

Edexcel Level 4 BTEC Higher Nationals in Computing

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This specification is Issue 3 and is valid for examination from June 2003. Key changes to requirements are sidelined. Centres will be informed in the event of any necessary future changes to this specification. The latest issue can be found on the Edexcel website, www.edexcel.org.uk

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EDEXCEL LEVEL 4 BTEC HIGHER NATIONALS IN COMPUTING

BTEC Higher National Certificate in Computing (General)

BTEC Higher National Certificate in Computing (ICT Systems Support)

BTEC Higher National Certificate in Computing (Software Development)

BTEC Higher National Diploma in Computing (General)

BTEC Higher National Diploma in Computing (ICT Systems Support)

BTEC Higher National Diploma in Computing (Software Development)

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Qualification titles covered by this specification

Edexcel Level 4 BTEC Higher National Certificate in Computing (General)

Edexcel Level 4 BTEC Higher National Certificate in Computing (ICT Systems Support)

Edexcel Level 4 BTEC Higher National Certificate in Computing (Software Development)

Edexcel Level 4 BTEC Higher National Diploma in Computing (General)

Edexcel Level 4 BTEC Higher National Diploma in Computing (ICT Systems Support)

Edexcel Level 4 BTEC Higher National Diploma in Computing (Software Development)

These qualifications have been accredited to the National Qualifications Framework (NQF).
The NQF (QAN) codes for these qualifications are listed in *Annex A*.

These qualification titles are as they will appear on the learner's certificate. Learners need to be made aware of this when they are recruited by the centre and registered with Edexcel. Providing this happens, centres are able to describe the programme of study leading to the award of the qualification in different ways to suit the medium and the target audience.



Edexcel qualifications in the National Qualifications Framework

NQF level

5

BTEC Professional Award, Certificate, Diploma		Key skills level 5		NVQ level 5
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4

BTEC Higher National Diploma BTEC Higher National Certificate		Key skills level 4		NVQ level 4
BTEC Professional Award, Certificate, Diploma				

3

BTEC National Diploma BTEC National Certificate BTEC National Award		Key skills level 3	GCE A Level GCE AS Level VCE AEA	NVQ level 3
BTEC Diploma in Foundation Studies (Art and Design)				
BTEC Award, Certificate, Diploma				

2

BTEC First Diploma	Level 2 Certificate in Adult Numeracy	Key skills level 2	GCSE (A*–C) GCSE (Double Awards) (A* A*–CC) GCSE (Short Courses) (A*–C) Intermediate GNVQ	NVQ level 2
BTEC Award, Certificate, Diploma	Level 2 Certificate in Adult Literacy			

1

BTEC Introductory Certificate BTEC Introductory Diploma	Level 1 Certificate in Adult Numeracy	Key skills level 1	GCSE (D–G) GCSE (Double Awards) (DD–GG) GCSE (Short Courses) (D–G) Foundation GNVQ	NVQ level 1
BTEC Award, Certificate, Diploma	Level 1 Certificate in Adult Literacy			

ENTRY

Entry Level Certificate in Skills for Working Life Entry Level Certificate in Personal Skills	Entry Level Certificate in Adult Numeracy Entry Level Certificate in Adult Literacy		Entry Level Certificates	
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Introduction

This document contains the units and associated guidance for the National Qualifications Framework (NQF) Edexcel Level 4 BTEC Higher Nationals in Computing. Each unit sets out the required outcomes and content and includes advice regarding appropriate delivery and assessment strategies. The guidance contains further details of the teaching, learning, assessment and quality assurance of these qualifications. It includes advice about Edexcel's policy regarding access to its qualifications, the design of programmes of study and delivery modes.

Structure of the qualification

BTEC Higher National Certificate

The BTEC Higher National Certificates in Computing are 10-unit qualifications of which four are core units and two are specialist units block A. The remaining four units must be taken from the list of specialist units block B.

The BTEC Higher National Certificate programme must contain a minimum of five units designated at H2 level.

BTEC Higher National Diploma

The BTEC Higher National Diplomas in Computing are 16-unit qualifications of which six are core units and two are specialist units block A. The remaining eight units must be taken from the list of specialist units block B.

The BTEC Higher National Diploma programme must contain a minimum of eight units designated at H2 level.

Structure of Edexcel Level 4 BTEC HN Certificate in Computing (General)

Unit no	Core units — all four units must be taken	Unit level H1 or H2
1	Computer Platforms	H1
2	Systems Analysis	H2
3	Programming Concepts	H1
4	Database Design Concepts	H1
Specialist units block A — both must be taken		
8	Information Systems Project	H2
16	Information Systems	H2
Specialist units block B — choose four units		
7	Quality Systems	H2
5	Networking Concepts	H1
6	Personal Skills Development	H1
11	Financial Systems	H1
12	Networking Technology	H2
13	Data Analysis and Design	H2
14	Management in IT	H1
15	End-User Support	H1
17	MS Office Solution Development #	H2
18	Multimedia Design and Authoring	H1
19	Website Design	H1
20	Internet Server Management #	H2
21	Work Experience	H1
22	Human Computer Interface	H1
23	Project Management	H2
24	e-Business Strategy	H2
25	e-Business Development	H1
26	e-Business Technology	H1
27	e-Business Project	H2
28	Professional Development	H1
29	Knowledge Systems	H2
42	Visual Programming	H2

unit is mapped to the Microsoft Official Curriculum.

The BTEC Higher National Certificate programme must contain a minimum of five units designated at H2 level.

Structure of Edexcel Level 4 BTEC HN Certificate in Computing (ICT Systems Support)

Unit no	Core units — all four units must be taken	Unit level H1 or H2
1	Computer Platforms	H1
2	Systems Analysis	H2
3	Programming Concepts	H1
4	Database Design Concepts	H1
Specialist units block A — both must be taken		
9	Networking Project	H2
12	Networking Technology	H2
Specialist units block B — choose four units		
7	Quality Systems	H2
5	Networking Concepts	H1
6	Personal Skills Development	H1
13	Data Analysis and Design	H2
14	Management in IT	H1
15	End-User Support	H1
20	Internet Server Management #	H2
21	Work Experience	H1
23	Project Management	H2
24	e-Business Strategy	H2
28	Professional Development	H1
29	Knowledge Systems	H2
31	Networking Infrastructure #	H2
33	Formal Methods	H2
34	Supporting NOS and OS	H2

unit is mapped to the Microsoft Official Curriculum.

The BTEC Higher National Certificate programme must contain a minimum of five units designated at H2 level.

Structure of Edexcel Level 4 BTEC HN Certificate in Computing (Software Development)

Unit no	Core units — all four units must be taken	Unit level H1 or H2
1	Computer Platforms	H1
2	Systems Analysis	H2
3	Programming Concepts	H1
4	Database Design Concepts	H1
Specialist units block A — both must be taken		
10	Software Development Project	H2
42	Visual Programming	H2
Specialist units block B — choose four units		
7	Quality Systems	H2
6	Personal Skills Development	H1
13	Data Analysis and Design	H2
14	Management in IT	H1
15	End-User Support	H1
17	MS Office Solution Development #	H2
19	Website Design	H1
21	Work Experience	H1
22	Human Computer Interface	H1
23	Project Management	H2
28	Professional Development	H1
29	Knowledge Systems	H2
30	Java Programming	H1
32	Maths for Software Development	H1
33	Formal Methods	H2
35	Distributed Design and Development #	H2
36	OOP Programming	H1
37	VB Enterprise Development #	H2
38	Visual Programming Development #	H2
39	Visual Programming Fundamentals #	H1
40	Software Testing	H1
41	Data Structures and Algorithms	H2

unit is mapped to the Microsoft Official Curriculum.

The BTEC Higher National Certificate programme must contain a minimum of five units designated at H2 level.

Structure of Edexcel Level 4 BTEC HN Diploma in Computing (General)

Unit no	Core units — all six units must be taken	Unit level H1 or H2
1	Computer Platforms	H1
2	Systems Analysis	H2
3	Programming Concepts	H1
4	Database Design Concepts	H1
5	Networking Concepts	H1
6	Personal Skills Development	H1
Specialist units block A — both must be taken		
8	Information Systems Project	H2
16	Information Systems	H2
Specialist units block B — choose eight units		
7	Quality Systems	H2
11	Financial Systems	H1
12	Networking Technology	H2
13	Data Analysis and Design	H2
14	Management in IT	H1
15	End-User Support	H1
17	MS Office Solution Development #	H2
18	Multimedia Design and Authoring	H1
19	Website Design	H1
20	Internet Server Management #	H2
21	Work Experience	H1
22	Human Computer Interface	H1
23	Project Management	H2
24	e-Business Strategy	H2
25	e-Business Development	H1
26	e-Business Technology	H1
27	e-Business Project	H2
28	Professional Development	H1
29	Knowledge Systems	H2
42	Visual Programming	H2

unit is mapped to the Microsoft Official Curriculum.

The BTEC Higher National Diploma programme must contain a minimum of eight units designated at H2 level.

Structure of Edexcel Level 4 BTEC HN Diploma in Computing (ICT Systems Support)

Unit no	Core units — all six units must be taken	Unit level H1 or H2
1	Computer Platforms	H1
2	Systems Analysis	H2
3	Programming Concepts	H1
4	Database Design Concepts	H1
5	Networking Concepts	H1
6	Personal Skills Development	H1
Specialist units block A — both must be taken		
9	Networking Project	H2
12	Networking Technology	H2
Specialist units block B — choose eight units		
7	Quality Systems	H2
13	Data Analysis and Design	H2
14	Management in IT	H1
15	End-User Support	H1
20	Internet Server Management #	H2
21	Work Experience	H1
23	Project Management	H2
24	e-Business Strategy	H2
28	Professional Development	H1
29	Knowledge Systems	H2
31	Networking Infrastructure #	H2
33	Formal Methods	H2
34	Supporting NOS and OS	H2

unit is mapped to the Microsoft Official Curriculum.

The BTEC Higher National Diploma programme must contain a minimum of eight units designated at H2 level.

Structure of Edexcel Level 4 BTEC HN Diploma in Computing (Software Development)

Unit no	Core units — all six units must be taken	Unit level H1 or H2
1	Computer Platforms	H1
2	Systems Analysis	H2
3	Programming Concepts	H1
4	Database Design Concepts	H1
5	Networking Concepts	H1
6	Personal Skills Development	H1
Specialist units block A — both must be taken		
10	Software Development Project	H2
42	Visual Programming	H2
Specialist units block B — choose eight units		
7	Quality Systems	H2
13	Data Analysis and Design	H2
14	Management in IT	H1
15	End-User Support	H1
17	MS Office Solution Development #	H2
19	Website Design	H1
21	Work Experience	H1
22	Human Computer Interface	H1
23	Project Management	H2
28	Professional Development	H1
29	Knowledge Systems	H2
30	Java Programming	H1
32	Maths for Software Development	H1
33	Formal Methods	H2
35	Distributed Design and Development #	H2
36	OOP Programming	H1
37	VB Enterprise Development #	H2
38	Visual Programming Development #	H2
39	Visual Programming Fundamentals #	H1
40	Software Testing	H1
41	Data Structures and Algorithms	H2

unit is mapped to the Microsoft Official Curriculum.

Key features

BTEC Higher Nationals are designed to provide a specialist vocational programme, linked to professional body requirements and National Occupational Standards where appropriate, with a strong work related emphasis. The qualifications provide a thorough grounding in the key concepts and practical skills required in their sector and their national recognition by employers allows progression direct into employment. BTEC Higher Nationals offer a strong emphasis on practical skills development alongside the development of requisite knowledge and understanding in their sector. Learners are attracted to this strong vocational programme of study that meets their individual progression needs whether this is into employment or to further study on degree or professional courses.

A key progression path for BTEC Higher National Certificate and Diploma learners is to the professional qualifications offered by the British Computer Society (www1.bcs.org.uk)

The BTEC Higher National Certificate and Diploma also offer a progression route to the second or third year of a degree or honours degree programme, depending on the match of the BTEC Higher National units to the degree programme in question.

The BTEC Higher Nationals in Computing have been developed to focus on:

- providing education and training for a range of careers in computing
- providing opportunities for facilities managers to achieve a nationally recognised Level 4 vocationally specific qualification
- providing opportunities for full-time learners to gain a nationally recognised, vocationally specific qualification to enter employment in computing or to progress to higher education vocational qualifications such as a full-time degree in computing or a related area
- developing the knowledge, understanding and skills of learners in the field of computing
- providing opportunities for learners to focus on the development of higher-level skills in a computing context
- providing opportunities for learners to develop a range of skills and techniques and attributes essential for successful performance in working life.

