (text, integer, real, object, link, boolean, date, time).
♦ Definition of data domain including domain constraints.
♦ Description of methods of achieving good database design, including appropriate choice of entities and entity relationships.
♦ Description, exemplification and identification of entity relationships, including: cardinality (one-to-one, one-to-many, many-to-many), use of entity occurrence modeling, use of entity relationship diagrams.

Data Modelling Concepts
♦ Definition and exemplification of data relationships using consistent notation and appropriate nomenclature (defining relation names, primary keys, foreign keys and non-key column names).
♦ Design and creation of linked data tables, including consideration of: table names, uniquely named columns, choice of primary key with one or two attributes including non-meaningful identifiers, compound key, surrogate keys, foreign keys (domain constraints and null values).
♦ Definition of referential integrity.
♦ Definition of Entity Integrity: non-null primary key, no multi-valued attributes.
♦ Exemplification of data retrieval, including consideration of: user views and queries, answer tables.
♦ Description of need for, and exemplification of data dictionaries including name, type, size, validation, index/key.

Normalisation
♦ Definitions of normal forms: UNF, first normal form (1NF), second normal form (2NF), third normal form (3NF).
♦ Creation of UNF from source documents.
♦ Normalisation to 1NF, by identifying and eliminating repeating groups.
♦ Description of problems of 1NF.
♦ Normalisation to 2NF by identifying partial key dependency.
♦ Description of problems of 2NF.
♦ Normalisation to 3NF by identifying non-key dependency.

Implementation
♦ Implementation of database system based on a data model, including entity/relationship diagram and data dictionary.
♦ Description and implementation of complex queries including: sorting (multiple fields, ascending/descending), searching (multiple fields, across linked/related tables), calculating and summarising (including count, sum and average).

National Course Specification: Course details (cont)

Higher Information Systems: Relational Database Systems (mandatory Unit) (cont)

♦   Use of related tables as sources for data entry (including lookups).
♦   Enforcement of data integrity through validation.
♦   Implementation of simple macros and scripting for navigation.

National Course Specification: Course details (cont)

Higher Information Systems: Applied Multimedia (optional Unit)

The candidate must demonstrate knowledge and understanding, practical skills and problem solving based on the following content statements:

Contemporary Uses and Means of Delivery
- Description and exemplification of how multimedia applications are used in the following areas:
  - business (e-commerce, presentations, teleconferencing, collaborative working)
  - training (CBT, simulations)
  - home (entertainment, edutainment, shopping)
- Description of multimedia delivery media and exemplification of appropriate uses: CD-ROM/DVD-ROM, kiosk, WWW, mobile communication devices, hybrids, virtual reality.
- Comparison of relative advantages/disadvantages of different multimedia delivery media in terms of: data capacity, data transfer rate/bandwidth, information 'window' size, ease of update.

Stages of Development — Analysis
- Description of the difference between a project brief and contractual requirements specification.
- Description of the contents of requirements specification, including: purpose, user/audience, content, delivery media, budget, timescale.
- Description of the uses made of the requirements specification by: client, multimedia developer.

Stages of Development — Design of navigation structures and HCI
- Representation and comparison of the different types of navigation structures to include: linear, hierarchical, web, composite/hybrid.
- Implications of increasing complexity of navigation structures including 'Lost in Hyperspace' and resulting solutions: backtracking, highlighting, history, bookmarks, breadcrumbs, use of search facilities (AND, OR, NOT).
- Description of user interfaces with relative advantages/disadvantages: CLI, menu, form fill-in, direct manipulation (GUI).
- Description and exemplification of use of 'metaphors'.
- Description and exemplification of guidelines for good user interface design: consistency, differing ability levels, providing feedback, easy correction of errors, avoiding information overload.

Stages of Development — Design of screens and media elements
- Critical evaluation of screen design in terms of: layout of elements, user interface, transitions, navigation.
- Explanation of the difference between an outline and detailed storyboard.
- Description and use of additional text features: kerning, anti-aliasing.
- Explanation of difficulties of using non-standard fonts and solutions including: embedding fonts, graphical text.
- Explanation of implications of using colour and graphics including: different platforms/gamma correction, dithering, web palettes, progressive display.
- Description of the advantages and disadvantages of streaming audio as against downloading audio.
- Explanation of implications of using video: user controlled (using VCR controls), danger of flashing sequences/epilepsy, streaming video vs downloading video.

Stages of Development - Implementation (general)
- Description of advanced functions and features of software for creating of multimedia applications: presentation, authoring (icon-based and scripting), web-page.

Higher Information Systems: Applied Multimedia (optional Unit) (cont)

♦ Description of the advanced functions and features of software for delivering of multimedia applications: stand-alone applications, players.
♦ Explanation of advantages and disadvantages of both stand-alone applications and players.
♦ Description and exemplification of the skills required by personnel: project manager. multimedia designer, subject expert, media specialists (graphic, audio, video), multimedia programmer, webmaster.

Stages of Development — Implementation (media elements)
♦ Simple description of graphic file types TIFF, JPEG and GIF in terms of: colour depth, resolution, file size, degree of compression, appropriate uses.
♦ Simple description of audio file types MP3 and MIDI in terms of: contents of file, file size, degree of compression, appropriate uses.
♦ Explanation of how frame rate, video window size and compression affect video file size and quality.
♦ Recognition of MPEG as video file type.
♦ Explanation and exemplification of the structure of a URL.
♦ Comparison between absolute and relative pathnames.

Stages of Development —Testing
♦ Description and exemplification of the different types of testing that should be carried out including: screen testing, integration testing, acceptance testing, usability testing.

Stages of Development — Documentation
♦ Identification of the two different types of documentation and their contents including: project development documentation (requirements specification, navigation map, storyboards, record of testing) and user documentation (hardware and software system requirements, user instructions).
♦ Description of need for clearly documented copyright licences including:
    – use of other peoples materials (description and exemplification of the purpose of the Copyright Design & Patents Act, Fair Use policy)
    – protection of your own materials (parts of a multimedia application that can be copyrighted, duration of copyright, legal redress, means of tracing copyrighted materials: enforced online registration and digital watermarks)

Stages of Development — Evaluation
♦ Critical evaluation of a multimedia application in terms of: fitness for purpose, accessibility (disabilities), clarity of presentation.

National Course Specification: Course details (cont)

Higher Information Systems: Expert Systems (optional Unit)

The candidate must demonstrate knowledge and understanding, practical skills and problem solving based on the following content statements:

Expert Systems in context
♦ Description of the advantages/benefits of expert systems, including preservation of expertise, dissemination of expert knowledge, training, combining expertise of multiple experts.
♦ Description of the limitations/drawbacks of expert systems, including restricted domain, high development and maintenance costs.
♦ Description of the social, ethical and legal implications of expert systems, including responsibility for 'bad' advice.
♦ Distinction between expert systems and other information systems (including Management/ Executive Information Systems, Decision Support Systems).
♦ Comparison of databases and expert systems, in terms of representation of data/knowledge; method of extraction of information/knowledge.
♦ Description of the characteristics of a deductive database which combines the inferencing of an expert system with the power of a database for large scale storage of 'facts'.
♦ Description of the components of an expert system: knowledge base, inference engine, user interface.
♦ Correct classification and description of the domains and main characteristics of the following 'classical' expert systems: MYCIN, ONCOCIN, R1/XCON, INTERNIST, DENDRAL, PROSPECTOR, OPS5, STRIPS.

Characteristics of Expert Systems
♦ Description of the knowledge base as representing knowledge in a knowledge representation language (KRL).
♦ Representation of knowledge in a range of knowledge representation forms, including forward and backward chaining rules, factor tables, decision trees.
♦ Transformation of knowledge between representations.
♦ Description of the advantages and limitations of each representation.
♦ Representation of simple statements using propositional (zero order) or predicate (1st order) logic.
♦ Comparison of forward chaining and backward chaining inference engines.
♦ Description of the main characteristics of a forward chaining system: working memory; conflict set; conflict resolution.
♦ Explanation of why conflict resolution strategies are required.
♦ Explanation of how different conflict resolution strategies achieve the required effect, including: rule ordering (first-come-first-served), recency, specificity/size ordering, refractoriness, data ordering, context limiting/setting a rule agenda.
♦ Description of the RETE algorithm for achieving conflict resolution.
♦ Representation of the degree of certainty of the data provided by the user, the degree of certainty inherent in the rules within the rule base, or the degree of certainty in the conclusion reached using certainty factors (as percentages or probabilities).
♦ Calculation of the certainty of a conclusion using the formula
  $CF_{conc} = CF_{rule} \times \min(CF_{cond1}, CF_{cond2}, \ldots)$.
♦ Explanation of how explanations are generated, using a rule tree.

National Course Specification: Course details (cont)

Higher Information Systems: Expert Systems (optional Unit)

Development, use and evaluation of Expert Systems
♦   Description of the stages of development of an expert system, and the roles performed by personnel at each stage: knowledge acquisition/elicitation, knowledge representation, system validation.
♦   Description of the sources of error which can occur at each stage of development, including expert's knowledge; mis-interpretation of expert knowledge; programming; inferencing; expert system advice beyond the 'limits of ignorance'.
♦   Querying of the expert system to answer more complex unstructured questions.
♦   Design of a set of structured test cases to thoroughly test an expert system.
♦   Critical evaluation of an expert system, in terms of: purpose (type of expert system, domain of expertise); range and coverage of rules; quality of reasoning; quality of user interface (structure/syntax/order of questions asked, presentation of conclusion; quality of explanation facilities); correctness of conclusions; fitness for purpose.

Construction of a working Expert System
♦   Description and demonstration of techniques of analysis, design, implementation, testing and evaluation of an expert system.
♦   Derivation of suitable attribute-value pairs, from an extended piece of unstructured text, involving some multi-valued attributes.
♦   Representation of attribute-value pairs as a factor table and as a decision tree.
♦   Derivation of structured rules involving multiple (3 or more) conditions to represent knowledge.
♦   Construction of forward and backward chaining rules (in pseudocode or appropriate KRL).
♦   Exemplification of parameterised rules which can provide multiple conclusions.
♦   Construction of a rule base of at least 15 rules, demonstrating chaining to a minimum of three levels.
♦   Derivation of structured questions to extract necessary information from a user consultation in an efficient manner, without duplication.
♦   Entry of rules into an expert system shell.
♦   Debugging of rules to produce a working system.
♦   Design and use of a set of structured test cases to thoroughly test that the expert system produces correct results against the knowledge provided.