This qualification meets the needs of the above rationale by:

- equipping individuals with knowledge, understanding and skills for success in employment in the computing industry
- enabling progression to an undergraduate degree or further professional qualification in computing or a related area
- providing opportunities for specialist study relevant to individual vocations and contexts
- supporting individuals employed or entering employment in the computing industry
- developing the individual's ability in the computing industry through effective use and combination of the knowledge and skills gained in different parts of the programme
- developing a range of skills and techniques, personal qualities and attributes essential for successful performance in working life and thereby enabling learners to make an immediate contribution to employment
- providing flexibility, knowledge, skills and motivation as a basis for future studies and career development in computing.

Professional body recognition

The BTEC Higher Nationals in Computing have been developed with career progression and recognition by professional bodies in mind. It is essential that learners gain the maximum benefit from their programme of study.

Further details of professional body recognition and exemptions for BTEC Higher Nationals are contained in the publication *BTEC Professional Recognition* which is available on Edexcel's website (www.edexcel.org.uk).

National Occupational Standards

BTEC Higher Nationals in Computing are designed to relate to the National Occupational Standards in the IT and Computing sector at Level 4, which in turn form the basis of the IT National Vocational Qualifications (NVQs). BTEC Higher Nationals do not purport to deliver occupational competence in the sector, which should be demonstrated in a work context. However, the qualifications provide underpinning knowledge for the National Occupational Standards, as well as developing practical skills in preparation for work and possible achievement of NVQs in due course.

Links to National Occupational Standards are indicated in *Annex B*.

Through the study of core and relevant specialist units learners will cover much of the underpinning knowledge, skills and understanding for NVQ level 4 units in IT Development and NVQ level 4 in IT Management. The Occupational Standards for IT are currently being revised and it was felt that mapping to the Skills Framework for the Information Age (SFIA) was more appropriate at this level.

The mapping to SFIA is outlined in *Annex B*.

Qualification requirement

Edexcel has published Qualification Requirements as part of the revision of BTEC Higher Nationals. Qualification Requirements set out the aims and rationale of the qualifications and provide the framework of curriculum content. They also identify the higher-level skills associated with the qualifications and any recognition by relevant professional bodies. The Qualification Requirement for BTEC Higher Nationals Computing is given in *Annex B*.

Edexcel standard specifications titles are developed from the Qualification Requirements. Licensed centres comply with Qualification Requirements when developing BTEC Higher Nationals under these standard titles.

Qualification Requirements provide consistent standards within the same vocational area and clearly identify the skills and knowledge that can be expected of any holder of an identical BTEC Higher National. This will allow higher education institutions, employers and professional bodies to confidently provide progression opportunities to successful learners.

Higher-level skills

Learners studying for BTEC Higher Nationals in Computing will be expected to develop the following skills during the programme of study:

- synthesis of a range of concepts, knowledge and skills relating to computing
- application of complex theories to practical realistic work situations in the computing sector
- independence of approach to study and the generation of computing evidence

- ability to engage with complex and/or unpredictable situations in computing contexts
- ability to take responsibility to manage and direct their own and others' activities
- insight and judgement in relation to the margins and consequences of error
- research and investigative skills
- responsiveness to change and ability to multi-task
- ability to innovate and work in a creative way.

BTEC Higher National Certificate

The 10-unit BTEC Higher National Certificate in Computing provides a specialist work-related programme of study that covers the key knowledge, understanding and practical skills required in the computing sector and also offers particular specialist emphasis through the choice of specialist units.

BTEC Higher National Certificates provide a nationally recognised qualification that offers career progression and professional development for those already in employment and opportunities to progress into higher education. The qualifications are mode-free but they are primarily undertaken by part-time learners studying over two years. In some sectors there are opportunities for those wishing to complete an intensive programme of study in a shorter period of time.

The qualification offers an engaging programme for higher education learners who are clear about the area of employment that they wish to enter. Their access to suitable IT and computing work situations may allow learners to achieve an NVQ qualification in Management or individual Management NVQ units.

This specification provides centres with a framework to develop engaging programmes for higher-education learners who are clear about the area of employment that they wish to enter.

The BTEC Higher National Certificate in Computing mainly offers a progression route for learners who are employed in the IT and computing sectors.

Learners studying on the BTEC Higher National Certificate will be able to progress to the workplace or to a Higher National Diploma or a degree programme. The endorsed titles of General, ICT Systems Support and Software Development have been designed to enable learners to choose a particular specialist route and reflects the main areas of activity in the IT and Computing sectors. The SFIA mapping in Annex B can guide you in the type of roles available in the industry.

BTEC Higher National Diploma

The 16-unit BTEC Higher National Diploma provides greater breadth and specialisation than the BTEC Higher National Certificate. Higher National Diplomas are mode free but are followed predominately by full-time learners. They allow progression into or within employment in the computer sector, either directly on achieving of the award or following further study to degree level.

The BTEC Higher National Diploma in Computing provides opportunities for learners to apply their knowledge and practical skills in the workplace. Full-time learners have the opportunity to do this through formal work placements or their part-time employment experience.

The qualification prepares learners for employment in the computing sector and will be suitable for learners who have already decided that they wish to enter this area of work. Some adult learners may wish to make the commitment required by this qualification in order to enter a specialist area of employment in computing or progress into higher education. Other learners may want to extend the specialism that they followed on the BTEC Higher National Certificate programme. Progression from this qualification may well be into or within employment in the IT and computing sector where learners may work towards membership or study for professional body exams, such as the British Computer Society exams.

Learners studying on the BTEC Higher National Diploma will be able to progress to a number of roles in the IT and computing sectors. General specialist can enter system management, while ICT System Support specialists can install or manage IT networks. Learners following the Software Development endorsed title can enter the many jobs available in this area. The SFIA mapping in Annex B can guide you in the type of roles and job categories available. The BTEC Higher National Diploma will also enable learners to progress on to further study such as a degree or a Professional Development Qualification or vendor qualifications offered by Cisco and Microsoft.

Teaching, learning and assessment

Learners must pass all 10 units on their programme of learning to be awarded a BTEC Higher National Certificate and all 16 units to be awarded a BTEC Higher National Diploma.

The assessment of BTEC Higher National qualifications is criterion-referenced and centres are required to assess learners' evidence against published learning outcomes and assessment criteria. All units will be individually graded as 'pass', 'merit' or 'distinction'. To achieve a pass grade for the unit learners must meet the assessment criteria set out in the specifications. This gives transparency to the assessment process and provides for the establishment of national standards for each qualification.

The units in BTEC Higher National qualifications all have a standard format which is designed to provide clear guidance on the requirements of the qualification for learners, assessors and those responsible for monitoring national standards.

Unit format

Each unit is set out in the following way.

Unit title, learning hours and NQF level

The unit title is accredited by QCA and this form of words will appear on the learner's Notification of Performance. In BTEC Higher National qualifications each unit consists of 60 guided learning hours.

Each unit is assigned a notional level indicator of H1 or H2, indicating the relative intellectual demand, complexity and depth of study, and learner autonomy.

At **H1 level** the emphasis is on the application of knowledge, skills and understanding, use of conventions in the field of study, use of analytical skills and selection and organisation of information.

At **H2 level** the emphasis is on application and evaluation of contrasting ideas, principles, theories and practices, greater specialisation in the field of study, and an increasing independence in systematic enquiry and analysis.

Description of unit

A brief description of the overall purpose of the unit is given, together with the key areas of study associated with the unit.

Summary of learning outcomes

The outcomes of the unit identify what each learner must do in order to pass it. Learners must achieve all the outcomes in order to pass the unit.

Content

This section picks up highlighted words from the outcomes and amplifies the content coverage required when addressing the outcomes. The content section will often provide lists of topics. Please note all aspects of the listed topics should be covered, except those that begin with 'eg', where items listed are merely indicative.

Outcomes and assessment criteria

Each unit contains statements of the evidence that each learner should produce in order to receive a pass.

Guidance

This section is not prescriptive but provides additional guidance and amplification related to the unit to support teachers/deliverers and assessors. Its subsections are given below. Only those subsections which apply to the unit will appear.

- *Delivery* — offers guidance about possible approaches to delivery. The guidance is based on the more usual delivery modes and is not intended to rule out alternative approaches.
- *Assessment* — provides advice about the nature and type of evidence that learners are likely to need to produce. This subsection should be read in conjunction with the assessment criteria and the generic grade descriptors.
- *Links* — sets out the links between units. Provides opportunities for integration of learning, delivery and assessment. Any links to the National Occupational Standards will be highlighted here.
- *Resources* — identifies the specialist resources likely to be needed to allow learners to generate the evidence required by each unit. The centre will be asked to ensure that this resource requirement is in place when it seeks approval from Edexcel to offer the qualification.
- *Support materials* — identifies, where appropriate, textbooks, videos, magazines, journals, publications and websites that may support the delivery of the unit.

Learning and assessment

The purpose of assessment is to ensure that effective learning of the content of each unit has taken place. Evidence of this learning, or the application of the learning etc, is required for each unit. The assessment of the evidence relates directly to the assessment criteria for each unit, supported by the generic grade descriptors.

The process of assessment can aid effective learning by seeking and interpreting evidence to decide the stage that learners have reached in their learning, what further learning needs to take place and how best to do this. Therefore, the process of assessment should be part of the effective planning of teaching and learning by providing opportunities for both the learner and assessor to obtain information about progress towards learning goals. The assessor and learner must be actively engaged in promoting a common understanding of the assessment criteria and the grade descriptors (what it is they are trying to achieve and how well they achieve it) for further learning to take place. Therefore, learners need constructive feedback and guidance

about how to improve, capitalising on strengths, with clear and constructive comments about weaknesses and how these might be addressed.

Assessment instruments are constructed by centres. Assessment instruments should collectively ensure coverage of all assessment criteria within each unit and should provide opportunities for the evidencing of all the grade descriptors. It is advised that assessment criteria and contextualised grade descriptors are clearly indicated on each assessment instrument to provide a focus for learners (for transparency and to ensure that feedback is specific to the criteria) and to assist with internal standardisation processes. Tasks/activities should enable learners to produce evidence that relates directly to the assessment criteria and grade descriptors.

When centres are designing assessment instruments, they need to ensure that the instruments are valid, reliable and fit for purpose, building on the application of the assessment criteria. Centres are encouraged to place emphasis on practical application of the assessment criteria, providing a realistic scenario for learners to adopt, making maximum use of work-related practical experience and reflecting typical practice in the sector concerned. The creation of assessment instruments that are fit for purpose is vital to achievement and their importance cannot be over-emphasised.

Grading Higher National units

The assessment of BTEC Higher National qualifications will be at unit level and there will be no overall grade for either the Certificate or the Diploma. This means that learners are able to access the qualification through a unitised approach.

Each unit will be graded as a pass, merit or distinction. A pass is awarded for the achievement of all outcomes against the specified assessment criteria. Merit and distinction grades are awarded for higher-level achievement.

The generic merit and distinction grade descriptors listed on pages 16–17 are for grading the total evidence produced for each unit and describe the learner's performance over and above that for a pass grade.

The merit and distinction grade descriptors can be achieved in a flexible way, eg in a sequential or holistic mode, to reflect the nature of the sector concerned.

Each of the generic merit and distinction grade descriptors can be amplified by use of **indicative characteristics**. These give a guide to the expected learner performance, and support the generic grade descriptors. The indicative characteristics should reflect the nature of a unit and the context of the sector programme.

The indicative characteristics shown in the table for each of the generic grade descriptors are not exhaustive. Consequently, centres should select from the list or may construct other appropriate indicative characteristics for their sector programme which may be drawn from the appropriate higher-level skills. It is important to note that each assessment activity does not need to incorporate all the merit and/or distinction grade descriptors.

Contextualising the generic grade descriptors

The generic merit and distinction grade descriptors need to be viewed as a qualitative extension of the assessment criteria for pass within each individual unit. The relevant generic grade descriptors must be identified and specified within an assignment and the relevant indicative characteristics should be used to place the required evidence in context.