National Course Specification: Course details (cont)

Higher Information Systems: The Internet (optional Unit)

The candidate must demonstrate knowledge and understanding, practical skills and problem solving based on the following content statements:

Internet Fundamentals
♦ Explanations of the following technical concepts in relation to Internet operation and usage: packet switching, the role of routers tables in forwarding data packets, Uniform Resource Locator structure (protocol, domain name, path, file identifier, additional parameter/port), IP address structure and classification (class A, B, C), gateway address, sub-net mask.
♦ Description of the purpose and the use of the following Internet protocols, or contemporary replacements: TCP/IP (Transmission Control Protocol/Internet Protocol, DNS (Domain Name Server) Protocol, TELNET (terminal emulation protocol).
♦ Explanation of the reasons for the continued revision of some protocols.
♦ Description of the function of the following organisations: The Internet Engineering Task Force (IETF), Internet Assigned Numbers Authority (IANA), The World Wide Web Consortium (W3C), domain name registers (including Nominet in the UK).
♦ Description of the main features and purposes of current national rules and policing policies relating to the Internet: Data Protection Act, (web servers and guest books), Computer Misuse Act (viruses, hacking, file copying), need for international agreements, need for international policing of the internet.

Services and resources provided by the Internet
♦ Descriptions of features and uses of a range of Internet resources including academic, commercial and personal web pages.
♦ Assessment of web resources information for accuracy, bias and credibility.
♦ Description of the capabilities of browsers (including HTML interpretation, client side scripting, cookie functions and built in encryption functions).
♦ Description of the security and privacy issues relating to: encryption, key distribution, PGP and RSA, public and private keys, secure sockets, proxy servers, site usage tracking, firewalls.

Internet Developments
♦ Description of contemporary technical developments related to Internet usage and operation including: web based databases and dynamic page design.

Construction of Internet web pages
♦ Description of the use of web authoring packages in web site design (including page layout design and uploading of pages).
♦ Description and exemplification of HTML coding skills including the attributes of the following common tags: <meta>, the NAME and HREF (including mailto) attributes of the<A>element, <head>, <body>, <div>, <titles>, <table>, <tr>, <td>, <hl -h6>, <p>, <br>, <font>, <img>, <span>.
♦ Description and exemplification of cascading style sheets, client side scripting (including form validation and alerts).
♦ Description of the use of server side scripting and php.
♦ Description and identification of the characteristics of site design with reference to: page structure and layout, uniformity of presentation (including use of style sheets, server-side scripting, dynamic pages), download efficiency, browser compatibility issues.
♦ Description and exemplification of the creation of a multi-paged web site.

National Course Specification: Course details (cont)

INFORMATION SYSTEMS (Higher)

ASSESSMENT

To achieve the Course award the candidate must pass the Units as well as the Course assessment. The candidate's grade is based on the Course assessment.

The Course is made up of two mandatory Units and one from a choice of three optional Units.

Unit assessment
Unit assessment consists of knowledge tests and a practical skills checklist. The knowledge test is a closed book test, under supervision, lasting no more than 45 minutes. The practical skills can be demonstrated through a single extended task or a number of smaller tasks.

Further details about the Unit assessment can be found in each of the Unit Specifications.

DETAILS OF THE INSTRUMENTS FOR COURSE ASSESSMENT

Course assessment should provide opportunities to demonstrate:

♦ retention of knowledge, understanding and skills over a longer period of time
♦ integration of knowledge, understanding and skills acquired in the Units
♦ application of knowledge, understanding and skills in more complex contexts
♦ application of knowledge, understanding and skills in less familiar contexts

The Course assessment for Information Systems at Higher level will consist of two components:

♦ practical coursework task
♦ question paper

The purpose of the question paper is to assess the candidate's competence to integrate and retain knowledge and understanding and demonstrate higher order cognitive abilities across the contents of all the component Units, and in varied contexts, and to demonstrate the ability to communicate computing concepts clearly.

The practical coursework task provides candidates with the opportunity to demonstrate and integrate the practical skills, knowledge and understanding from the Units, and apply these in a more complex practical context.

Practical coursework task

Candidates will undertake a practical coursework task provided by SQA. The task may be undertaken in 'open book' conditions, but under supervision, to ensure that the work presented is the candidate's own work. The task will be marked internally, using a marking scheme provided by SQA, but be subject to moderation. The marking scheme will provide a mark out of 60, which will be submitted directly to SQA.

National Course Specification: Course details (cont)

INFORMATION SYSTEMS (Higher)

Question paper

The question paper will comprise a single paper of 2 hours and 30 minutes duration. The total marks available will be 140. The examination will be set and marked by the SQA. The paper will be composed of three sections:

SECTION 1 (30 marks)
This will consist of objective and short response questions which sample across the content statements of the two mandatory Units. These questions will test both knowledge and understanding and problem solving. Approximately 2/3 of the marks will be for knowledge and understanding, and 1/3 for problem solving. The problem solving will be based in familiar contexts and be of a fairly straightforward nature. Candidates will be expected to tackle all questions.

SECTION 2 (60 marks)
This will consist of questions requiring extended responses requiring structuring and reasoning. These questions will involve both knowledge and understanding and problem solving. Approximately 1/3 of the marks will be for knowledge and understanding, and 2/3 for problem solving, and will be set in less familiar and more complex contexts than those in Section 1. The questions will sample across the content statements associated with the mandatory Units, and will require some integration of knowledge across the two Units. Candidates will be expected to tackle all questions.

SECTION 3 (50 marks)
This will have three sub-sections, one for each of the optional Units. Candidates will be expected to tackle all the questions within one sub-section. The questions will require extended responses from candidates. Approximately 1/3 of the marks will be for knowledge and understanding, and 2/3 for problem solving as in Section 2, and the questions, which will sample across the content statements for the optional Unit, will also require some integration of knowledge from the mandatory Units.

Note: refer to the table on page 7 of these arrangements for guidance on the meaning of the terms 'knowledge and understanding' and 'problem solving' in this context.

Further details about assessment for the Course can be found in the Course Assessment Specification, the Specimen Question Paper and the specimen coursework task.

National Course Specification: Course details (cont)

INFORMATION SYSTEMS (Higher)

GRADE DESCRIPTIONS AT A AND C

The candidate's grade will be based on the total score obtained from the Course assessment by adding the marks from the practical coursework task and the question paper. The descriptions below indicate the nature of achievement required for the award at grade C and A in the Course.

GRADE C	GRADE A
♦ **retention of knowledge, understanding and skills over a longer period of time**	
Candidates are able to describe and explain **some** of the facts and concepts to the standard defined by the Performance Criteria.	Candidates are able to describe and explain **most** of the facts and concepts to the standard defined by the Performance Criteria.
Candidates are able to demonstrate **some** practical skills to the standards defined by the Performance Criteria.	Candidates are able to demonstrate **most** of the practical skills to the standards defined by the Performance Criteria.
♦ **integration of knowledge, understanding and skills acquired in component Units**	
Candidates are able to demonstrate their knowledge and understanding in the context of specific Units.	Candidates are able to demonstrate the **integration** of knowledge and understanding from more than one Unit.
Candidates are able to demonstrate their practical skills in the context of specific Units.	Candidates are able to demonstrate the **integration** of practical skills from more than one Unit.
♦ **application of knowledge, understanding and skills in more complex contexts**	
Candidates are able to apply knowledge and understanding to solve problems in straightforward contexts relating to a single Unit.	Candidates are able to apply knowledge and understanding to solve problems in **more complex contexts relating to more than one Unit**.
Candidates are able to apply practical skills to solve problems in straightforward contexts relating to a single Unit.	Candidates are able to apply practical skills to solve problems in **more complex contexts relating to more than one Unit**.

National Course Specification: Course details (cont)

INFORMATION SYSTEMS (Higher)

♦ application of knowledge, understanding and skills in less familiar contexts	
Candidates are able to apply knowledge, understanding and skills to solve problems in familiar contexts.	Candidates are able to apply and **transfer** knowledge, understanding and skills to solve problems in **less familiar contexts**.
Candidates are able to carry out defined tasks to the standards defined in the Performance Criteria.	Candidates are able to **resolve non-routine problems** that arise during practical activity, **by independent research**.

ESTIMATES AND APPEALS

Estimates

In preparing estimates, evidence of performance should be considered across the breadth of coverage of the content of the Course and must take account of performance in both of the Course components, the coursework task and the question paper. Further advice on the preparation of estimates is given in the Course Assessment Specification.

Appeals

Evidence used to support appeals for the Question Paper component must come from an integrated test (or tests) adequately reflecting the Course content and Grade Descriptions.

Although a "prelim" examination is not mandatory, it can provide the opportunity for a candidate to demonstrate problem solving skills, integration across Units, and the application of knowledge in more complex and less familiar contexts as in the external examination. Any prelim should replicate the style, level of demand and mark allocation of the Specimen SQA examination.

Centres that submit an integrated test or prelim that only covers the knowledge and understanding of Units 1 and 2 should also submit an additional test covering the knowledge and understanding of Unit 3. Furthermore, this additional test must integrate some knowledge and understanding from Unit 1 and Unit 2.

The coursework task which has been completed and marked internally (with the mark submitted to SQA by the due date) is expected to represent a candidate's best practical work. Additional evidence of problem solving in practical contexts does not require to be submitted for appeals.

While it is acceptable for centres generating their own test materials to draw on past SQA question papers or commercial papers from previous years, such papers **must not** be used in their entirety. Where material from past papers is used, a judicious selection of items and/or appropriate adaptation is required to make this acceptable as evidence to support an appeal. Items from past SQA papers may also be supplemented or replaced by internally devised materials.

Whatever approach is taken to the creation of prelim papers or other assessment items, centres must be certain that the material has not been seen previously by the candidates.

NABs are designed to allow candidates to demonstrate the knowledge and understanding and practical skills required to pass the Units. NABs do not provide opportunities for the candidate to demonstrate

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National Course Specification: Course details (cont)

INFORMATION SYSTEMS (Higher)

problem solving skills, integration across Units, and application of knowledge in more complex and less familiar contexts, and therefore do not provide sufficient evidence for appeals.