Grade descriptors

Pass grade

A **pass grade** is achieved by meeting all the requirements defined in the assessment criteria for pass for each unit.

Merit grade

Merit descriptors	Indicative characteristics
In order to achieve a merit the learner must:	The learner's evidence shows:
<ul style="list-style-type: none"> identify and apply strategies to find appropriate solutions 	<ul style="list-style-type: none"> effective judgements have been made complex problems with more than one variable have been explored an effective approach to study and research has been applied
<ul style="list-style-type: none"> select/design and apply appropriate methods/techniques 	<ul style="list-style-type: none"> relevant theories and techniques have been applied a range of methods and techniques have been applied a range of sources of information has been used the selection of methods and techniques/sources has been justified the design of methods/techniques has been justified complex information/data has been synthesised and processed appropriate learning methods/techniques have been applied
<ul style="list-style-type: none"> present and communicate appropriate findings 	<ul style="list-style-type: none"> the appropriate structure and approach has been used coherent, logical development of principles/concepts for the intended audience a range of methods of presentation have been used and technical language has been accurately used communication has taken place in familiar and unfamiliar contexts the communication is appropriate for familiar and unfamiliar audiences and appropriate media have been used

Distinction grade

Distinction descriptors	Indicative characteristics
In order to achieve a distinction the learner must:	The learner's evidence shows:
<ul style="list-style-type: none"> • use critical reflection to evaluate own work and justify valid conclusions 	<ul style="list-style-type: none"> • conclusions have been arrived at through synthesis of ideas and have been justified • the validity of results has been evaluated using defined criteria • self-criticism of approach has taken place • realistic improvements have been proposed against defined characteristics for success
<ul style="list-style-type: none"> • take responsibility for managing and organising activities 	<ul style="list-style-type: none"> • autonomy/independence has been demonstrated • substantial activities, projects or investigations have been planned, managed and organised • activities have been managed • the unforeseen has been accommodated • the importance of interdependence has been recognised and achieved
<ul style="list-style-type: none"> • demonstrate convergent/lateral/creative thinking 	<ul style="list-style-type: none"> • ideas have been generated and decisions taken • self-evaluation has taken place • convergent and lateral thinking have been applied • problems have been solved • innovation and creative thought have been applied • receptiveness to new ideas is evident • effective thinking has taken place in unfamiliar contexts

Accreditation of Prior Learning (APL)

Edexcel encourages centres to recognise learners' previous achievements and experience through the Accreditation of Prior Learning. Learners may have evidence that has been generated during previous study, in their previous or current employment or whilst undertaking voluntary work that relates to one or more of the units in the qualification. Assessors should assess this evidence against the Higher National standards in the specifications in the normal way. As with all evidence, assessors should be satisfied about the authenticity and currency of the material when considering whether or not the outcomes of the unit have been met.

Full guidance about Edexcel's policy on APL is provided on our website (www.edexcel.org.uk).

Quality assurance of BTEC Higher Nationals

The quality assurance system for BTEC Higher National qualifications, as higher-level vocational qualifications at Level 4 on the NQF, will comprise three main components.

- **approval process** — a control measure to confirm that individual centres (and programme teams) are appropriately resourced and competent to deliver a BTEC Level 4 programme of study.
- **monitoring of centres** — a method of monitoring centres' internal quality systems to ensure ongoing fulfilment of initial requirements and, where appropriate, enhancement of those requirements to accommodate new qualifications.
- **independent assessment** — a measure that provides independence within the assessment process, so that the certificated outcomes for each learner are not reliant on determinations by individuals or groups with a vested interest in the outcome. This measure should be consistent and reliable over time, and should not create unnecessary barriers.

Centre and programme approval

Approval to offer BTEC Higher National qualifications will vary depending on the status of the centre. Centres that have a recent history of delivering BTEC Higher National qualifications and have an acceptable quality profile in relation to their delivery will be able to gain approval through an accelerated process. Centres that are new to the delivery of BTEC Higher National qualifications will be required to submit evidence to demonstrate that they:

- have the human and physical resources required for effective delivery and assessment
- understand the implications for independent assessment and agree to abide by these
- have a robust internal assessment system supported by 'fit for purpose' assessment documentation
- have a system to internally verify assessment decisions to ensure standardised assessment decisions are made across all assessors and sites.

Such applications have to be supported by the head of the centre (principal, chief executive, etc).

We communicate all approvals in writing to the head of centre in the form of a qualification approval letter. The approval letter will also contain a programme definition for each qualification approved. The programme definition clearly states to the centre all units that comprise the qualification for which the centre is approved.

Monitoring centres' internal quality systems

Centres will be expected to demonstrate ongoing fulfilment of approval criteria across all programme areas. This should include the consistent application of policies affecting learner registrations and appeals, together with the effectiveness of internal examination and standardisation processes.

Centres may opt for a review of their provision under the quality verifier/quality reviewer arrangements, which already apply to all further education centres. Alternatively, centres may present evidence of their operation within a recognised code of practice, such as that of the Quality Assurance Agency for Higher Education. Edexcel reserves the right to confirm independently that these arrangements are operating to our satisfaction.

Independent assessment: the role of the external examiner

Supporting consistency and appropriateness of centre assessor decisions

For all BTEC Higher Nationals accredited at Level 4 on the NQF, Edexcel will appoint appropriately qualified subject-specific external examiners to the programme in each centre. Edexcel will define the selection, appointment and training process, together with the roles and responsibilities of the external examiners and will communicate the details to centres in a centre handbook.

The function of the external examiner will be to review and evaluate objectively the assessment process and standards of learner attainment by independently reviewing, in the first year of the programme, a sample of learner work (including the centre-designed assignments on which the samples are based) selected by the external examiner, from across the programme.

When they visit centres, external examiners must be afforded reasonable access to the assessed parts of the programme, including evidence of learner performance on placement. They are required to:

- verify that standards are appropriate for the qualification and its elements
- assist institutions in the comparison of academic standards across similar awards nationally.

Should any disparity occur between the judgement of centre assessors and that of the external examiner, this will be reported to the centre and to Edexcel by the external examiner. The centre will be required to agree appropriate corrective action as a result of this report.

Independence in confirmation of certificated outcomes

In the final year of the programme, the external examiner will revisit the centre in order to independently assess learner work and to evaluate centre assessor decisions on final outcomes. This process of evaluation may focus upon work in units, selected by the external examiner, that present the most appropriate evidence for this exercise. The work of all learners not already sampled in the first year of the programme will be reviewed.

Resolution of assessments will normally be handled at the centre's final programme review board. The external examiner will be expected to endorse the outcomes of assessment before certification can be authorised. Should the external examiner be unable to provide such endorsement, certification will be withheld until appropriate corrective action has taken place. (The senior subject examiner may become involved in such instances.)

The external examiner will be required to prepare a written report after each visit. The report will include comments from the external examiner on:

- academic standards and programme specification
- academic standards and learner performance
- academic standards and assessment

- the assessment process
- assessment meetings
- physical resources
- comments of learners
- meetings with staff
- external examiner practice
- issues arising from previous reports
- details of sampling
- general points, areas of good practice and major issues
- action points.

The external examiner report provides the mechanism by which the external examiner independently verifies learner ability, endorses the validity of the assessment process and releases certification for a cohort.

The report is a confidential document between Edexcel, the appointed external examiner, and the centre to use for internal/external quality assurance processes. It provides the centre with feedback on the external examining process and on the judgements that determine the external examiner's decisions on endorsement, or otherwise, of learner outcomes.

Programme design and delivery

The qualifications consist of core units (which are mandatory) and specialist units. These specialist units will be mostly optional and are designed to provide a specific focus to the qualification. Required combinations of specialist units are clearly set out in relation to each qualification in the defined qualification structures provided in this document.

In BTEC Higher National qualifications each unit consists of 60 guided learning hours. The definition of guided learning hours is 'a notional measure of the substance of a qualification'. It includes an estimate of time that might be allocated to direct teaching, instruction and assessment, together with other structured learning time such as directed assignments or supported individual study. It excludes learner-initiated private study. Centres are advised to consider this definition when planning the programme of study associated with this specification.

Mode of delivery

Edexcel does not define the mode of study for BTEC Higher National qualifications. Centres are free to offer the qualifications using any mode of delivery that meets the needs of their learners. This may be through traditional classroom teaching, open learning, distance learning or a combination of these. Whatever mode of delivery is used, centres must ensure that learners have appropriate access to the resources identified in the specifications and to the subject specialists delivering the units. This is particularly important for learners studying for the qualification through open or distance learning.

Full guidance on Edexcel's policies on 'distance assessment' and 'electronic assessment' are provided on our website.

Learners studying for the qualification on a part-time basis bring with them a wealth of experience that should be utilised to maximum effect by tutors and assessors. Assessment instruments based on learners' work environments should be encouraged. Those planning the programme should aim to enhance the vocational nature of the BTEC Higher National qualification by:

- liaising with employers to ensure that the course is relevant to the specific needs of the learners
- accessing and using non-confidential data and documents from learners' workplaces
- including sponsoring employers in the delivery of the programme and, where appropriate, in the assessment
- linking with company-based/workplace training programmes
- making full use of the variety of experiences of work and life that learners bring to the programme.

Resources

BTEC Higher National qualifications are designed to prepare learners for employment in specific sectors. Physical resources need to support the delivery of the programme and the proper assessment of the outcomes and, therefore, should normally be of industry standard. Staff delivering programmes and conducting the assessments should be fully familiar with current practice and standards in the sector concerned. Centres will need to meet any specialist resource requirements when they seek approval from Edexcel.

Specialist resources should include case study materials, real resources acquired from commercial operations, videos and documented examples of current practice, eg reports from the Computing/IT industry. These are detailed in each unit.

Delivery approach

It is important that centres develop an approach to teaching and learning that supports the specialist vocational nature of the BTEC Higher National qualifications. The specifications contain a balance of practical skill development and knowledge requirements, some of which can be theoretical in nature. Tutors and assessors need to ensure that appropriate links are made between theory and practice and that the knowledge base is applied to the sector. This will require the development of relevant and up-to-date teaching materials that allow learners to apply their learning to actual events and activity within the sector. Maximum use should be made of the learner's experience.

Meeting local needs

Centres should note the qualifications set out in these specifications have been developed in consultation with centres, employers and professional bodies for the computing sector, together with support from the Sector Skills Council or NTO for the sector. The units are designed to meet the skill needs of the sector and the specialist units allow coverage of the full range of employment. Centres should make maximum use of the choice available to them within the specialist units in these specifications to meet the needs of their learners, as well as the local skills and training needs identified by organisations such as Regional Development Agencies and Local Learning and Skills Councils.

Centres may not always be able to meet local needs using the units in this specification. In this situation, centres may seek approval from Edexcel to make use of units from other standard NQF BTEC Higher National specifications. Centres will need to justify the need for importing units from other specifications and Edexcel will ensure that the vocational focus of the qualification has not been diluted.

Locally-devised specialist units

There may be exceptional circumstances where even the flexibility of importing units from other specifications does not meet a particular local need. In this case, centres can seek permission from Edexcel to develop a unit with us to meet this need. The cases where this will be allowable will be very limited. Edexcel will ensure that the integrity of the qualification is not reduced and that there is a minimum of overlap and duplication of content of existing units. Centres will need strong evidence of the local need and the reasons why the existing standard units are inappropriate. Edexcel will need to validate these units.

Limitations on variations from standard specifications

The flexibility to import standard units from other BTEC Higher National specifications and/or to develop unique locally-devised specialist units is **limited to a maximum of four units in a BTEC Higher National Diploma qualification and a maximum of two units only in any BTEC Higher National Certificate qualification**. The use of these units cannot be at the expense of the core units in any qualification.

Access and recruitment

Edexcel's policy regarding access to its qualifications is that:

- the qualifications should be available to everyone who is capable of reaching the required standards
- the qualifications should be free from any barriers that restrict access and progression
- there should be equal opportunities for all wishing to access the qualifications.

Centres are required to recruit learners to BTEC qualifications with integrity. This will include ensuring that applicants have appropriate information and advice about the qualifications and that the qualification will meet their needs. Centres should take appropriate steps to assess each applicant's potential and make a professional judgement about their ability to successfully complete the programme of study and achieve the qualification. This assessment will need to take account of the support available to the learner within the centre during their programme of study and any specific support that might be necessary to allow the learner to access the assessment for the qualification. Centres should also show regard for Edexcel's policy on learners with particular requirements.