QA STATEMENT

All National Courses are subject to external marking and/or moderation. External markers, visiting examiners and moderators are trained by SQA to apply national standards. SQA is currently seeking to assist centres by preparing exemplification of standards materials in a number of subject areas. This will be rolled out to all subjects in due course.

The Units of all Courses are subject to internal moderation and may also be chosen for external moderation. This is to ensure that national standards are being applied across all subjects.

Courses may be assessed by a variety of methods. Where marking is undertaken by a trained marker in their own time, markers meetings are held to ensure that a consistent standard is applied. The work of all markers is subject to scrutiny by the Principal Assessor and a PA report is published for all subjects.

The external examination is marked by trained markers. Markers meetings are held to ensure that a consistent standard is applied. The work of all markers is subject to scrutiny by the Principal Assessor and a PA report is published for all subjects.

National Course Specification: Course details (cont)

INFORMATION SYSTEMS (Higher)

APPROACHES TO LEARNING AND TEACHING

The main aims of the Course are:

♦ to provide candidates with knowledge and understanding of Information Systems
♦ to develop candidates skill in the process of systems analysis and design
♦ to develop critical skills, practical problem solving abilities and analytical skills in the use of a range of Information Systems
♦ to develop an awareness of modern trends in Information Systems
♦ to foster an appreciation and awareness of the social, professional, ethical, and legal implications of Information Systems
♦ to foster an appreciation of the value of information as a resource
♦ to foster the use of Information Systems and associated technologies

There is no prescriptive 'best way' to approach the teaching and learning of this Course. However, a holistic approach is recommended which relates each of these aims to the computing facts and concepts being studied. Within each Unit, there is a combination of knowledge and understanding with practical problem solving skills. Teachers and lecturers are encouraged to provide learning experiences which blend together the acquisition of knowledge and understanding, the development of practical skills and opportunities to apply these to solve problems.

Throughout the Course, reference should be made to professional, social, ethical and legal implications where appropriate, and to 'real world' applications. Candidates should be encouraged to develop the use of appropriate computing terminology to communicate their understanding.

Related to the Course aims, a number of unifying themes have been identified which should be used to bring a coherence to the Course. Most of these themes can be illustrated and exemplified in each of the component Units of the Course. These themes include:

♦ the characteristics of information
♦ information in decision making
♦ an ethos of practical problem solving
♦ technological developments in information systems
♦ social, professional, ethical and legal implications associated with information systems

The Course has been designed to articulate with the Intermediate 2 Information Systems Course. The content/context grids in the support notes for each Unit show how the content and contexts at Higher extend and deepen the Intermediate 2 Unit content. This should assist teachers and lecturers who have to work with bi-level classes to design an appropriate Course plan.

Candidates will require individual access to appropriate computer hardware and software throughout the Course. More detailed guidance is given within the support notes for each Unit.

Teachers and lecturers are encouraged to make use of the wide range of teaching and learning materials (both paper-based and electronic) which have been developed to support this Course.

National Course Specification: Course details (cont)

INFORMATION SYSTEMS (Higher)

The Units of the Course may be taught sequentially or in parallel (or a combination of these). When taught sequentially the *Using Information* Unit should be taught before the *Relational Databases* and optional Units. The latter Units are designed to build on and exemplify key concepts of *Using Information* within contemporary developing areas of Information Systems. The practical coursework task is designed to allow candidates to demonstrate and integrate practical skills and knowledge they have developed within component Units, and so should not be undertaken until at least the two mandatory Units have been covered.

A typical Course plan might, therefore, take the form:

August – October:	Using Information
October – December	Relational Database Systems
January	Practical coursework task
January	preparation for prelim examination (s)
February – March	optional Unit
April	flexible time

Preliminary examinations, if used, should be timed to allow maximum coverage of the three Course Units. This can be achieved by holding the prelim as late as possible (end of March), or by having an early prelim covering two Units, with a supplementary prelim later covering the third Unit, and integration with the mandatory units.

The teaching and learning and internal assessment of the three component Units of the Course is designed to be completed within 120 hours. This includes practical activities in preparation for the practical coursework task. As centres are advised to allow 160 hours for the delivery of a National Course, this leaves up to 40 hours of flexible time.

Use of the additional 40 hours

Appropriate activities for this time include:
♦ an introduction to the Course
♦ revision of required prior learning
♦ consolidation and integration of learning
♦ remediation and re-assessment
♦ formative assessment (class tests)
♦ preliminary examination(s)
♦ preparation for external assessment
♦ completion of the practical coursework task
♦ extending the range of study

SPECIAL NEEDS
This Course 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 alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, September, 2003).

National Course Specification: Course details (cont)

INFORMATION SYSTEMS (Higher)

INFORMATION SYSTEMS IN A BROADER CONTEXT

A number of national initiatives and programmes have been designed to promote themes that are important to contemporary society such as citizenship and enterprise. These themes contribute to individual subjects and Courses by making connections beyond the subject boundaries and enrich the learning experience. Similarly, the specialist knowledge and skills developed through study of a particular subject contributes to the understanding of these themes.

There are opportunities within Information Systems (Higher) for assessors to help candidates make links to cross-curricular themes. Some suggestions are given below.

Cross–curricular theme	Course content
Enterprise in Education	Understanding the impact of information systems on globalisation and competitive advantage
	Understanding the impact of information systems on decision making at every level in business
	Understanding the impact that multimedia has had on CBT
	Understanding the binding nature of a contractual requirements specification
	Understanding the social, ethical and legal implications of expert systems
	Understanding the benefits of expert systems
Education for Citizenship	Understanding and respecting the legal requirements of using ICT to manage information
	Developing skills to locate, handle, use and compile information using ICT, as appropriate
Financial Education	Understanding the rights, responsibilities and protection offered by copyright law
Health Education	Design of screen images that give accessibility to users with disabilities

National Unit Specification: general information

UNIT   Using Information (Higher)

NUMBER   DM4C 12

COURSE   Information Systems (Higher)

SUMMARY

This Unit is designed to develop knowledge and understanding of the principles, features and purposes of information and the systems used to retrieve, create and manipulate information. It also develops knowledge and understanding of the wide-ranging implications of the growing use of ICT within society. It provides an opportunity to develop practical skills in the use of contemporary information handling. Candidates may then apply this knowledge and these skills to solve practical problems. It is designed for candidates undertaking the Higher Information Systems Course, but it is also suitable for anyone wishing to develop an understanding of the use of information systems in a variety of contexts.

OUTCOMES

1.   Demonstrate knowledge and understanding of the principles, features and purposes of information, organisational information systems, information management software, and the social, legal, ethical and economic implications of information systems.

2.   Demonstrate practical skills in the use of contemporary hardware and software in the context of creating, storing, processing, retrieving and presenting information.

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 Using Information Unit
♦   Intermediate 2 Information Systems
♦   Intermediate 2 Computing
♦   Standard Grade Computing Studies at Credit level

Administrative Information

National Unit Specification: general information (cont)

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

This Unit gives automatic certification of the following:

| **Core Skill components for the Unit** | Critical Thinking | H |
| | Planning and Organising | H |

National Unit Specification: statement of standards

UNIT   Using Information (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 the principles, features and purposes of information, organisational information systems, information management software, and the social, legal, ethical and economic implications of information systems.

Performance Criteria
a)   A range of terminology is used appropriately.
b)   Technically accurate 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 information, decision making, applications and systems accurately and concisely. Evidence should be obtained using questions in a closed book test, under supervision, lasting no more than 45 minutes. The test must sample the content (see Information Systems (Higher) Course Content) in each of the following areas:

♦   data and information
♦   organisational information systems
♦   information management software
♦   implications of information and communications technology

(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.

OUTCOME 2
Demonstrate practical skills in the use of contemporary hardware and software in the context of creating, storing, processing, retrieving and presenting information.

Performance Criteria
a)   An appropriate range of features of hardware are used effectively and efficiently.
b)   An appropriate range of features of software are selected and 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.

National Unit Specification: statement of standards (cont)

UNIT   Using Information (Higher)

Evidence Requirements
Observation checklist showing that the candidate has carried out practical activities in the following contexts:

♦   presenting information for print media using word processing **or** desktop publishing software
♦   presenting information for online media using presentation **or** web authoring software
♦   handling information using spreadsheet software

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 defined in the content statements (see Information Systems (Higher) Course Content).

The candidate will be allowed access to books, notes and online help while completing the task(s).

(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   Using Information (Higher)

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 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 statements in the right-hand column define the content for this Unit.

Content Statements: Data and Information	
Intermediate 2	Higher
Definitions and exemplification of the following terms in the context of an information system: ♦ *data* ♦ *information*	Explanations and descriptions of the following terms in the context of an information system, and the relationships between them: ♦ data (raw facts and figures) ♦ information (processed data with structure, organisation, context or meaning) ♦ knowledge (derived from information)
	Describing and exemplification of metadata (data describing data).
	Categorisation of information in terms of its: ♦ source (primary, secondary, internal, external) ♦ nature (formal, informal, quantitative, qualitative) ♦ level (strategic, tactical, operational) ♦ time (historic, present, future) ♦ frequency (continuous, hourly, daily, monthly, annually) ♦ use (planning, control, decision making) ♦ form (written, aural, visual) ♦ type (detailed, sampled, aggregated)

National Unit Specification: support notes (cont)

UNIT Using Information (Higher)

	Identification and description of the characteristics which affect the quality of information, in terms of its:
	♦ relevance (or appropriateness)
	♦ accuracy
	♦ completeness
	♦ reliability (or objectivity)
	♦ timing
	♦ level of detail (or conciseness)
	♦ presentation
	♦ availability
	Understanding of the relationship between the characteristics of information and its value, and of the distinction between its cost and value.