Centres will need to review the profile of qualifications and/or experience held by applicants, considering whether this profile shows an ability to progress to a Level 4 qualification. For learners who have recently been in education, the entry profile is likely to include one of the following:

- a BTEC National Certificate or Diploma for IT Practitioners, in Business Studies, e-Business, or a similar discipline
- an AVCE/Advanced GNVQ in an appropriate vocational area
- a GCE Advanced level profile which demonstrates strong performance in a relevant subject or an adequate performance in more than one GCE subject. This profile is likely to be supported by GCSE grades at A* to C
- other related Level 3 qualifications

- an Access to Higher Education Certificate awarded by an approved further education institution
- related work experience.

Mature learners may present a more varied profile of achievement that is likely to include extensive work experience (paid and/or unpaid) and/or achievement of a range of professional qualifications in their work sector.

Restrictions on learner entry

The majority of BTEC Higher National qualifications are accredited on the NQF for learners aged 16 years and over. Learners aged 15 and under cannot be registered for a BTEC Higher National qualification.

Learners with particular requirements

Edexcel recognises that some learners, when studying vocationally-related qualifications, will have coped with the learning demands of a course but may find the standard arrangements for the assessment of their attainment presents an unfair barrier. This would apply to learners with known and long-standing learning problems and to learners who are affected at, or near to, the time of a time-constrained assessment.

Edexcel will seek to approve alternative arrangements that:

- meet the needs of learners with particular requirements
- do not confer advantage over other learners
- are commensurate with the proper outcomes from the qualification.

Details of the allowable arrangements for such learners are given in *Assessment of Vocationally Related Qualification: Regulations and Guidance relating to Learners with Special Requirements* (Edexcel, 2002).

The wider curriculum

The study of the BTEC Higher Nationals in Computing provides opportunities for learners to develop an understanding of spiritual, moral, ethical, social and cultural issues and an awareness of environmental issues, health and safety considerations, and European developments. These wider curriculum opportunities are indicated in the units as appropriate. Mapping of wider curriculum opportunities issues is provided in *Annex C*.

Spiritual, moral, ethical, social and cultural issues

The specification contributes to an understanding of:

- **social, cultural, moral and ethical issues** are encountered throughout the BTEC Higher Nationals in Computing as dealing with people will always involve the learner engaging in moral and ethical behaviour. In particular these occur in:
 - *Unit 6 Personal Skills Development*
 - *Unit 14 Management in IT*
 - *Unit 20 Internet Server Management*
 - *Unit 21 Work Experience*
 - *Unit 22 Human Computer Interface*

- *Unit 25 e-Business Development*
- *Unit 26 e-Business Technology*
- *Unit 28 Professional Development.*

Health and safety issues

The BTEC Higher Nationals in Computing are practically based and so health and safety issues are encountered throughout the courses. Learners will develop awareness of the safety of others as well as themselves in all practical activities.

Equal opportunities issues

Equal opportunities issues are implicit throughout the BTEC Higher Nationals in Computing.

Useful publications

Further copies of this document and related publications can be obtained from:

Edexcel Publications
Adamsway
Mansfield
Nottinghamshire NG18 4FN

Telephone: 01623 467 467
Fax: 01623 450 481
Email: publications@linneydirect.com

Related publications include:

- the current Edexcel publications catalogue and update catalogue
- Edexcel publications concerning the quality assurance system and the internal and external verification of vocationally-related programmes may be found on the Edexcel website and in the Edexcel publications catalogue.

NB: Most of our publications are priced. There is also a charge for postage and packing. Please check the cost when you order.

Professional body contact details

Institute for the Management of Information Systems
5 Kingfisher House
New Mill Road
Orpington
Kent
BR5 3QG

Telephone: 0700 00 23456
Website: www.imis.org.uk

British Computer Society

1 Sanford Street
Swindon
Wiltshire
United Kingdom
SN1 1HJ

Telephone: 01793 417417

Website: www1.bcs.org.uk

How to obtain National Occupational Standards

The National Occupational Standards for NVQs in IT can be obtained from:

e-skills UK Ltd
1 Castle Lane
London
SW1 6DR

Telephone: 020-7963 8920

Website: www.e-skills.com

Professional development and training

Edexcel supports UK and international customers with training related to BTEC qualifications. This support is available through a choice of training options offered in our published training directory or through customised training at your centre.

The support we offer focuses on a range of issues including:

- planning for the delivery of a new programme
- planning for assessment and grading
- developing effective assignments
- building your team and teamwork skills
- developing student-centred learning and teaching approaches
- building key skills into your programme
- building in effective and efficient quality assurance systems.

The national programme of training we offer can be viewed on the Edexcel website (www.edexcel.org.uk). You can request customised training through the website or by contacting one of our advisers in the Professional Development and Training Team on telephone number 020 7758 5620 to discuss your training needs.

The training we provide:

- is active — ideas are developed and applied
- is designed to be supportive and thought provoking
- builds on best practice.

Our training will also underpin many areas of the Higher Education Staff Development Agency (HESDA)/FENTO standards for teachers and lecturers working towards them.

Further information

For further information please call Customer Services on 0870 240 9800, or visit our website at www.edexcel.org.uk.

Core units

Unit 1: Computer Platforms

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

This unit is aimed at IT practitioners who need sufficient knowledge of computer architecture to make rational and commercial decisions on the selection and specification of systems. Learners will learn how to evaluate operating systems in order to create their own operating environment. Many IT practitioners communicate with specialist technical support staff during the specification and planning of systems implementation. This unit aims to give learners the confidence to communicate with technical and non-technical specialists to justify their recommendations.

It is expected that centres will use current personal computer and networking resources. Learners should be encouraged to read current journals to investigate and evaluate new hardware and software developments.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Investigate **computer systems**
- 2 Investigate **operating systems**
- 3 **Design a computer system**
- 4 **Test your computer system.**

Content

1 Computer systems

Processor: description of components (Von-Neuman architecture), terminology (eg bits, bytes, kilobytes etc), identification of factors affecting performance (eg millions of instructions per second (MIPS), floating point operations per second (FLOPS), clock speed, computed performance indexes, bus architectures, pipelining)

Backing store: identification of types (disc, CD, CD-R, CD-RW, DVD-RW, DVD-RAM etc), performance factors (eg data transfer rate, seek times, capacity)

Peripherals: description of available peripherals (displays, printers etc), understanding of performance factors (eg displays — performance, resolution, colour depth, video RAM, refresh rate, interlacing, slot pitch, etc, printer — speed, resolution, image quality, software requirements, postscript, PCL and associated printer control)

Computer selection: specification of requirements, performance of the selected system, costs, user benefits

2 Operating systems

Operating system functions: overview of functions (eg user interface, machine and peripheral management etc), comparison between functions of different types of operating system (personal computer, network, mainframe etc)

Computer operations: proprietary operating systems, creation of environment and systems for a computer user (file/directory structures, tailoring of screen interface, backup systems etc), user profile

3 Design a computer system

Selection: processor (eg speed, special characteristics), memory, storage devices, display, peripherals, specialised components (eg sound cards, video cards, datalogging interfaces), bus system, network readiness/adaptability

User needs: costs, productivity, particular requirements (eg power, display, special needs), training needs

4 Test your computer system

Test plan: software testing (eg: black box, white box), hardware testing methodologies, documentation, health and safety issues (eg compliance)

User support planning: identifying user training needs, producing a training schedule, functions of a help desk/help line/help software.

Security: physical and logical security measures, backup and recovery, hacking, encryption, levels of access rights

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Investigate computer systems	<ul style="list-style-type: none">• select machine components or sub-systems appropriate to given tasks• evaluate the performance of the selected system
2 Investigate operating systems	<ul style="list-style-type: none">• contrast the functions and features of different types of operating systems• understand how to customise operating systems
3 Design a computer system	<ul style="list-style-type: none">• investigate and identify the key components for a computer system for a particular user• specify a complete computer system to suit a given task
4 Test a computer system	<ul style="list-style-type: none">• produce a plan that checks the main hardware and software components, using standard techniques• produce user documentation for your system• produce a security policy for your system.• demonstrate that the system meets health and safety requirements

Guidance

Delivery

The range of hardware and software devices covered in this unit is at the centre's discretion but should reflect those in current use as well as emergent technologies (and older technologies likely to be encountered in the workplace). Centres are expected to keep abreast of modern developments in computer architecture.

Assessment

The learner must be given the opportunity to select an appropriate computer system for a defined set of applications. It is suggested learners produce a specification which both describes the function of the selected components and evaluates the recommended system against the requirements. A log book would be a useful tool to demonstrate competence in both stand-alone and network operations and in upgrading a computer system. A case study would be useful in providing evidence of planning an IT system.

Links

Although designed as a core unit, this unit is ideal for implementing as a stand-alone unit and can be related to any type of business. The unit has some links with and provides a background to *Unit 15: End-User Support*, *Unit 18: Multimedia Design and Authoring* and *Unit 20: Internet Server Management*.

Resources

It is expected that most centres will use personal computers with the appropriate hardware and software. Centres should set up machines to cover network use and administration. Where possible upgrading can be performed on personal computers or by simulations. There should also be library resources providing up-to-date information on current computer developments.

Centres should make sure that learners are familiar with communication systems such as email and the internet.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Dick, D — *The PC Support Handbook* — (Dumbreck Publishing, 2002)
ISBN: 0954171101

Unit 2: **Systems Analysis**

Learning hours: 60

NQF level 4: **BTEC Higher National — H2**

Description of unit

This unit will provide learners with a detailed insight into the systems analysis life cycle, modelling tools and techniques, testing procedures and the need for systems evaluation. This unit will examine the requirements of analysis for both commercial and technical applications. It will also introduce the data and functional modelling techniques which learners can be expected to use.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Understand the **systems analysis life cycle**
- 2 Use **systems analysis tools and techniques**
- 3 Perform a **system investigation**
- 4 Investigate **functional and data modelling**.

Content

1 Systems analysis life cycle

Systems lifecycle: the stages of a chosen cycle (eg feasibility, analysis, specification, design, detailed design, code and unit test, integrate and test, maintenance), the purpose of each stage, differentiation between validation and verification

Evaluation of other lifecycle models: comparison of a chosen model with other models (eg prototyping, dynamic systems development, waterfall, spiral, rapid applications design)

2 Systems analysis tools and techniques

Tools: using a variety of modelling tools, for example context diagrams, data flow diagrams and entity relationship diagrams

Techniques: using systems analysis documentation — requirements and user catalogue preparing BSOS (business systems options) and TSOS (technical systems options)

3 System investigation

Fact-finding techniques: interview, observation, investigation, questionnaire

Fact-recording methods and standards: current computer and paper-based fact-recording methods such as grid charts, flow diagrams, standard documentation technique

4 Functional and data modelling

Functional modelling: identification of system processes and functions, data flow diagrams and process modelling techniques

Data modelling: top down techniques, entity relationship modelling

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Understand the systems analysis life cycle	<ul style="list-style-type: none"> • identify the functions and purpose of each stage of a systems life cycle • provide evidence to support an understanding of the lifecycle • compare different life cycle models
2 Understand systems analysis tools and techniques	<ul style="list-style-type: none"> • use data modelling techniques • create entity-relationship diagrams • use modelling documentation
3 Perform a system investigation	<ul style="list-style-type: none"> • investigate a given problem • identify system requirements • document an investigated system
4 Perform functional and data modelling	<ul style="list-style-type: none"> • identify system processes and functions • produce a functional model • perform data modelling

Guidance

Delivery

Learners should be given the opportunity to support all theory with a range of practical examples that focus on all levels of the systems analysis life cycle.

Assessment

Evidence for this unit will focus on covering a range of systems analysis theory coupled with practical activities such as using fact-finding techniques, identifying user needs, preparing a feasibility report, using modelling tools and designing a database to meet user needs.

Links

This is a core unit and the content is fundamental to all computing pathways. This unit could be taught in conjunction with *Unit 4: Database Design Concepts* and it is also a good pre-requisite to *Unit 13: Data Analysis and Design*.

Resources

Learners should have access to a range of reading material based on current additions and revisions to Systems Analysis (SSADM Version 4 or above). Learners should also use appropriate modelling software such as Prince to assist with any designs. Any suitable database applications software can be used to support the database designs.

Support materials

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

Textbooks

- Yeates, D — *Systems Analysis and Design* — (Pitman Publishing, 1994)
ISBN: 0273600664

Unit 3: Programming Concepts

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

An understanding of the general principles and concepts of programming should underpin some of the basic knowledge that learners need.

Learners will develop programs and although the content could be delivered from a range of languages, compilers or platforms, the unit should aim to deliver skills and knowledge that will easily transfer to other areas of the qualification life cycle.

This unit will design programs using industry techniques in order that learners will adopt good practice.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Design and develop code using **structured programming** methods
- 2 Use **modularisation** appropriate to the chosen programming language
- 3 Produce appropriate **documentation** for a given program application
- 4 Create and apply appropriate **test schedules**.

Content

1 Structured programming

Storage: the concepts of data storage within a computer program, using variables, constants and literals. For a third generation language, the pre-defined data types, integers, floating-point, character, Boolean (logical), strings, 1D and 2D arrays of simple types, and simple files, consequences of using these types, and the available operators within the supplied language

Control structures: identify and select appropriate iterative and selection structures when writing simple programs

Programming language syntax: the facilities and rules of the language (operators, I/O commands etc)

Program design: employment of an algorithmic approach for the development of a solution to a problem (structure charts, pseudo code etc), producing tested programs to meet given specifications

Programming standards and practice: use of comments, code layout eg consistent indentation and descriptive identifiers

2 Modularisation

Use of functions/procedures: the learner should use/create functions/procedures both pre-defined and user-defined, map structured design onto a program using functions/procedures

Scope of variables: global, local, static and external variables

Parameters: passing data by value and reference, using return values

3 Documentation

Presentation of documentation: software applications (word processor or graphics), analysis, design and implementation documentation, professional standards, needs of industry

User documentation: user documentation for specified programming applications. Purpose and operation of the program developed

Program documentation: documentation that covers technical aspects of a given programming application, including algorithms implemented, data table, syntax (selection, iteration) structures used, user interface methods adapted

4 Test schedules

Error types: semantic, syntax and run-time

Test documentation: test plan and related evidence of testing (may include reading sample inputs from a file and/or writing test results to a file)

Test data and schedules: eg black box, white box, dry testing, data collection

Error detection techniques: compiler and linker error messages, debugging tools and structured walk-through

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Design and develop code using structured programming methods	<ul style="list-style-type: none"> • identify and select appropriate pre-defined data types • use simple input/output and appropriate operators with the above • identify and use appropriate selection structures and loop structures for the given task • produce programs to desired standards
2 Use modularisation appropriate to the chosen programming language	<ul style="list-style-type: none"> • construct a program from a design and use appropriate functions/procedures • demonstrate the effect of scope and life-time of variables • pass data effectively between modules
3 Produce appropriate documentation for a given program application	<ul style="list-style-type: none"> • produce user documentation for a completed programming application including the user interface design • develop documentation for a prescribed program application
4 Create and apply appropriate test schedules	<ul style="list-style-type: none"> • demonstrate discrimination between semantic and syntax errors • produce test documentation • successfully construct and use test data and schedules to detect logic errors • use appropriate techniques for detecting errors

Guidance

Delivery

Centres may choose any appropriate programming language as a vehicle for developing this unit. Programs should be written to defined quality standards and problem solving tools (structure diagrams, pseudo code etc) should be used. Emphasis should be placed on the need for modularity and an indication should be given of the link between modularity and object-based development.

Assessment

Evidence of outcomes may be in the form of tested and documented programs of varying difficulty. Requirements should be written as formal specifications and the learner submissions should adhere to defined quality standards.

Links

This unit links with *Unit 10: Software Development Project*, *Unit 30: Java Programming*, *Unit 36: OOP Programming*, *Unit 40: Software Testing*, *Unit 41: Data Structures and Algorithms* and *Unit 42: Visual Programming*.

Resources

Appropriate computer hardware and software is needed, as is a quality framework for the development of code.

Support material

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Henkmans, D — *C++ Programming for the Absolute Beginner* — (Premier Press, 2003) ISBN: 1931841438
- Perry, G — *Sams Teach Yourself Beginning Programming in 24 Hours* — (Sams, 2001) ISBN: 0672323079 Covers BASIC programming, but useful for beginners.
- Veeraraghavan, S — *Sams Teach Yourself Shell Programming in 24 Hours* — (SAMS, 2002) ISBN: 0672323583

Unit 4: Database Design Concepts

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

Databases play an integral part in both academic and commercial domains, they provide users with a tool in which to store, model and retrieve data. Database development is fundamental to the area of computing and ICT as it offers so many links to other areas such as programming, systems analysis, HCI as well as embracing issues of compatibility and end user interfacing.

This core unit introduces learners to the practical aspects of designing a database. Learners will be expected to use applications software to a prescribed level in order to design, use basic tools, develop and demonstrate a database that is fully functional.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Understand **database environments**
- 2 Use and **manipulate** appropriate **database software**
- 3 **Design a database**
- 4 **Demonstrate the database.**

Content

1 Database environments

Database environment: examination of the database environment and its relationship with different users, platforms, issues of compatibility

DBMS: the emergence of the DBMS, what it is, how it is structured, how it works

Database uses: examine different case studies and organisational contexts in which databases are used. Look at the contrast in database use across a range of environments eg academic, medical, industrial etc

2 Manipulate database software

Database software: use appropriate applications software eg Microsoft Access or database tools and functions as part of an integrated software applications tool

Tools and techniques: tables, forms, dropdown lists, check boxes etc, reports, queries, macros, validation techniques

3 Design a database

Normalisation: normalise a data set to third normal form prior to building a database

Methodology: adopt a framework for the database design. Ensure that the design meets the given requirements of the specified user criteria

Documentation: user manual providing a step-by-step guide on how to use the database or part of the database, draft designs, test logs, evaluations

4 Demonstrate the database

Format: in a formal and professional environment demonstrate the database design giving clear explanations and justifications as to the overall structure

Documentation: instruction manuals to support the designs, printed screen shots to further clarify certain design decisions made, printed examples of reports

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Understand database environments	<ul style="list-style-type: none"> • provide evidence to support a knowledge and understanding of database environments • examine a range of issues that are integral to database environments such as the end user, use across different platforms and compatibility • identify the importance of DBMS in commercial and non-commercial environments
2 Use and manipulate appropriate database software	<ul style="list-style-type: none"> • use database or database function applications software • develop a range of sample input and output screens eg tables, forms and reports, dropdown lists, checkboxes, etc • critique the software used and state how it will be used to develop your own database design
3 Design a database	<ul style="list-style-type: none"> • apply normalisation techniques to a given data set • use a range of database tools and techniques • design a fully working database
4 Demonstrate the use of a database	<ul style="list-style-type: none"> • demonstrate the database design to a third party • provide clear justifications as to the structure of the database or the use of particular tools and techniques • provide supporting documentation to complement the design

Guidance

Delivery

This unit should be divided into taught theory sessions and also practical machine based sessions. Learners should be given time to familiarise themselves with database software, plan their designs and develop documentation, especially as the group might include learners who have never used a database.

Assessment

Evidence for this unit will mainly focus on practical activities that will involve learners in looking at and using database software. Learners will also be expected to provide written documentation that justifies and describes how they have applied the software and the impact of using the software on their own designs. Assessment should focus heavily on producing database designs, documentation and evaluations. Learners will also be expected to demonstrate their database design and explain how it meets a particular user need or requirement.

Links

This unit is intended to complement a number of units that include: *Unit 2: Systems Analysis* and *Unit 13: Data Analysis and Design*.

Resources

A number of resources can be used to support this unit, including traditional textbooks on database design and DBMS. Learners should also have access to database software such as Microsoft Access; industry standard software would be more appropriate for this as learners can then transfer any skills and knowledge and map it directly into a commercial environment.

Support material

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Bowman, J/Emerson, S and Darnovsky, M — *The Practical SQL Handbook: Using Structured Query Language* — (Addison-Wesley, 1996) ISBN: 0201447878
- Dowling, N — *Applying Software: Database Design and Management* — (Continuum, 2000) ISBN: 0826453902

Unit 5: Networking Concepts

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

The importance of networked solutions in the business world grows year on year. The increasingly sophisticated technologies and widening user base mean a fundamental understanding of networks is essential for many. The aim of this unit is to provide a rigorous introduction to networks, and practical experience in installing users and software on a network.

This unit will clarify the issues associated with network use and how this has developed. It will identify the architectural concepts behind networking and help develop the preliminary skills necessary to install and manage networks.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Evaluate the **benefit of networks**
- 2 Apply architectural concepts to the **design/evaluation of networks**
- 3 Install **network software**
- 4 Perform **network management** responsibilities.

Content

1 Benefit of networks

Network principles and applications definition of a network: evolution of network uses, from simple file and print networks, through small office computing, to client-server architectures, review of remote access, starting with email through to intranets and the internet, LANs (local area networks), WANs (wide area networks) and MANs, (metropolitan area networks), networked applications, overview of cost/benefits of network use

Network use: an overview of network resources (hardware and software), facilities of a network operating system, understanding of security implications and software licensing issues, constraints on capacity and performance (such as being asked to run video off a 10Mbit Ethernet connection)

2 Design/evaluation of networks

Network architecture concepts: the ISO OSI 7-layer model (and/or IEEE 802), topologies, eg bus, ring, structured, a description of communication devices, repeaters, bridges and hubs, standard connectors and wiring, functions of a network card, differences between peer to peer and server based networks, description of main protocols, ie Ethernet, ATM, token ring, IPX, SPX, and their relationship with the 7-layer model, the principles and resources required to connect LANs to WANs, TCP/IP as a WAN protocol, TCP/IP addressing and how routing works

Network design: using architectural principles and definitions to design a new network or evaluate an existing one

3 Network software

User factors: design and definition of users and groups, the definition of directory structures on the file server, file and directory attributes, trustee rights, IRM (inherited rights management), and setting up security

Login scripts: definition of the user environment, menu systems

Hardware and software factors: printing set-up, understanding of printing options, installation and configuration of applications on the network (including operating system constraints), file server installation and utilities

4 Network management

Management responsibilities: the problems of creating large numbers of accounts on a network and keeping it up-to-date, management of users, workgroup managers, network security and virus protection (elements of good practice)

Resource management: control resource usage estimation and tracing of resource usage, managing printer queues, connecting of the network to the outside world, advantages (eg internet) and disadvantages (eg hackers), firewalls

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Evaluate the benefit of networks	<ul style="list-style-type: none"> • produce a coherent argument as to the advantages and disadvantages of using networks within an organisation • evaluate the various cost, performance, security and utility values associated with the installation of a network • provide an overview of a network operating system and how it works
2 Apply architectural concepts to the design/evaluation of networks	<ul style="list-style-type: none"> • design a LAN for a specific purpose or assess an existing network for fitness of purpose • identify the various parts (software and hardware) of a network system and relate it to the 7-layered model • differentiate between different kinds of network, network topologies and network operating systems
3 Install network software	<ul style="list-style-type: none"> • set up a software network environment, for example departments in an organisation • install a piece of network software on to a server to be used by different selected users in a group • configure user workstations on the network
4 Perform network management responsibilities	<ul style="list-style-type: none"> • write a report on the rights and responsibilities of the network manager and the network user • apply control mechanisms in a typical network for managing users • control printer queues and other forms of resource usage

Guidance

Delivery

This unit may be delivered as a stand-alone package or alongside other units. Most learner effort should be spent in practical activities in this unit. It may be that the major part of these could be achieved in groups, each learner developing a different department in an organisation, for instance.

Assessment

There is an obvious need to combine practical and theoretical assessment. The theory can be delivered by using case studies that consider existing networks. Learners can produce reports that describe features and show an understanding of the principles and definitions. The practical aspects provide an opportunity for learners to design, install and maintain a simple network. It is essential that a log book is maintained for recording both progress and effectiveness.

Links

Learners should have completed, or be studying a unit such as *Unit 1: Computer Platforms*, before attempting this unit.

Resources

In order to deliver this unit centres must have a development server that can be booted up. A dedicated server needs to be available, and connected to several stations. At least one networked printer, network monitoring software and all relevant network documentation should be accessible to learners. Centres must also provide networkable applications (software), which can be installed on the server.