Content Statements: Organisational Information Systems	
Intermediate 2	Higher
Explanation of the following concepts in relation to organisational information systems: ♦ *speed* ♦ *accuracy* ♦ *efficiency* ♦ *volume*	Definition, description and exemplification of data processing (DP) systems. Definition, description and exemplification of Management Information Systems (MIS) ♦ Decision Support Systems (DSS) ♦ Executive Information Systems (EIS) Definition, description and exemplification of Expert Systems.
Description and exemplification of the functions of organisational information system: ♦ *gathering information* ♦ *storing information* ♦ *processing information* ♦ *outputting information*	Identification of organisational information system management strategies: ♦ network strategy ♦ security strategy ♦ backup strategy ♦ upgrade strategy ♦ software strategy
Explanation of the need for organisational information system management strategies: ♦ *network strategy* ♦ *security strategy* ♦ *backup strategy* ♦ *upgrade strategy* ♦ *software strategy*	Description, exemplification and application of network strategy: ♦ identification and description of network topologies, including LANs, WANs, distributed networks ♦ identification and description of hardware, client/server, network adapter, structured cabling ♦ identification and description of software, including network operating system, network accounts ♦ description of audit and monitoring procedures and software

UNIT   Using Information (Higher)

	Description, exemplification and application of security strategy: ♦ distinction between security, integrity and privacy of data ♦ description of the security risks to information systems, including viruses, hacking, denial of service ♦ description and exemplification of policies and procedures for implementing data security, including codes of conduct, password guidelines ♦ description and exemplification of methods of implementing data security, including virus protection, firewalls, encryption ♦ description and exemplification of access rights on a network system
	Description, exemplification and application of backup strategy: ♦ identification and description of archive, recovery and storage methods ♦ description of a rotation method for regular back-up, in terms of frequency and version control
	Description, exemplification and application of upgrade strategy: ♦ understanding of the need for 'future proofing', and of difficulties regarding hardware and software compatibility ♦ understanding the requirements to maintain legacy systems, and of methods of doing so, including emulation
	Description, exemplification and application of software strategy: ♦ identification and description of criteria for evaluation of software, in terms of functionality, performance, usability, compatibility, data migration, reliability, resource requirements, portability, and support ♦ description of the methods of providing training in using information systems software, including on-the-job training, in-house and external Courses ♦ identification and description of the means of obtaining user support, including manuals, online help/tutorials, help desk, newsgroups, and FAQs ♦ identification and description of the issues affecting decisions to upgrade software

UNIT Using Information (Higher)

Description of the impact and advantages of a centralised database within an organisation.	Description of distributed databases; data warehouses and data mining within an organisation.

Content Statements: Information Management Software	
Intermediate 2	Higher
Description and exemplification of personal and organisational uses of the following types of applications software: ♦ *word processing* ♦ *spreadsheet* ♦ *database* ♦ *graphic design* ♦ *browsers* ♦ *e-mail clients* ♦ *chat clients* ♦ *DTP* ♦ *presentation* ♦ *financial* ♦ *reference* ♦ *web authoring*	Identification, description and application of the following classes of software: ♦ word processing/desktop publishing (presenting information for print media) ♦ presentation/web authoring (presenting information for online media) ♦ spreadsheet (data handling) ♦ project management ♦ personal information management
Description of standard word processing software in terms of data objects, operations and formatting functions	Description and exemplification of the main features of word processing/desktop publishing software, including: ♦ multi-page layout, including use of columns, header and footer, pagination ♦ contents/index ♦ incorporation of graphics with text wrapping ♦ use of stylesheets to implement a 'house style', including selection of fonts (serif/sans-serif), use of colour, formatting of text (font, size, style, alignment)
	Description and exemplification of the main features of presentation/Web authoring software, including: ♦ structuring of pages/slides ♦ incorporation of graphics and animation ♦ consideration of presentational style including selection of fonts and use of colour ♦ navigation including hyperlinks, home links and page transitions ♦ use of templates/masters to implement 'house style'

UNIT   Using Information (Higher)

Description of standard spreadsheet software in terms of data objects, operations and formatting functions.	Description and exemplification of the main features of spreadsheet software, including: ♦ goal seeking/forecasting ♦ lookup tables ♦ advanced functions (nested if, count) ♦ use of macros
	Description and exemplification of the main features of project management software, including: ♦ timelining ♦ resource allocation ♦ Gantt (and other) charts ♦ optimisation and critical path analysis
	Description and exemplification of the main features of personal information management software, including: ♦ communication ♦ contacts ♦ calendar ♦ task lists
Evaluation of software in terms of: ♦ *range of data objects* ♦ *range of operations* ♦ *formatting functions* ♦ *HCI (including use of keyboard commands, menus and toolbars/icons)* ♦ *online help and online tutorials*	

Content Statements: Implications of ICT	
Intermediate 2	Higher
Description and exemplification of the social implications of ICT in terms of: ♦ *ease of access and availability of IS* ♦ *information rich/poor and the impact of IS on social structures.* ♦ *educational qualifications and the need for citizens to be ICT aware.* ♦ *the range of jobs in industries that employ knowledge worker.* ♦ *online retail and changing shopping habits*	Description and exemplification of the social implications of ICT in the following contexts: ♦ globalisation and the impact of IS on business and societies ♦ the impact on business organisations of an IS driven business model ♦ e-commerce and the changing relationship between businesses and customers brought about by the internet ♦ the development of individuals' identities and persona when communicating on the internet ♦ the right to private communications across the Internet

National Unit Specification: support notes (cont)

UNIT Using Information (Higher)

Description and exemplification of the legal implications of information systems in term of: ♦ *Data Protection Act (1998): data protection principles; rights of data subject; responsibilities of data controller; role of the Information Commissioner* ♦ *Computer Misuse Act (1990): offences* ♦ *Copyright, Designs & Patents Act (1988): works covered; copyright ownership; use of copyrighted material* ♦ *Health & Safety regulations: seating, lighting, RSI, eye strain and radiation*	Identification, description, application and implications of current legislation applying to information systems, including: ♦ Data Protection Act (1998): inadequacies of the 1984 Act; changes from the 1984 Act, including coverage of data in electronic transmission; requirement for prior consent of data subject; harmonisation of EU Data Protection legislation; export of data; paper based records ♦ Copyright, Designs and Patents Act (1988): application of copyright to computer software, computer databases, web content, and digital media; software piracy ♦ Regulation of Investigatory Powers Act (2000) (including Lawful Business Practice Regulations) ♦ Freedom of Information (Scotland) Act (2002) ♦ Health & Safety regulations: employers' responsibilities
Description and exemplification of the economic implications of ICT in terms of: ♦ *the type of jobs and associated costs within various modern organisations* ♦ *the effect of new ICT on business and individuals productivity and profitability*	Description and exemplification of the economic implications of ICT in terms of: ♦ the impact on business organisations in relation to competitive advantage ♦ business costs including initial/running and investment cost
Description and exemplification of the ethical implications of in terms of: ♦ *netiquette in both personal and business contexts* ♦ *information intellectual property rights*	Description and exemplification of the ethical implications of in terms of: ♦ censorship and freedom of speech ♦ privacy and encryption ♦ global citizenship

National Unit Specification: support notes (cont)

UNIT Using Information (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, students will benefit from having some experience of alternative operating systems.

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

It is not intended that candidates make extensive use of **both** word processing and desktop publishing software. Rather an exploration of **one** or other of these would exemplify the common features listed in the contents grid. The same applies to presentation and web authoring software. Candidates should develop knowledge and understanding of project management software and personal information management software, but there is no requirement for them to have practical experience of either of these.

Assessors should choose appropriate contexts to exemplify the concepts of the Course. Suitable contexts might include financial institutions, educational establishments, small and large businesses, manufacturing and retail, service industries.

Candidates who have completed the *Using Information* Unit at Intermediate 2 level should already have covered the content listed in the left-hand column of the content grids, but may well 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 students. However, the following times are suggested as a rough guide:

Data and Information	4 hours
Organisational Information Systems	8 hours
Information Management Software	18 hours
Implications of Information and Communications Technology	6 hours

1½ hours will be set aside to:
   a) administer the Outcome 1 test
   b) 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.

National Unit Specification: support notes (cont)

UNIT   Using Information (Higher)

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 assessment 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 will normally be demonstrated in the context of a number of relatively small tasks. The skills will normally be demonstrated 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 online help while completing the task(s).

To gain success in this Outcome, the candidate must demonstrate practical skills at an appropriate level in the following contexts, defined in the content statements (see Higher Information Systems Course contents):

♦   presenting information for print media using word processing **or** desktop publishing software
♦   presenting information for on-line media using presentation **or** web authoring software
♦   handling information using spreadsheet software

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

An 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).

National Unit Specification: general information

UNIT   Relational Database Systems (Higher)

NUMBER DM4K 12

COURSE Information Systems (Higher)

SUMMARY

This Unit is designed to develop knowledge and understanding of the principles of relational database systems and provides an opportunity to apply this knowledge to solve problems through the use of contemporary hardware and software. It is designed for candidates, undertaking the Higher Information Systems Course, but it is also suitable for anyone wishing to extend and deepen their experience of database systems beyond Intermediate 2 Level.

OUTCOMES

1. Demonstrate knowledge and understanding of the principles, features and techniques of relational database systems.
2. Demonstrate practical skills using contemporary hardware and software in the context of relational database systems.

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 Database Systems Unit
♦ Intermediate 2 Information Systems Course
♦ Standard Grade in Computing Studies at Credit level

Administrative Information

National Unit Specification: general information (cont)

CREDIT VALUE
1 credit at Higher (6 SCQF 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
This Unit gives automatic certification of the following:

Core Skill components for the Unit	Critical Thinking	H
	Planning and Organising	H

National Unit Specification: statement of standards

UNIT Relational Database Systems (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 the principles, features and techniques of relational database systems.

Performance Criteria
a) A range of database 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, explain and apply the principles, features and techniques of relational database systems accurately and concisely.

Evidence should be obtained using questions in a closed book test, under supervision, lasting no more than 45 minutes. The test must sample the content (see Information Systems (Higher) Course Content) in each of the following areas:

♦ database fundamentals
♦ entities and data relationships
♦ data modelling concepts
♦ normalisation
♦ implementation

(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.

OUTCOME 2
Demonstrate practical skills using contemporary hardware and software in the context of relational database systems.

Performance Criteria
a) A range of appropriate hardware is used effectively and efficiently.
b) A range of appropriate 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.

National Unit Specification: statement of standards (cont)

UNIT   Relational Database Systems (Higher)

Evidence Requirements

Observation checklist showing that the candidate has demonstrated practical skills in each of the following contexts:

♦   design of data tables from source documents
♦   normalisation of data to 3NF
♦   creation of database (including interface) from design
♦   implementation of complex queries
♦   implementation of macros/scripting

Candidates will be presented with two source documents and one requirements specification which must be represented as one entity in UNF. At most complex this decomposes to two entities in 1NF, three entities in 2NF and four entities in 3NF.