Support materials

Textbooks

- *Networking Complete* (Sybex International, 2002) ISBN: 0782141439
- Parnell, T — *Network Administrator's Reference* — (McGraw Hill, 1999) ISBN: 0078825881
- Tanenbaum, A — *Computer Networks* — (Prentice Hall PTR, 2002) ISBN: 0130384887

Unit 6: Personal Skills Development

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

Personal skills development implies the professional and personal growth in knowledge and skills. Personal skills development embraces a whole range of practical and transferable skills that can be applied within higher education and the workplace.

This unit examines a range of skills that are deemed necessary to aid learners through various scenarios which are not necessarily implicit within the content of more theoretical or academically orientated units within the HN programme. Learners will be able to improve their own learning, be involved with team work and be more capable of problem solving through the use of case studies, role play and real-life activities.

This unit can be taught traditionally or integrated within other units on the programme. The rationale behind this unit is to enable learners to have exposure to softer skills that are critical in the work place and higher education. This unit attempts to encapsulate a range of key and common skills and deliver this information in a dynamic learning environment.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 **Demonstrate and deliver** a range of **transferable skills**
- 2 Show evidence of **working and contributing to a group situation**
- 3 **Identify a given problem and provide feasible solutions**
- 4 **Monitor and review own learning experience.**

Content

1 Demonstrate and deliver a range of transferable skills

Transferable skills: ability to communicate to users at all levels (non-technical to technical). Evidence of producing documents to meet a range of user needs. Evidence to support considerations that need to be given when communicating with users at different levels

Delivery formats: ability to deliver transferable skills using a variety of formats. Demonstration of transferable skills through written and oral delivery

2 Working and contributing to a group situation

Contributing: providing input (suggestions, proposals, recommendations, overview, analysis) and feedback (written or verbal) within a group environment

Group dynamics: evidence to support participation in a group dynamics process ie stages of group formation and development (forming, norming, storming, performing)

Team role: evidence to support taking on a team role based on Honey and Mumford or Belbins characteristics, team roles eg activist, theorist, plant, shaper and implementor

3 Identify a given problem and provide feasible solutions

Stages: steps for problem solving ie recognition of problem, research, analysis, solution and recommendations

Methodology: adopt a framework for solving the problem using informal or formal methods

Decision making: examine the stages involved in the decision making process and relate this to your own problem solving scenario and the steps taken to overcome it

Techniques: cost benefit analysis, impact analysis, business system options, technical system options

4 Monitor and review own learning experience

Critique: monitor skills, knowledge and learning throughout a set period of time

Documentation: evidence to support evaluation of both a qualitative and quantitative nature could be in a written or verbal format. Examples to include action plans, progress reports, diary, observation sheets, schedules etc

Evaluation: review the stages of development, evaluate successes and failures in terms of what you have learned and achieved and feed this back in an appropriate format

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Demonstrate and deliver a range of transferable skills	<ul style="list-style-type: none"> • produce a range of documents that demonstrate support to users at a range of levels and target audiences • produce a technical document that could be used in an organisation and deliver this to an audience using at least two appropriate transferable skills • justify why it is important to have good transferable skills and the ability to communicate these across a wide audience
2 Show evidence of working and contributing to a group situation	<ul style="list-style-type: none"> • provide evidence to support a knowledge and understanding of group dynamics • assess own learning style and apply to a group situation • take part in discussions, debates and other group activities as an observer and a participator
3 Identify a given problem and provide feasible solutions	<ul style="list-style-type: none"> • apply problem solving techniques to a given problem domain, document each stage of this process • clearly identify the stages taken in the decision-making process to overcome the problem • use appropriate methods to select the most feasible solution with full justification as to your selection
4 Monitor and review own learning experience	<ul style="list-style-type: none"> • set realistic and achievable targets using standard action planning techniques • state any problems, difficulties, limitations and advancements made during the period of learning • provide an account of personal development during the period of learning and use a variety of tools and techniques to document this improvement in knowledge and skill base

Guidance

Delivery

This unit can be delivered as a stand-alone unit or in conjunction and with reference to other units within the HND qualification. Learners can collect their evidence from other units within the qualification to provide greater depth and application of knowledge and skills.

Assessment

Evidence is likely to be in the form of a portfolio that might include reports, schedules, action plans, target setting, evaluations and accounts of group working activities. Learners should be encouraged to retain all pieces of evidence collected as these will help in the preparation of the final critique. Some pieces of evidence might be generated within a group context.

Links

This unit is intended to be linked with all the core units and a host of other units within the qualification, especially the *Unit 21: Work Experience*. This unit will provide learners with softer transferable skills that can assist in the progress and development of their HN qualification. This unit is also linked to communication key skills at level 4 and will provide much of the evidence for the learners key skills portfolio.

Resources

A number of resources can be used to support this unit, including traditional textbooks on personal development, key skills or business skills. Videos on transferable skills and team building should also be used. Learners should have access to computers that will allow them to develop their portfolio in class and also provide opportunity for internet research.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- BBC Learning — *Get Confident* — (Online learning programme, 2003)
- Belbin, M — *Team Roles at Work* — (Butterworth-Heinemann, 1996) ISBN: 0750626755
- Cameron, S — *The Business Learners Handbook* — (Pearson, 2002) ISBN: 0273655272
- Honey, P — *Improve Your People Skills* — (Chartered Institute of Personnel and Development, 1988) ISBN: 0852923961

Specialist core units

Specialist units

block A

Unit 16: Information Systems

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

Organisations have always depended on information to ensure success. Over the years, organisations have changed their information systems from dealing purely with data processing to strategic and decision support. Managers need information to plan successfully in the short, medium and long term. It is also recognised nowadays that information is required at all levels in an organisation and that information itself can have many sources. The importance of valid information in gaining competitive advantage needs to be stressed.

Learners will gain an understanding of the ways in which data can be processed and the applications that support organisations. They will also be asked to evaluate the capacity of an information system to satisfy the needs of the user.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Identify **information needs within different functional areas** of an organisation
- 2 Compare a **range of information systems**
- 3 Examine the **tools** available to organisations **for information processing**
- 4 Evaluate the **information systems within an organisation.**

Content

1 Information needs within different functional areas

Information needs: requirements analysis (strategic, tactical, operational); data requirements (inputs, outputs, processing activities)

Functional areas of an organisation: finance, personnel, accounts, stock control, logistics and supply chain management, sales, marketing

2 Range of information systems

Information systems: business information systems, decision support systems, management information systems, data warehouse systems

Information and data: definition of information and data, sources of information, information requirements and the needs for information at different levels within an organisation, storing information and its importance with regard to security, accuracy and relevance; outputs (payroll, invoicing, ordering, bookings, stock control, personnel records, goods tracking)

3 Tools available for information processing

Tools: current tools (text processors, client-server, databases, artificial intelligence, expert systems, data warehousing, data mining), description of the use of telecommunications (internet, email etc)

Information processing: transaction processing, information presentation and reporting, strategic advantage and problem-solving; relationship with tools

Methods: batch, transaction, single user, multi-user; centralised, distributed

Real-time processing: process control, information processing

4 Information systems within an organisation

Evaluation techniques: criteria (accuracy, suitability, timeliness, benefits, cost, confidence); professional, legal, ethical and social issues of usage

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Identify information needs within different functional areas of an organisation	<ul style="list-style-type: none"> • compare and contrast the different functional areas of an organisation • understand the information needs of each functional area • analyse the information needs for a given scenario or case study
2 Compare a range of information systems	<ul style="list-style-type: none"> • identify different types of information systems • examine the current trends in using applications to solve business problems • recognise the information systems suitable for different functional areas of an organisation
3 Examine the tools available to organisations for information processing	<ul style="list-style-type: none"> • identify the tools required to solve a specific problem within an organisation • describe the current information processing methods for a given problem • examine alternative methods of supplying the same information
4 Evaluate the information systems within an organisation	<ul style="list-style-type: none"> • employ evaluation measures effectively • evaluate the effectiveness of a given application associated with a given scenario or case study • provide written documentation to support the evaluation

Guidance

Delivery

Whenever possible the unit should use real-life examples of information systems and suitable computer-based tools. Centres are advised to use the resources and experience of local organisations to provide case study material.

Assessment

Evidence of outcomes may be in the form of assignments and projects undertaken individually or as part of a group. Learners should use computer-based tools such as word processors to provide their assessment evidence.

Links

This unit builds on knowledge gained on developing information systems strategies in *Unit 2: Systems Analysis*. This unit also provides a foundation for those specialising in information systems or for those wishing to develop their information systems knowledge within an organisational context.

Resources

Case study material is needed for evaluating information systems. Many textbooks offer case study material, as does the internet.

Suitable software tools should also be available to evaluate in the light of an organisation's information needs.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Checkland, P and Holwell, S — *Information, Systems and Information Systems: Making Sense of the Field* — (John Wiley and Sons, 1997) ISBN: 0471958204
- Marchand et al — *Mastering Information Management: The Complete Companion in Information Management* — (Financial Times Prentice Hall, 1999) ISBN: 0273643525

See also list in *Unit 8: Information Systems Project*.

Unit 8: Information Systems Project

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

This unit will form a central part in the development of the learner's ability to link and integrate the knowledge and skills acquired during the programme to produce a practical solution to a realistic problem from the use of applications software. Learners will also appreciate how to use the tools and techniques of the software to produce a range of documentation to include written, graphical and oral formats of delivery.

This unit will provide learners with a good overview of a range of applications software, its function and uses within an IT context. Learners will be expected to design, use and test applications software to meet a specified user requirement.

This is a major piece of work that should demonstrate the performance expected at a Higher National level. The problem should be developed within an IT context in accordance with the unit's frameworks and constraints. This will develop the ability to produce an acceptable and viable business solution to an agreed specification with a defined timescale and constraints.

Summary of outcomes

To achieve this unit a learner must:

- 1 **Develop a project plan** to an agreed specification
- 2 **Develop a solution** using applications software
- 3 **Implement solution** using applications software
- 4 **Present and evaluate** project.

Content

1 Develop a project plan

Project selection: research and review IS (information systems) areas of interest, selection of project, design of structure and production of aims for the project, estimation and list of required resources for chosen project

Project planning: production of an appropriate plan for the project to cover all stages of the chosen systems development life cycle (SDLC), including drafting, analysis (user requirements, resources required), design, implementation, testing, review. Selection of an appropriate project management software tool to plan the project

Applications software selection: evaluation of range of applications software appropriate to provide solution to problem, including spreadsheet, database, word processing, presentation, drawing and graphical. Identification and justification of chosen applications software to implement and deliver solution to problem

2 Develop a solution

Objectives: to improve speed of a given task, to incorporate standardisation, allow wider access, save money and resources

User type: low level end user (operator) — basic, intermediate solution, competent user/semi-professional (middle management) — intermediate, IT literate, fully competent user/professional (senior management) — advanced

Design stages: gathering information from user, drafting design, actual design, test, update, completed design, evaluation and review

Specification: development, maintenance and operating environments, functional requirements and constraints, external interfaces, data flows, screen mock-ups, dialogues, reports, data dictionaries

3 Implement solution

Implementation: use chosen applications software to implement project to agreed specification. Monitor development against agreed plan and take appropriate action if the project does not go to plan for unforeseen reasons

Testing: test plans, test cases/scenarios, functionality, user interface and documentation testing compliance with standards, verification that project meets specification

Documentation: Project Log File (project plans, action plans, feasibility study, records of meetings/progress meetings, full technical documentation including testing), review and evaluation, full user documentation

4 **Present and evaluate**

Presentation: professional delivery formats (an electronic version of the product developed, written reports, oral presentations, formal referencing notation)

Evaluation: an overview of the success or failure of the project (aims, objectives, outcomes, techniques used, improvements required), statement of whether or not project meets requirements of user, problems encountered, resolution of problems, self-reflection

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Develop a project plan to an agreed specification	<ul style="list-style-type: none"> • identify and agree a project for a suitable problem • structure and quantify a project plan modelled on a recognised information system model, using a chosen systems development life cycle • evaluate and select suitable applications software to provide a solution to the problem
2 Develop a solution using applications software	<ul style="list-style-type: none"> • identify clear objectives for the business solution design • produce a specification for the business solution including complete user requirements and design specifications • review, select and use appropriate testing techniques to validate the project
3 Implement solution using applications software	<ul style="list-style-type: none"> • develop a fully working is solution using applications software apply complex software tools and techniques, such as macros, programming languages, • apply all verification and testing required at all levels of the system • produce documentation for the entire development process
4 Deliver and evaluate the project	<ul style="list-style-type: none"> • deliver the project to a third party using electronic, written and oral formats • state any problems, difficulties, limitations during the design of the business solution and how these were overcome • assess the quality of the product compared to the clients original requirements

Guidance

Delivery

This unit, ideally, should be divided into taught theory sessions and practical machine based sessions. Learners must work individually. The delivery methods for this unit are likely to include tutorials, workshops, demonstrations, presentations and personal study by the learner.

Once a specific project has been agreed, the tutor's role is verifying, encouraging and counselling rather than directing. Part of the unit should be formally devoted to verifying the project stages. During the development it would be useful to feed back to the learner so that the learner can benefit from comments on good and bad practice, for example. It is considered good practice to involve some employers in the delivery and/or review.

Assessment

Evidence of the outcomes for this unit will be divided into written tasks covering IS solutions designs and evaluations. Learners should be encouraged to retain all pieces of evidence collected, in a project log file, as these will help in the preparation of the final evaluation. Learners will also be expected to demonstrate their IS solution and explain how it meets a particular user need or requirement that should be specified within the overall design objectives.

Links

This unit has links with the core units and other appropriate units within the qualification including *Unit 21: Work Experience*. This unit would allow learners to plan, develop and evaluate, for example, any one of:

- a database management system
- a functional website
- an e-commerce system
- a financial system for an organisation.

This unit also links well with *Unit 22: Human Computer Interface* and *Unit 23: Project Management*.

Resources

A number of resources can be used to support this unit, including traditional textbooks on business systems. Learners should also use a suitable project management tool, for example, MS Project 2000. Learners will also require access to applications software sufficient to be able to develop the required product.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Harry, M — *Information Systems in Business* — (Prentice Hall) ISBN: 0273600419
- Stacey, R — *Strategic Management & Organisational Dynamics* — (FT Prentice Hall, 2002) ISBN: 0273658980
- Stokes, D — *Marketing: A Case Study Approach* — (Continuum, 2000) ISBN: 0826454062

See also list in *Unit 16: Information Systems*

Unit 12: Networking Technology

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

Understanding of the underlying principles of networking is of vital importance to all IT practitioners in today's increasingly sophisticated world. The aim of this unit is to provide a background to the basic components of networked systems from which all networking operations derive. It also includes the evaluation of networks and network applications.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Evaluate **networks and networking approaches**
- 2 Investigate basic **hardware components and the role of network operating system (NOS) software**
- 3 Explore the **connection of network components**
- 4 Explain the **Open Systems Interconnection (OSI) model and common network architectures**
- 5 Evaluate **data transmission and protocols** in a network environment.

Content

1 Networks and networking approaches

Networks: introduction, role, purpose, benefits, resource implications

Approaches: peer-to-peer, client-server computing (model, functions, client role, front-end tools, advantages), centralised computing

Server: role, types, purpose

2 Hardware components and the role of network operating system (NOS) software

Components: workstation, servers, cabling, hubs and repeaters

Software: control, connect, manage, secure

Topology: types, common variants, comparison (cost, reliability, speed), advantages, disadvantages

Selection: criteria (type of network, network topology, reliability, cost, future needs, cabling)

3 Connection of network components

Cabling: types, specifications, connectors, terminators, industry standards
Signal transmission: broadband, baseband, bandwidth, analogue, digital

Network interface cards: role, installation, configuration (NOS tools, configuration parameters eg IRQ number, I/O port, memory address, setting protocols), selection, performance factors (eg DMA, onboard RAM, system RAM, bus mastering, RAM buffering, processor model), types (eg wireless, fibre optic, remote boot)

Selection: criteria (installation logistics, shielding, crosstalk, transmission speed, cost, attenuation)

4 Open Systems Interconnection (OSI) model and common network architectures

Model: outline of network communications, function of layers, services of layers

Architectures: Local Area Network, OSI 802 modifications (logical link control, media access control), access methods and features, comparison, IEEE 802 definitions: Ethernet, Token Ring, Apple Talk, ArcNet (components, features, cabling, selection)

Drivers: purpose, sources, NIC drivers (function, relationship to OSI layers), implementation by NOS

5 Data transmission and network protocols

Data packets: role, structure, components, origin and formation (OSI layers), sending, receiving, examples

Protocols: definition, purpose, stacks and OSI layers, binding, types (application, transport, network), standards

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Evaluate networks and networking approaches	<ul style="list-style-type: none"> • discuss the role of networks within different organisations and the resource implications of networks • discuss the different distributed computing approaches of peer-to-peer and client-server networks • explain the functions of client and server computers on a network and give at least one example of the interactions between a client and server computer • describe the advantages of client-server approaches particularly over centralised services
2 Investigate basic hardware components and the role of network operating system (NOS) software	<ul style="list-style-type: none"> • draw and describe basic network topologies and define basic network components • discuss role of software and hardware • discuss factors influencing choice of networks stating advantages and disadvantages that arise from different topologies • determine a suitable network for a given site
3 Explore the connection of network components	<ul style="list-style-type: none"> • explain different connection materials including their specifications and list the criteria you would use to choose such materials • describe basic signalling methods and their characteristics • explain the role of the network interface card and carry-out selection, installation and configuration of a network interface card using NOS tools • identify how the relevant parameters and protocols are set • discuss factors that affect the performance of network interface cards • determine a cabling and hardware connection configuration for a given site

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
4 Explain the Open Systems Interconnection (OSI) model and common network architectures	<ul style="list-style-type: none"> • present the OSI layered model • explain the role of drivers in a network, discussing their relationship to the NOS and OSI model • discuss how drivers are selected and implemented for various network components; install NIC driver and demonstrate how to remove and update • explain the detailed operation of different IEEE 802.N network configurations • refer the 802 protocols to the existing OSI layers • relate how architecture influences access and control of the network and draw out merits of different architectures • describe scenarios where one architecture might be favoured over another
5 Evaluate data transmission and protocols in a network environment	<ul style="list-style-type: none"> • discuss the role of packets and how they are built up from their various components, giving an example where data packets are transmitted through different layers of the OSI model • discuss the role of protocols at different layers of the OSI model, describing the function of specific protocols • explain examples of transmission between different network layers

Guidance

Delivery

The delivery methods for this unit are likely to include tutorials, workshops, presentations and personal study by the learner.

Assessment

Evidence of the outcomes for this unit will be in the form of a portfolio of work that learners will develop. The portfolio will include exercises and assignments demonstrating coverage of the assessment criteria. Centres may wish to develop exam type assessments to give learners this experience.

Links

This unit has links with *Unit 5: Networking Concepts*.

Resources

The following resources may be used:

- exemplar materials and case studies
- videos
- internet access.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following.

- Halsall, F — *Data Communication, Computer Networks and Open Systems* — (Addison Wesley, 1995) ISBN: 020142293
- Hodson, P — *Local Area Networks 3rd Edition* — (Continuum, 2002) ISBN: 0826458661
- Hunter, P — *Local Area Networks* — (Addison-Wesley, 1993) ISBN: 0201627639
- *Networking Essentials Plus* — (Microsoft Press, 2003) ISBN: 0072850620
- *Networking Essentials with CD ROM* — (Microsoft Press, 2003) ISBN: 157231902X
- Tannebaum, A — *Computer Networks* — (Prentice Hall International, 2002) ISBN: 0130384887

Websites

Websites that support the development of this unit include those of computing associations and employers. The following may be useful:

- *Network World* — www.network-world.com/

Web pages provide access to a further range of internet information sources. Learners must use this resource with care, justifying the use of information gathered.

Unit 9: Networking Project

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

This unit will examine the way in which network computers are prepared for the installation of an operating system. Candidates will learn how to distinguish between the basic characteristics of an operating system (OS) used on a network workstation and that of an OS running a network server. Candidates examine the structure of network operating system (NOS) architecture and will install an OS for both a workstation and a network server. They will learn common troubleshooting and upgrade options.

Summary of outcomes

To achieve this unit a learner must:

- 1 Identify **features of a network operating system**
- 2 Explain **NOS architecture and network operations**
- 3 Carry out the **installation of OS** for network workstation and network server
- 4 Investigate **troubleshooting of NOS installation.**

Content

1 Features of a network operating system

NOS: features, overview components, purpose, performance, resource management (CPU, memory, disc space, I/O), multitasking (pre-emptive and non-pre-emptive), traditional OS vs. network OS, multiple platforms (processor types, multi-processor support), security, client software (redirector, designators, peripherals), server software (resource sharing, managing users, managing network)

Client OS features: use, purpose, performance, system compatibility (hardware and software environment), operation, web services (eg MS Peer Web Services), examples (Win9x, WinNT, 2000, XP, Apple OS, etc), selection criteria

Server NOS features: purpose, performance, system compatibility (hardware and software environment), operation, internet services (eg MS Internet Information Services), examples (Windows NT, 2000, XP Server, Novell Netware etc), selection criteria

2 NOS architecture and network operations

Architecture: features: use, purpose, system software layers, modes (user, kernel), executive, memory model, virtual memory management features

Operations: domains (types, server roles (eg primary and backup domain controllers), directory services), workgroups, log-on to computer, log-on to network domain, create user accounts, adding computers to domain

Network: computers: workstations, network servers, distribution servers

3 Installation of OS

OS preparations: identify hardware requirements of network computers, determine disc partition requirements, installation of file system (choose, plan)

Network server: choose server roles, plan network domains, select licensing mode (per server, per seat), identify installation media, select OS components (additional facilities), select domain (create, rename, join), initialise installation (OS version, hardware, partition, file system, select system folder), prepare system information (name, organisation, licensing mode, computer ID, type of server (eg PDC, BDC, stand-alone), password, emergency disc, optional components), network information (network type, internet options, NIC details, network protocols, network services, domain or workgroup name, time zone, time, date, video adapter configuration)

Network workstations: identify installation media, select OS components (additional facilities), select installation methods (full, compact, portable, custom), select network options (workgroup, domain), initialise installation (OS version, hardware, partition, file system, select system folder), prepare system information (installation method, name, organisation, computer ID, password, emergency disc, optional components), network information (network type, NIC details, network protocols, network services, domain or workgroup name, time zone, date, time, video adapter configuration)

Distribution server and additional components: purpose, setting-up, install from server (install options), perform unattended set-up of NOS on workstation, create unattended control and parameter files, OEM set-up, online documentation

4 **Troubleshooting of NOS installation**

Troubleshooting: definition, common problems, and possible resolution strategies

Options: components to upgrade, versions, services, support services from software vendor

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Identify features of network operating systems	<ul style="list-style-type: none">• explain purpose, performance and components of a common NOS describing the elements of client and server software• examine the features of common client OS and describe the compatibility of the client OS with their hardware and software• suggest reasons for selecting different client OS giving key technical decision criteria and identify common NOS used on network servers• describe the role of NOS with hardware and software, and suggest reasons for selecting different NOS• compare and contrast common features of an NOS with a client OS
2 Explain NOS architecture and network operations	<ul style="list-style-type: none">• describe the architecture of a named NOS and explain how its operating modes work• explain how memory management is implemented• demonstrate how to log-on to a computer running a particular OS• demonstrate how to log-on onto a computer attached to a network• demonstrate how a user account can be created• demonstrate how to add a workstation to network domain

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
3 Carry out the installation of OS for network workstation and network server	<ul style="list-style-type: none"> • prepare installation of OS for network workstation and network server • determine steps for installing NOS on server • determine steps for installing OS on workstation • prepare the necessary information for installation processes • perform installation of NOS on network computers • record outcomes of installation process on workstation and server • explain the purpose of a distribution server, and set up a distribution server to install OS to workstation • run an installation process from a distribution server • prepare unattended control and parameter files • carry out unattended installation of NOS from distribution server • explain the purpose of OEM set-up tools and describe a situation where they might be used
4 Investigate troubleshooting of NOS installation	<ul style="list-style-type: none"> • describe common installation problems, and why they happen • suggest ways of overcoming installation problems • describe how an NOS can be upgraded and suggest factors which influence choice of upgrade • outline steps in upgrading an NOS

Guidance

Delivery

The delivery methods for this unit are likely to include tutorials, workshops, demonstrations, presentations and personal study by the learner.