Hard copy evidence should be provided of the database implementation.

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 Information Systems (Higher) Course Content).

The candidate will be allowed access to books, notes and on-line 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   Relational Database Systems (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: Database fundamentals	
Intermediate 2	Higher
Description of the benefits of an electronic database system in comparison with manual data storage, including. ♦ *searching and sorting* ♦ *data retrieval* ♦ *data storage and updating* ♦ *data analysis and reporting*	Description of need for and methods of achieving good database design, including consideration of the following: ♦ data duplication ♦ data insertion ♦ data deletion ♦ data modification ♦ problems associated with meaningful identifiers

UNIT   Relational Database Systems (Higher)

Content Statements: Entities and Data Relationships	
Intermediate 2	Higher
Description and exemplification of simple data entities, in terms of the following attributes: ♦ *name* ♦ *multi-valued or single valued* ♦ *data type (text, integer, real, object, date, time)*	Description and exemplification of data entities, in terms of the following attributes: ♦ name ♦ multi-valued attributes ♦ single valued attributes ♦ data type (text, integer, real, object, link, boolean, date, time) Definition of data domain including domain constraints. Description of methods of achieving good database design, including appropriate choice of entities and entity relationships. Description, exemplification and identification of entity relationships, including: ♦ cardinality (one-to-one, one-to-many, many-to-many) ♦ use of entity occurrence modelling ♦ use of entity relationship diagrams

National Unit Specification: support notes (cont)

UNIT Relational Database Systems (Higher)

Content Statements: Data Modelling Concepts	
Intermediate 2	Higher
	Definition and exemplification of data relationships using: ♦ consistent notation ♦ appropriate nomenclature (defining relation names, primary keys, foreign keys and non-key column names)
Design and creation of data tables, including consideration of: ♦ *table names* ♦ *fields (name and type)* ♦ *keys (primary and foreign)* ♦ *validation (presence, restricted choice)* *Description and exemplification of the following field types: text, number, object, link, date, time, Boolean.* *Identification of the limitations of flat file databases, and the advantages of linked tables (relational databases).*	Design and creation of linked data tables, including consideration of: ♦ table names ♦ uniquely named columns ♦ choice of primary key with one or two attributes including non-meaningful identifiers, compound key, surrogate keys ♦ foreign keys (domain constraints and null values)
	Definition of referential integrity. Definition of entity integrity: ♦ non-null primary key ♦ no multi-valued attributes
	Exemplification of data retrieval, including consideration of: ♦ user views and queries ♦ answer tables
	Description of need for, and exemplification of data dictionaries including name, type, size, validation, index/key.

National Unit Specification: support notes (cont)

UNIT   Relational Database Systems (Higher)

Content Statements: Normalisation	
Intermediate 2	Higher

Explanation of normalisation.
 	
Identification of entities with a single one-to-many relationship between them in a single source document.
 	
Identification and removal of multi-valued fields in records.
	Definitions of normal forms:
	   ♦ UNF
	   ♦ first normal form (1NF)
	   ♦ second normal form (2NF)
	   ♦ third normal form (3NF)
	
	Creation of UNF from source documents.
	
	Normalisation to 1NF, by identifying and eliminating repeating groups.
	Description of problems of 1NF.
	
	Normalisation to 2NF by identifying partial key dependency.
	Description of problems of 2NF.
	
	Normalisation to 3NF by identifying non-key dependency.

Content Statements: Implementation	
Intermediate 2	Higher

Implementation of database system based on data table.
 	
Description and implementation of simple queries including:
   ♦ *sorting (two fields, ascending/descending)*
   ♦ *searching (two fields)*
 	
Description and implementation of data input forms and simple reports.
	Implementation of database system based on a data model, including entity/relationship diagram and data dictionary.
	
	Description and implementation of complex queries including:
	   ♦ sorting (multiple fields, ascending/descending)
	   ♦ searching (multiple fields, across linked/related tables)
	   ♦ calculating and summarizing (including count, sum and average)
	
	Use of related tables as sources for data entry (including lookups).
	
	Enforcement of data integrity through validation.

Implementation of consistent, user-friendly user interface and screen design.	Implementation of simple macros and scripting for navigation.

National Unit Specification: support notes (cont)

UNIT   Relational Database Systems (Higher)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Candidates will require individual access to appropriate computer hardware and software throughout this Unit.

The two Outcomes should be delivered in an integrated way. Appropriate practical activities, both computer based and non-computer based, should be taught and used to illustrate and exemplify the knowledge and understanding required for Outcome 1.

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

Candidates will be required to demonstrate knowledge and understanding of the principles and concepts of relational database systems as specified in the content grids at Intermediate 2 and Higher levels. Candidates are required to explain features of the content grids and use appropriate terminology. The context within which Intermediate 2 content is examined will be appropriate to Higher level.

The Unit is designed to provide candidates with the skills to produce a data model, correct to third normal form, and then to implement this using relational database software. Current relational database management software which would be appropriate for this task includes MySQL/PHP, Microsoft Access and Corel Paradox.

Candidates should be presented with **two** source documents and a requirements definition detailing the restrictions which apply to the system and, from this, should analyse, design and implement a database system. In the **most** complex problem presented to the candidate the source documents should breakdown into two tables in 1NF (one of which will have a compound key of not more than **three** attributes), three tables in 2NF (based on the compound key given in 1NF) and four tables in 3NF (based on a single non-key dependency). It is appropriate that some problems given to candidates will not require all of the stages of normalisation to be applied. Candidates should be aware that entities in 3NF are already in 1NF and 2NF by definition and that entities in 2NF are already in 1NF.

The problems presented to candidates should be familiar, and appropriate contexts include video clubs, lending library and sales systems. However, all the information presented in the requirements definition should be sufficient to allow the candidate to produce the correct data model irrespective of how familiar the candidate is with context.

The implementation of the database system involves the application of knowledge, understanding and skills from Intermediate 2 level. These knowledge, understanding and skills are now applied to a problem at Higher level and this should be reflected in the complexity of the problem. In addition, Higher level introduces referential integrity and the use of linked/related tables. Candidates should be aware of the importance of referential integrity in a database system. Candidates should be aware of the appropriate use of referential integrity and when it is and is not appropriate to enforce it. Limited use of scripting or macros should also be covered where this adds to the navigation of the implemented system.

National Unit Specification: support notes (cont)

UNIT   Relational Database Systems (Higher)

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 are suggested as a rough guide:

database fundamentals	3 hours
entities and data relationships	4 hours
data modelling concepts	9 hours
normalisation	8 hours
implementation	12 hours

1½ hours should be set aside to:
- a) administer the Outcome 1 test
- b) 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 will normally be demonstrated in a number of relatively short tasks. Skills will normally be demonstrated 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 online help while completing the tasks.

To gain success in this Outcome, the candidate must demonstrate practical skills at an appropriate level in four of the following contexts, as defined in the content statements (see Information Systems (Higher) Course Content):

- ♦ design of data tables from source documents
- ♦ normalisation of data to 3NF
- ♦ creation of database (including interface) from design
- ♦ implementation of complex queries
- ♦ implementation of macros/scripting

Hard copy evidence should be provided of the database implementation.

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

National Unit Specification: support notes (cont)

UNIT   Relational Database Systems (Higher)

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

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).

National Unit Specification: general information

UNIT   Applied Multimedia (Higher)

NUMBER   DM4D 12

COURSE   Information Systems (Higher)

SUMMARY

This Unit is designed to develop knowledge and understanding of the principles of multimedia applications and practical skills related to the development of multimedia applications 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 multimedia applications. It is designed as an option for candidates undertaking the Higher Information on Systems Course, but is also suitable for anyone wishing to extend and deepen their experience of multimedia applications beyond Intermediate 2 level.

OUTCOMES

1. Demonstrate knowledge and understanding of the principles, features and purposes of multimedia applications.
2. Demonstrate practical skills in the context of multimedia applications 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 Applied Multimedia Unit
♦ Intermediate 2 Information Systems
♦ Standard Grade Computing Studies at Credit level

Administrative Information

National Unit Specification: general information (cont)

CREDIT VALUE

1 credit at Higher (6 SCQF 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

This Unit gives automatic certification of the following:

Core Skill components for the Unit	Critical Thinking	H
	Planning and Organising	H

National Unit Specification: statement of standards

UNIT   Applied Multimedia (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 the principles, features and purposes of multimedia applications.

Performance Criteria
a)   Terminology related to multimedia applications is used appropriately.
b)   Descriptions and explanations are technically correct and concise.
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 multimedia applications accurately and concisely. Evidence should be obtained using questions in a closed book test, under supervision, lasting no more than 45 minutes. The test must sample the content (see Information Systems (Higher) Course Content) in each of the following areas:

♦   contemporary uses and means of delivery
♦   stages of development
      –   analysis
      –   design of navigational features and HCI
      –   design of screens and media elements
      –   implementation (general)
      –   implementation (media elements)
      –   testing
      –   documentation
      –   evaluation

(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   Applied Multimedia (Higher)

OUTCOME 2
Demonstrate practical skills in the context of multimedia applications 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 all of the following contexts:

♦   analysis of a project brief
♦   design of a navigation map and series of storyboards
♦   implementation of a 'non-linear' multimedia application
♦   testing of a multimedia application
♦   documentation of a multimedia application
♦   evaluation of a multimedia application

Hard copy evidence should be provided of implementation and one other of these skills.

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 defined in the content statements (see Information Systems (Higher) Course Content).

The candidate will be allowed access to books, notes and online help while completing these 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   Applied Multimedia (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 statements in the right-hand column define the new content for this Unit.

Content Statements: Contemporary uses and means of delivery	
Intermediate 2	Higher

Simple description and exemplification of how multimedia applications are used in the following areas:
 ♦ *business*
   o *advertising and selling products*
   o *presentations*
 ♦ *education*
   o *CAL*
   o *reference materials*
 ♦ *home*
   o *games*
   o *leisure pursuits*
 ♦ *public places*
   o *information points*
	Description and exemplification of how multimedia applications are used in the following areas:
	 ♦ business
	   o e-commerce
	   o presentations
	   o teleconferencing
	   o collaborative working
	 ♦ training
	   o CBT
	   o simulations
	 ♦ home
	   o entertainment
	   o edutainment
	   o shopping

Exemplification of appropriate uses for delivery media: ♦ *CD-ROM/DVD-ROM* ♦ *kiosk* ♦ *WWW*	Description of multimedia delivery media and exemplification of appropriate uses: ♦ CD-ROM/DVD-ROM ♦ kiosk ♦ WWW ♦ mobile communication devices ♦ hybrids ♦ virtual reality

UNIT   Applied Multimedia (Higher)

Comparison of delivery media in terms of: ♦ *data capacity* ♦ *ease of update*	Comparison of relative advantages/disadvantages of different multimedia delivery media in terms of: ♦ data capacity ♦ data transfer rate/bandwidth ♦ information 'window' size ♦ ease of update

Content Statements: Stages of development — analysis	
Intermediate 2	Higher
Identification of the following aspects of the analysis stage : ♦ *purpose* ♦ *user / audience* ♦ *content* ♦ *delivery media* ♦ *budget* ♦ *timescale*	Description of the difference between a project brief and contractual requirements specification. Description of the contents of requirements specification, including: ♦ purpose ♦ user/audience ♦ content ♦ delivery media ♦ budget ♦ timescale Description of the uses made of the requirements specification by: ♦ client ♦ multimedia developer

National Unit Specification: support notes (cont)

UNIT Applied Multimedia (Higher)

Content Statements:	
Stages of development — design of navigation structures and HCI	
Intermediate 2	Higher
Simple representation using navigation maps of the different types of navigation structures to include: ♦ *linear* ♦ *hierarchical* ♦ *web*	Representation and comparison of the different types of navigation structures to include: ♦ linear ♦ hierarchical ♦ web ♦ composite/hybrid
Description and use of complex search facilities (AND).	Implications of increasing complexity of navigation structures including 'Lost in Hyperspace' and resulting solutions: ♦ backtracking ♦ highlighting ♦ history ♦ bookmarks ♦ breadcrumbs ♦ use of search facilities (AND, OR, NOT)
Description of user interfaces: ♦ *CLI* ♦ *menu* ♦ *form fill-in* ♦ *direct manipulation (GUI)*	Description of user interfaces with relative advantages/disadvantages: ♦ CLI ♦ menu ♦ form fill-in ♦ direct manipulation (GUI)
	Description and exemplification of use of 'metaphors'.
	Description and exemplification of guidelines for good user interface design: ♦ consistency ♦ differing ability levels ♦ providing feedback ♦ easy correction of errors ♦ avoiding information overload

UNIT   Applied Multimedia (Higher)

Content Statements: Stages of development — design of screens and media elements	
Intermediate 2	Higher
Description and use of storyboarding to represent the design of screens including: ♦ *layout of screen elements* ♦ *user interface* ♦ *transitions* ♦ *navigation*	Critical evaluation of screen design in terms of: ♦ layout of elements ♦ user interface ♦ transitions ♦ navigation
	Explanation of the difference between an outline and detailed storyboard.
Description and use of general design principles (text): ♦ *quantity of text* ♦ *choice of font(s)* ♦ *alignment and size* ♦ *consistency in headings/subheadings/body* ♦ *use of lists and tables* ♦ *use of white space*	Description and use of additional text features: ♦ kerning ♦ anti aliasing Explanation of difficulties of using non-standard fonts and solutions including: ♦ embedding fonts ♦ graphical text
Description and use of general design principles (graphics): ♦ *number of graphics per screen* ♦ *captions* ♦ *text wrap*	Explanation of implications of using colour and graphics including: ♦ different platforms/gamma correction ♦ dithering ♦ web palettes ♦ progressive display
Description and use of general design principles (audio): ♦ *advantages/disadvantages of background music, sound effects* ♦ *user controlled(volume, on/off)* ♦ *voice output*	Description of the advantages and disadvantages of streaming audio as against downloading audio.
	Explanation of implications of using video: ♦ user controlled (using VCR controls) ♦ danger of flashing sequences/epilepsy ♦ streaming video vs downloading video

National Unit Specification: support notes (cont)

UNIT Applied Multimedia (Higher)

Content Statements: Stages of development — implementation (general)	
Intermediate 2	Higher
Description of the basic functions and features of software for creating multimedia applications: ♦ *presentation* ♦ *authoring (icon-based and scripting)* ♦ *web-page*	Description of advanced functions and features of software for creating and delivering multimedia applications: creation ♦ presentation ♦ authoring (icon-based and scripting) ♦ web-page delivery ♦ stand-alone applications ♦ players
Comparison of the different types of software for creating multimedia applications in terms of: ♦ *ease of use* ♦ *cost* ♦ *programming requirements*	Explanation of advantages and disadvantages of both stand-alone applications and players.
Basic description of personnel and their role: ♦ *project manager* ♦ *multimedia designer* ♦ *subject expert* ♦ *media specialists (graphic, audio)* ♦ *multimedia programmer* ♦ *webmaster*	Description and exemplification of the skills required by personnel: ♦ project manager ♦ multimedia designer ♦ subject expert ♦ media specialists (graphic, audio, video) ♦ multimedia programmer ♦ webmaster

Content Statements: Stages of development — implementation (media elements)	
Intermediate 2	Higher
Explanation of how colour depth and resolution affect the file size and clarity of graphics.	Simple description of graphic file types TIFF, JPEG and GIF in terms of: ♦ colour depth ♦ resolution ♦ file size ♦ degree of compression ♦ appropriate uses
Explanation of how sampling rate and sampling depth (sampling resolution) affect the file size and audio quality. *Explanation of the need for compression.*	Simple description of audio file types MP3 and MIDI in terms of: ♦ contents of file ♦ file size ♦ degree of compression ♦ appropriate uses

UNIT   Applied Multimedia (Higher)

	Explanation of how frame rate, video window size and compression affect video file size and quality. Recognition of MPEG as video file type.
Definition of the terms node, link and anchor.	Explanation and exemplification of the structure of a URL. Comparison between absolute and relative pathnames.

Content Statements: Stages of development — testing	
Intermediate 2	Higher
Explanation of the need for testing.	
Simple description and exemplification of different tests that should be carried out including: ♦ *screen tests* ♦ *navigation tests*	Description and exemplification of the different types of testing that should be carried out including: ♦ screen testing ♦ integration testing ♦ acceptance testing ♦ usability testing

Content Statements: Stages of development — documentation	
Intermediate 2	Higher
Identification of the contents and purpose of user documentation including: ♦ *hardware and software system requirements* ♦ *user instructions*	Identification of the two different types of documentation and their contents including: ♦ project development documentation (requirements specification, navigation map, storyboards, record of testing) ♦ user documentation (hardware and software system requirements, user instructions)
Description of need for clearly documented copyright licenses including Copyright, Design & Patents Act.	Description of need for clearly documented copyright licences including: ♦ use of other people's materials (description and exemplification of the purpose of the Copyright Design & Patents Act, Fair Use policy) ♦ protection of your own materials (parts of a multimedia application that can be copyrighted, duration of copyright, legal redress, means of tracing copyrighted materials: enforced online registration and digital watermarks)

National Unit Specification: support notes (cont)

UNIT   Applied Multimedia (Higher)

Content Statements: Stages of development — evaluation	
Intermediate 2	Higher
Evaluation of a multimedia application in terms of: ♦ *fitness for purpose*	Critical evaluation of a multimedia application in terms of: ♦ fitness for purpose ♦ accessibility(disabilities) ♦ clarity of presentation

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Candidates will require individual access to appropriate computer hardware and software throughout this Unit.

The two Outcomes should be delivered in an integrated way. Appropriate practical activities should be taught and used to illustrate and exemplify the knowledge and understanding required for Outcome 1.

Candidates who have completed the *Applied Multimedia* Unit at Intermediate 2 level should already have covered the content listed in the left-hand column of the content grids, but may well 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 are a rough guide:

Contemporary uses and delivery media	7 hours
Stages of development	
analysis	3 hours
design	8 hours
implementation	11 hours
testing	2 hours
documentation	3 hours
evaluation	2 hours

1½ hours should be set aside to:
(a)   administer the Outcome 1 test
(b)   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.

National Unit Specification: support notes (cont)

UNIT   Applied Multimedia (Higher)

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 will normally be demonstrated in the context of a number of relatively short tasks. However, they may be demonstrated in the context of a single extended task. The tasks will normally be undertaken by the candidate as part of 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 online help while completing the tasks.

To gain success in this Outcome, the candidate must demonstrate practical skills at an appropriate level in all of the following contexts, defined in the content statements (see Information Systems (Higher) Course Content):

- analysis of a project brief
- design of a navigation map and series of storyboards
- implementation of a 'non-linear' multimedia application
- testing of a multimedia application
- documentation of a multimedia application
- evaluation of a multimedia application

Hard copy evidence should be provided for implementation and one other of these skills. Note that this need not be formal documentation — print outs, screen shots and handwritten notes on analysis and design would all be examples of suitable evidence.

An 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).

National Unit Specification: general information

UNIT   Expert Systems (Higher)

NUMBER   DM4H 12

COURSE   Information Systems (Higher)

SUMMARY

This Unit is designed to develop knowledge and understanding of the principles of expert systems and practical skills related to expert systems through the use of contemporary hardware and software. This knowledge and understanding, and these practical skills, may then be applied by the candidate to solve practical problems related to expert systems. It is designed as an option for candidates undertaking the Higher Information Systems Course, but is also suitable for anyone wishing to extend and deepen their experience of expert systems beyond Intermediate 2 level. It is also appropriate as an extension for those who have studied Artificial Intelligence at Higher level.

OUTCOMES

1. Demonstrate knowledge and understanding of the principles, techniques and applications of expert systems.
2. Demonstrate practical skills by applying knowledge and understanding of the principles, techniques and applications of expert systems 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 qualifications (or possess equivalent experience):

♦ Intermediate 2 Expert Systems Unit
♦ Intermediate 2 Information Systems
♦ Intermediate 2 Computing
♦ Standard Grade Computing Studies at Credit level

Administrative Information

National Unit Specification: general information (cont)

CREDIT VALUE

1 credit at Higher (6 SCQF 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

This Unit gives automatic certification of the following:

Core Skill components for the Unit	Critical Thinking	H
	Planning and Organising	H

National Unit Specification: statement of standards

UNIT   Expert Systems (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 the principles, techniques and applications of expert systems.

Performance Criteria
a)   Principles and techniques of expert systems are clearly explained using appropriate terminology.
b)   Descriptions of applications are technically accurate and concise.
c)   Conclusions, predictions and generalisations are made from knowledge and understanding.

Evidence Requirements
Written or oral evidence that the candidate can describe, explain and apply the principles, techniques and applications of expert systems accurately and concisely. Evidence could be obtained using questions in a closed book test under supervision, lasting no more than 45 minutes. The test must sample the content (see Information Systems (Higher) Course Content) in each of the following areas:

♦   expert systems in context
♦   characteristics of expert systems
♦   development, use and evaluation of expert system
♦   construction of a working expert system

(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.

OUTCOME 2
Demonstrate practical skills by applying knowledge and understanding of the principles, techniques and applications of expert systems to solve practical problems 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.

National Unit Specification: statement of standards (Cont)

UNIT Expert Systems (Higher)

Evidence Requirements

Observation checklist showing that the candidate has carried out practical activities in the following contexts:

♦ finding solutions to given problems by consultation of expert systems for advice, classification, diagnosis, and planning
♦ structured testing and critical evaluation of an expert system
♦ representation of a limited domain of knowledge in a structured form
♦ construction of a working expert system given a limited domain of knowledge

Hard copy evidence should be provided of the working expert system constructed.

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

The practical skills should be demonstrated in the context defined in the content statements (see Information Systems (Higher) Course Content).

The candidate will be allowed access to books, notes and on-line 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   Expert Systems (Higher)

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 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: Expert systems in context	
Intermediate 2	Higher
Description of the purpose of an expert system: to represent the knowledge of one or more domain experts; to provide advice to a user via a consultation; to provide explanations of why certain questions are being asked and how conclusions have been reached. *Definition of an 'expert system shell'.* *Identification of applications for expert systems, including medical, legal and financial advice.*	Description of the advantages/benefits of expert systems, including preservation of expertise, dissemination of expert knowledge, training, combining expertise of multiple experts. Description of the limitations/drawbacks of expert systems, including restricted domain, high development and maintenance costs. Description of the social, ethical and legal implications of expert systems, including responsibility for 'bad' advice.
Distinction between knowledge (created by the application of inference rules to known facts), data and information.	Distinction between expert systems and other information systems (including Management/Executive Information Systems, Decision Support Systems). Comparison of databases and expert systems, in terms of representation of data/knowledge; method of extraction of information/knowledge. Description of the characteristics of a deductive database which combines the inferencing of an expert system with the power of a database for large scale storage of 'facts'.
Identification of the components of an expert system: knowledge base, inference engine, user interface.	Description of the components of an expert system: knowledge base, inference engine, user interface.
Identification of the categories of expert system: planning, advice, classification, diagnosis. *Classification of example expert systems into these categories.*	Correct classification and description of the domains and main characteristics of the following 'classical' expert systems: MYCIN, ONCOCIN, R1/XCON, INTERNIST, DENDRAL, PROSPECTOR, OPS5, STRIPS.

National Unit Specification: support notes (cont)

UNIT   Expert Systems (Higher)

Content Statements: Characteristics of expert systems	
Intermediate 2	Higher
Description of the main features of the knowledge base: contains facts and rules.	Description of the knowledge base as representing knowledge in a knowledge representation language (KRL).
Representation of knowledge as rules and factor tables.	Representation of knowledge in a range of knowledge representation forms, including forward and backward chaining rules, factor tables, decision trees. Transformation of knowledge between representations. Description of the advantages and limitations of each representation.
	Representation of simple statements using propositional (zero order) or predicate (1st order) logic.
Description of the main features of the inference engine: to determine the order in which rules are applied, and hence questions are asked. *Identification of inferencing methods: forward and backward chaining.* *Description of advantages and disadvantages of forward and backward chaining.*	Comparison of forward chaining and backward chaining inference engines. Description of the main characteristics of a forward chaining system: working memory; conflict set; conflict resolution. Explanation of why conflict resolution strategies are required. Explanation of how different conflict resolution strategies achieve the required effect, including rule ordering (first-come-first-served), recency, specificity/size ordering, refractoriness, data ordering, context limiting/setting a rule agenda. Description of the RETE algorithm for achieving conflict resolution.
	Representation of the degree of certainty of the data provided by the user, the degree of certainty inherent in the rules within the rule base, or the degree of certainty in the conclusion reached using certainty factors (as percentages or probabilities). Calculation of the certainty of a conclusion using the formula $CF_{conc} = CF_{rule} \times \min(CF_{cond1}, CF_{cond2}, \ldots)$.
Description of the main functions of the user interface: to ask questions and obtain answers from the user; to display advice; to justify questions and answers.	Explanation of how explanations are generated, using a rule tree.

UNIT Expert Systems (Higher)

Content Statements: Development, use and evaluation of expert systems	
Intermediate 2	Higher
Identification of the principal personnel in the development of an expert system. ♦ *domain expert* ♦ *knowledge engineer* ♦ *programmer* ♦ *user* *Identification of the stages of development of an expert system* ♦ *knowledge acquisition/elicitation* ♦ *knowledge representation* ♦ *system validation*	Description of the stages of development of an expert system, and the roles performed by personnel at each stage: ♦ knowledge acquisition/elicitation ♦ knowledge representation ♦ system validation Description of the sources of error which can occur at each stage of development, including expert's knowledge; mis-interpretation of expert knowledge; programming; inferencing; expert system advice beyond the 'limits of ignorance'.
Querying of the expert system to answer simple structured questions.	Querying of the expert system to answer more complex unstructured questions.
Testing of an expert system using a set of structured test cases.	Design of a set of structured test cases to thoroughly test an expert system.
Use of How and Why justification facilities.	
Evaluation of an expert system, in terms of: purpose (type of expert system, domain of expertise); range and coverage of rules; quality of user interface (structure/syntax/order of questions asked, presentation of conclusion; quality of explanation facilities).	Critical evaluation of an expert system, in terms of: purpose (type of expert system, domain of expertise); range and coverage of rules; quality of reasoning; quality of user interface (structure/syntax/order of questions asked, presentation of conclusion; quality of explanation facilities); correctness of conclusions; fitness for purpose.

Content Statements: Construction of a working expert system	
Intermediate 2	Higher
Description and demonstration of techniques of analysis, design, implementation, testing and evaluation of an expert system.	Description and demonstration of techniques of analysis, design, implementation, testing and evaluation of an expert system.
Derivation of suitable attribute-value pairs, from a short piece of structured text, not involving multi-valued attributes. *Representation of attribute-value pairs as a factor table and as a decision tree.*	Derivation of suitable attribute-value pairs, from an extended piece of unstructured text, involving some multi-valued attributes. Representation of attribute-value pairs as a factor table and as a decision tree.

National Unit Specification: support notes (cont)

UNIT   Expert Systems (Higher)

Derivation of structured rules involving multiple (up to three) conditions to represent knowledge. *Construction of forward or backward chaining rules (in pseudocode or appropriate KRL).* *Construction of a rule base of 5—-10 rules, leading to direct conclusions without rule chaining.*	Derivation of structured rules involving multiple (three or more) conditions to represent knowledge. Construction of forward and backward chaining rules (in pseudocode or appropriate KRL). Exemplification of parameterised rules which can provide multiple conclusions. Construction of a rule base of at least 15 rules, demonstrating chaining to a minimum of three levels.
Production of structured questions, including some multi-response.	Derivation of structured questions to extract necessary information from a user consultation in an efficient manner, without duplication.
Entry of rules into an expert system shell. *Debugging of rules to produce a working system.* *Testing of expert system using a given set of structured test cases.*	Entry of rules into an expert system shell. Debugging of rules to produce a working system. Design and use of a set of structured test cases to thoroughly test that the expert system produces correct results against the knowledge provided.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Candidates will require individual access to appropriate computer hardware and software throughout this Unit. In particular, candidates will require access to an expert system shell which will enable them to construct and test a working expert system. In addition to commercial software, there are a wide variety of free expert system shells available. However, centres should note that these are very often research vehicles and are provided 'as is', without support, and may be aimed at a university level audience. Nevertheless, some shells have active user groups which can provide useful backup.

Candidates will also benefit from the opportunity to consult and evaluate as wide a range as possible of expert systems, including both those which they have constructed themselves, and others made available to them.

Possible sources of software are easily available by searching on the world wide web.

The two Outcomes should be delivered in an integrated way. Appropriate practical activities, both computer and non-computer based, should be taught and used to illustrate and exemplify the knowledge and understanding required for Outcome 1.

Candidates who have completed the *Expert Systems* Unit at Intermediate 2 level should already have covered the content listed in the left-hand column of the content grids, but may well 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 students. However, the following times may be suggested as a rough guide:

National Unit Specification: support notes (cont)

UNIT   Expert Systems (Higher)

Expert systems in context	4 hours
Characteristics of expert systems	9 hours
Development, use and evaluation of expert systems	8 hours
Construction of a working expert system	15 hours

1½ hours should be set aside to:
- a) administer the Outcome 1 test
- b) 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 will normally be demonstrated in the context of a number of relatively small tasks. The task(s) will normally be undertaken by the candidate as part of 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 online help while completing the task(s).

To gain success in this Outcome, the candidate must demonstrate practical skills in the following contexts and at an appropriate level as context defined by the content statements (see Information Systems (Higher) Course Content):

- ♦ find solutions to given problems by consultation of expert systems for advice, classification, diagnosis, or planning
- ♦ structured testing and critical evaluation of an expert system
- ♦ representation of a limited domain of knowledge in a structured form
- ♦ construction of a working expert system given a limited domain of knowledge (involving at least 15 rules, some involving multiple conditions, and requiring chaining to at least three levels)

Hard copy evidence should be provided of the expert system constructed; note that this need not be formal documentation — hard copy of the rule base is sufficient.

An 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.

UNIT   Expert Systems (Higher)

The assessment of this Unit will require candidates to be familiar with, and able to correctly use in context, the following technical terms:

♦ *advice*	♦ first order (predicate) logic	♦ production rule
♦ certainty factor	♦ *forward/backward chaining*	♦ *query*
♦ *classification*	♦ *inference engine, inferencing*	♦ *question*
♦ *conclusion*	♦ *justification*	♦ recency
♦ conflict resolution	♦ *knowledge*	♦ refractoriness
♦ conflict set	♦ *knowledge acquisition/elicitation*	♦ RETE algorithm
♦ *consultation*	♦ *knowledge base/rule base*	♦ *rule*
♦ decision tree	♦ *knowledge engineer*	♦ specificity
♦ deductive database	♦ *knowledge representation*	♦ *type of expert system: advice; classification; diagnosis; planning*
♦ *domain*	♦ *knowledge representation language (KRL)*	♦ uncertainty
♦ *domain expert*		♦ *user*
♦ *expert system*		♦ *user interface*
♦ *expert system shell*		♦ *validation*
♦ expertise		♦ working memory
♦ *explanation: how, why*		♦ zero order (propositional) logic
♦ *factor table*		
♦ fire		

The terms which are shown in italics are those which are listed in the corresponding table for the Unit Specification for *Expert Systems* (Intermediate 2).

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).

National Unit Specification: general information

UNIT The Internet (Higher)

NUMBER DM4F 12

COURSE Information Systems (Higher)

SUMMARY

This Unit is designed to develop knowledge and understanding of the operating principles of the Internet, Internet services and web site design and provides an opportunity to apply this knowledge to solve practical problems through the use of contemporary hardware and software. It is designed as an option for candidates undertaking the Higher Information Systems Course but is also suitable for anyone wishing to extend and deepen their understanding of the Internet beyond Intermediate 2 level or those who have practical experience of using the Internet wishing to develop a secure understanding of the underlying technology.

OUTCOMES

1. Demonstrate knowledge and understanding of the Internet with regard to operating principles, services, resources and web site construction.
2. Demonstrate practical skills using contemporary hardware and software in the context of Internet web site construction.

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 The Internet Unit
♦ Intermediate 2 Information Systems
♦ Intermediate 2 Computing
♦ Standard Grade Computing Studies at Credit level

Administrative Information

Superclass: CB

Publication date: August 2005

Source: Scottish Qualifications Authority

Version: 01

National Unit Specification: general information (cont)

CREDIT VALUE

1 credit at Higher (6 SCQF 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

Information on the automatic certification of any Core Skills in this Unit is published in *Automatic Certification of Core Skills in National Qualifications* (SQA, publication code BA0906).

National Unit Specification: statement of standards

UNIT   The Internet (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 the Internet with regard to operating principles, services, resources and web site construction.

Performance Criteria
a) Terminology is used appropriately.
b) Technically accurate 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 operating principles, services, and resources of the Internet and appropriate aspects of Internet web site construction accurately and concisely. Evidence should be obtained using questions in a closed book test, under supervision, lasting no more than 45 minutes. The test must sample the content (see Information Systems (Higher) Course Content) in each of the following areas:

♦   Internet fundamentals
♦   services and resources provided by the Internet
♦   Internet developments
♦   construction of Internet web site

(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.

OUTCOME 2
Demonstrate practical skills using contemporary hardware and software in the context of Internet web site construction.

Performance Criteria
a) A range of appropriate features of 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.

National Unit Specification: statement of standards (cont)

UNIT   The Internet (Higher)

Evidence requirements

Observation checklist showing that the candidate has demonstrated practical skills at an appropriate level in each of the following contexts:

♦   use of HTML coding (including layout tables) in web page design
♦   use of client side scripting in web page design
♦   use of a cascading style sheet in web site design
♦   creation of web pages forming multi-page web site with links to other pages on same site

Hard copy evidence should be provided demonstrating two of these skills.

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

The practical skills should be demonstrated in the context defined in the content statements (see Information Systems (Higher) Course Content).

The candidate will be allowed access to books, notes and on-line help while completing the task(s).

(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   The Internet (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 level, and are included here to clarify the context for the new learning for this Unit. They indicate the prior learning expected of the candidate before undertaking new learning within this Unit. Content in the right-hand column is the new content for this Unit.

Content Statements: Internet Fundamentals	
Intermediate 2	Higher
Description and explanation of the following concepts in relation to Internet operation and usage: ♦ *Internet hosting* ♦ *packets* ♦ *TCP/IP* ♦ *IP Addresses* ♦ *routing* ♦ *bandwith* ♦ *hardware components (router, switch, multiplexer)* ♦ *physical structure and topology of the Internet*	Explanations of the following technical concepts in relation to Internet operation and usage: ♦ packet switching ♦ the role of routers and routing tables in forwarding data packets ♦ Uniform Resource Locator structure (protocol, domain name, path, file identifier, additional parameter/port) ♦ IP address structure and classification (class A, B, C) ♦ gateway address ♦ sub-net mask
Description of the need for protocols. *Description of the purpose of the following protocols:* ♦ *http* ♦ *FTP* ♦ *POP/SMTP*	Description of the purpose and the use of the following Internet protocols: ♦ TCP/IP (Transmission Control Protocol/Internet Protocol) ♦ DNS (Domain Name Server) Protocol ♦ TELNET terminal emulation protocol Explanation of the reasons for the continued revision of some protocols.
	Description of the function of the following organisations: ♦ The Internet Engineering Task Force (IETF) ♦ Internet Assigned Numbers Authority (IANA) ♦ The World Wide Web Consortium (W3C) ♦ Domain name registrars (including Nominet in the UK)

National Unit Specification: support notes (cont)

UNIT   The Internet (Higher)

Intermediate 2	Higher
Description and explanation of the social, ethical and legal implications of the internet including effects on: family, employment and information rich and poor. *Explanation of issues related to censorship and privacy.*	Description of the main features and purposes of current national and policing policies relating to the Internet: ♦ Data Protection Act (web servers and guest books) ♦ Computer Misuse Act (viruses, hacking, file copying) ♦ need for international agreements ♦ need for international policing of the Internet

Content Statements: Services and resources provided by the Internet	
Intermediate 2	Higher
Description of the main features of the following Internet services and resources, or contemporary replacements. ♦ *World Wide Web (WWW)* ♦ *email (web and client based)* ♦ *conferencing and newsgroups* ♦ *file transfer and file updating* ♦ *chat/instant messaging* *Exemplification of uses of these services in business, educational and personal contexts.*	Description of features and uses of a range of Internet resources including academic, commercial and personal web pages. Assessment of web resource information for accuracy, bias and credibility.
Description and effective use of internet browser (including navigation, search and save facilities).	Description of the capabilities of browsers (including HTML interpretation, client side scripting, cookie functions and built in encryption functions).
Description and effective use of search engines, including Boolean searching. *Description of main features and uses of a range of Internet advanced search services.* *Explanation of the need for and use of virus protection, including the need for regular updating of virus protection software.*	Description of the security and privacy issues relating to: ♦ encryption ♦ key distribution ♦ PGP and RSA ♦ public and private keys ♦ secure sockets ♦ proxy servers ♦ firewalls ♦ site usage tracking

UNIT   The Internet (Higher)

Content Statements: Internet developments	
Intermediate 2	Higher
Description of current trends in Internet development with regard to the influence of the following on system performance: ♦ *communications hardware* ♦ *browsing software* ♦ *security software*	Description of contemporary technical developments related to Internet usage and operation including: ♦ web based databases ♦ dynamic page design

Content Statements: Construction of Internet web page	
Description of the main features of web authoring packages: ♦ *icon based* ♦ *web tools* ♦ *scripting tools* ♦ *hyperlinks* ♦ *file structure*	Description of the use of web authoring packages in web page design (including page layout design and uploading of pages). Comparison of the use of web authoring packages and direct HTML coding.
Description and exemplification of: ♦ *absolute page addressing* ♦ *relative page addressing* ♦ *picture compression* *Explanation of:* ♦ *problems associated with absolute addressing* ♦ *the need for picture compression*	Description and exemplification of HTML coding skills including the attributes of the following common tags: ♦ <meta> ♦ the NAME and HREF (including mailto) attributes of the<A>element ♦ <head>, <body>, <div>, <title>, <table>, <tr>, <td>, <hl –h6>, <p>, , <font>, <img>, <span> Description and exemplification of: ♦ cascading style sheets ♦ client side scripting (including form validation and alerts) Description of the use of server side scripting and php.
	Description and identification of the characteristics of site design with reference to: ♦ page structure and layout ♦ uniformity of presentation (including use of style sheets, server-side scripting, dynamic pages) ♦ download efficiency ♦ browser compatibility issues
Description and exemplification of the creation of web page with links to other pages on same site.	Description and exemplification of the creation of a multi-paged web site.

National Unit Specification: support notes (cont)

UNIT The Internet (Higher)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Candidates will require individual access to appropriate computer hardware and software throughout this Unit.

The two Outcomes should be delivered in an integrated way. Appropriate practical activities should be taught and used to illustrate and exemplify the knowledge and understanding required for Outcome 1. These practical activities can be used to generate evidence for Outcome 2.

Candidates who have completed *The Internet* Unit at Intermediate 2 level should already have covered the content listed in the left-hand column of the content grids, but may well 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 are suggested as a rough guide:

Internet fundamentals	12 hours
Services and resources provided by the Internet	8 hours
Internet developments	4 hours
Construction of Internet web site	12 hours

1½ hours should be set aside to:
    a)   administer the Outcome 1 test
    b)   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.

National Unit Specification: support notes (cont)

UNIT   The Internet (Higher)

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 will normally be demonstrated in the context of a number of relatively small tasks. The skills will normally be demonstrated by the candidate as part of 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 online help while completing the task(s). The practical skills should be demonstrated in the context defined in the content statements (see Information Systems (Higher) Course Content).

To gain success in this Outcome, the candidate must demonstrate practical skills at an appropriate level in each of the following contexts, defined in the content statements (see Information Systems (Higher) Course content):

♦   use of HTML coding (including layout tables) in web page design
♦   use of client side scripting in web page design
♦   use of a cascading style sheet in web site design
♦   creation of web pages forming multi-page web site with links to other pages on same site

Hard copy evidence should be provided demonstrating two of these skills. Note that this need not be formal documentation — print outs and screen shots showing appropriate activities are adequate — and that one hardcopy might show evidence of more than one skill.

An 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).