Assessment

Evidence of the outcomes for this unit will be in the form of a project where learners can develop a portfolio of evidence. The portfolio will include exercises and short assignments demonstrating coverage of the assessment criteria. The centre will also need to ensure learners maintain suitable logbooks that give a full record of practical work undertaken. Project management procedures are advised for learners undertaking this unit and can be taught alongside or after *Unit 23: Project Management* unit.

Links

This unit has links to *Unit 12: Networking Technology* and *Unit 23: Project Management*.

Resources

The following resources may be used:

- training room with networked computers
- network software for setting up client and server machines
- manuals on the operation of network software
- technician support
- VGA or SVGA output LCD projector
- training materials on the operation of the network software
- exemplar materials and case studies
- videos
- internet access.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Frisch, A — *Essential Windows NT System Administration* — (O'Reilly & Associates, 1997) ISBN: 1565922743
- Kirch, O — *Linux Network Administrator's Guide* — (O'Reilly & Associates, 2000) ISBN: 1565924002
- Lindberg, K — *Netware 5.00 Administrators Handbook* — (IDG/Novell Press, 1999) ISBN: 0764545469
- Parnell, T — *Network Administrator's Reference* — (Osbourne/McGraw, 1999) ISBN: 0078825881

Unit 42: Visual Programming

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

The development of visual environments has dramatically increased over the last decade. Most people are now familiar with graphical based operating systems and programs.

These graphical interfaces have made the life of the end user much easier.

The aim of this unit is to enable learners to develop these graphical interfaces in the form of visual applications. The learners will learn how to develop a user interface and then build code into that environment to create an application.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Use **visual objects**
- 2 Design a variety of **visual applications**
- 3 Use advanced features of a **visual development environment** to implement an application
- 4 Use suitable **testing** methods in a visual environment.

Content

1 Visual objects

Object types: some examples of the object types are as follows: buttons, text boxes, windows, frames, data controls, option buttons, timers, drive list boxes etc

Object structure: attributes, methods, properties, order of events etc

Creating objects: placing objects on a screen and customising attributes as appropriate

Linking objects: enabling different objects to interact using programming or scripting

2 Visual applications

Design strategies: state transition diagrams, storyboarding, event modelling, prototyping, layout of forms including details of design and properties of the objects

Design: using design strategies

3 Visual development environment

Identification of features: investigation of current advanced tools and development methods

Employment of features: use of advanced features to satisfy the requirements of an application. Features available will vary greatly between different development environments, but typical examples might be the use of drag and drop, simple animation, linking to databases, internet development, ActiveX

4 Testing

Testing methods: testing at various stages of development, test data plans, methods for analysing variable values through code sections (eg trace tables)

Testing tools: built-in applications for debugging and testing program code, system debugger with appropriate trace facilities and inspection techniques for the analysis of variables and associated data structures. The obvious tools are: step, watch, breakpoints, and error trapping

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Use visual objects	<ul style="list-style-type: none"> • use and customise visual objects • demonstrate an understanding of the different methods associated with the objects • develop simple forms using interacting objects
2 Design a variety of visual applications	<ul style="list-style-type: none"> • select an appropriate design technique for a given visual application • use appropriate design techniques to produce an application that can be modified • demonstrate appropriate planning before development
3 Use advanced features of a visual development environment to implement an application	<ul style="list-style-type: none"> • demonstrate an understanding of a number of advanced visual programming features • build a maintainable visual application using advanced features • create multi-form applications
4 Use suitable testing methods in a visual environment	<ul style="list-style-type: none"> • produce a suitable test plan • demonstration of effective use of debugging tools • demonstrate the ability to resolve errors found during testing

Guidance

Delivery

The focus of this unit is on the clear understanding and use of visual objects, the use of appropriate design methods, and experience in creating programs using a variety of visual tools. The importance of the interface and the layout and sequence of events also needs to be stressed to the learners.

It needs to be noted that the advanced features of a visual environment may well change over the next few years with the development of new environments.

Assessment

The main evidence of this unit is likely to be in the form of simple application programs written in the visual programming language and demonstrating the achievement of the learning outcomes.

The learners will need to demonstrate the ability to use a number of different features of the programming language that has been selected from the basic controls to a number of advanced features of the language in question.

The learners should also be demonstrating the importance of designing an appropriate and effective user interface.

Links

Learners should have good working skills and knowledge in basic programming techniques so that the principles presented here are delivered in context.

This unit has links with the following: *Unit 10: Software Development Project*, *Unit 22: Human Computer Interface* and *Unit 36: OOP Programming*.

Resources

In addition to standard computing resources, learners need access to a visual environment and an appropriate development tool. Centres need to keep development tools up-to-date and should provide opportunities for learners to investigate new developments.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Flanders, J/Griffiths, I and Sells, C — *Mastering Visual Studio NET* — (O'Reilly UK, 2003) ISBN: 0596003609
- Perry, G and Hettihewa, S — *Sams Teach Yourself Visual Basic 6 in 24 Hours* — (Sams Publishing, 1999) ISBN: 0672315335
- Wright, P — *Beginning Visual Basic 6* — (Wrox Press, 1998) ISBN: 1861001053

Websites

Websites that support the development of this unit include those of computing associations and employers. The following may be useful:

- www.alvbcode.com/
- www.programmersheaven.com/zone1/index.htm

Web pages provide access to a further range of internet information sources. Learners must use this resource with care, justifying the use of information gathered.

Unit 10: **Software Development Project**

Learning hours: 60

NQF level 4: **BTEC Higher National — H2**

Description of unit

This unit will form a central part in the development of the learner's ability to link and integrate the knowledge and skills acquired during the programme to produce a practical solution to a realistic problem. This is a major piece of work that should demonstrate the performance expected at a Higher National level.

The chosen problem may be work-based, college-based or a learner interest but it must be developed in accordance with the unit's frameworks and constraints. This will develop the ability to produce a suitable, realistic software solution to an agreed specification within a defined timescale.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Develop a **plan for a project to an agreed specification**
- 2 Develop a **solution** for the project
- 3 **Implement the solution** to the system
- 4 **Present and evaluate** the project.

Content

1 Plan for a project to an agreed specification

Project selection: research and review areas of interest, selection of project, design of structure and production of aims, estimation and list of required resources

Project plan: production of computer-based project plan, to include timescales, deliverables, milestones, resource allocation, quality assurance systems, quality plans

Design/structure: consideration of alternative design methods/techniques and environment (use of preliminary design, detailed design, data design, architectural design, procedural design, modular design, structured design, object design, real time design, graphical displays, storyboarding, data analysis)

2 Solution

Programming languages: selection of languages for the project, specification of language to include identification of area of project used

Programming techniques: techniques to be implemented, where techniques will be used

Program requirement: data type, data structure (arrays and records, declarations, assignments, expressions); control structures, subprograms, algorithms including recursion

Program testing: strategy, functional testing (black box), structural testing (white box)

3 Implement the solution

Specification: operating environment

Software installation: software installation procedures

Testing activities: component testing, case testing, unit testing, integrating testing, acceptance testing

4 Present and evaluate

Demonstration: well organised, structured, giving clear explanations, justify overall design

Audience: peer groups, tutors, clients, employers

Documentation: instruction manuals, user guides, evidence to support designs, printed screen shots where applicable, printed examples of input screens

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Develop a plan for a project to an agreed specification	<ul style="list-style-type: none"> • design a plan for an agreed project • produce a project specification including complete user requirements and design specifications • select and use appropriate software planning tools
2 Develop a solution for the project	<ul style="list-style-type: none"> • select a suitable programming language • produce all algorithms, pseudo code, flowchart, data dictionary, programme coding, classes, methods as required • review, select and use appropriate testing techniques to validate the project • use appropriate software tools to develop project coding
3 Implement the solution to the system	<ul style="list-style-type: none"> • identify and implement system requirements • apply verification and testing required at all levels of the system • produce a clear and structured implementation plan
4 Present and evaluate the project	<ul style="list-style-type: none"> • present your solution in a structured and well organised format • produce documentation for all stages of a project and a full report • assess the quality of the product compared to the clients' original requirements

Guidance

Delivery

Learners must work individually. Once a specific project has been agreed, the tutor's role is verifying, encouraging and counselling rather than directing. Part of the unit should be formally devoted to verifying the project stages. During the development it would be useful to feed back to the learner group so that the learners can benefit from comments on good and bad practice etc It is considered good practice to involve a few employers in the demonstration and/or the review.

It is important that learners document each stage of the project. The content will differ according to the specific project but in each case it should include complete, relevant documentation of all stages of the project to agreed standards, and critical evaluation of the project. It is advisable for learners to keep a log of the project as this can be used as part of their assessment evidence.

Assessment

Evidence will be obtained by validating the deliverables produced at each milestone against the agreed plan ie project selection, planning and outline specification or project selection, planning and detailed design, implementation, and project demonstration. If milestones are missed learners should demonstrate the remedial action taken. Demonstration should be to a known audience.

Links

The unit is intended to integrate skills and knowledge from the core units with other units from the rest of the programme. Learners should be aware of the significance of knowledge and experience gained from earlier work. In particular, knowledge and skills could be drawn on from *Unit 7: Quality Systems*.

Resources

Learners should have access to a wide variety of relevant software tools including management tools and resources depending on the specific project. Acknowledgement and support should be given for the use of relevant software tools not usually used in the centre. Centres should try to involve industrial organisations to bring realism and relevance to the project.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Hughes, B and Cotterell, M — *Software Project Management* — (McGraw Hill, 2002) ISBN: 0077095057
- Pressman, R S — *Software Engineering — A Practitioner's Approach* — (McGraw Hill, 2000) ISBN: 0077096770

Specialist units

block B

Unit 7: Quality Systems

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

This unit will enable the learner to learn about the quality process as applied to IT related systems development. Quality control and assurance relies on the establishment of standards by which projects can be measured. This is carried out through reviews, tests and inspections to ensure that the end product meets requirements.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Understand the need for **quality assurance** during all stages of the development of an IT system
- 2 Employ standard documentation in the **quality control** of development and maintenance
- 3 Employ **project management tools**
- 4 Contribute to the **review of stages of system development**.

Content

1 Quality assurance

Standards: compliance against national and international standards, quality standards, ISO 9000, best practice

Cost of quality: eg extra cost of design, testing for compliance, insurance, etc

Risk and failure: technical risk, business risk, impact assessment, risk assessment

Service level agreement: planning, scheduling, measurement and control of facilities to agreed levels of service

Quality management issues: asset management, network security tools, firewalls, internet security, real time systems, application design

2 Quality control

Control issues: quality plan, quality manual, referencing systems, version control, indexing/cross-referencing

Change control: request for change, implementation, review

3 Project management tools

Project management: development of project to meet organisational needs using resources and skills within costs, timescales and quality

Tools and techniques: Gantt charts, CPM, PERT, project management software

System documentation: quality assurance teams, quality review meetings, estimating models

4 Review of stages of systems development

Development methodology: analysis and development tools, systems specification and design

Systems testing: planning, design, management, execution and reporting of testing, prototyping, testing tools and techniques, walkthroughs and inspection records

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Understand the need for quality assurance during all stages of the development of an IT system	<ul style="list-style-type: none"> • select appropriate standards for a system • assess the risks associated with the development of a system • examine the level of service requirements of a system
2 Employ standard documentation in the quality control of development and maintenance	<ul style="list-style-type: none"> • produce a quality plan for selected system • identify the contents of a quality manual for a system • recommend a referencing facility for system documentation
3 Employ project management tools	<ul style="list-style-type: none"> • define timescales and milestones of system development • apply project planning and management tools • evaluate system documentation using suitable tools
4 Contribute to the review of stages of system development	<ul style="list-style-type: none"> • justify the selection of a development methodology • verify conformance of development to quality procedures • evaluate testing strategy of system development

Guidance

Delivery

This unit would benefit from reference to project developments making use of real scenarios and case studies. Group discussion and role play will help consolidate understanding and application. Teams play an important role in walkthroughs and evaluations.

Assessment

Evidence can be produced in the development of a project or through case studies by adopting specified standards throughout the project life cycle and monitoring the adherence to the standards.

Links

This unit may be linked with project development units (8, 9 and 10). It relies on the core units and units giving exposure to object-oriented analysis/design (eg *Unit 36: OOP Programming*).

Resources

It is expected that case tools will be used as a means to ensure the production of high quality products. Project management software such as MS Project or Prince should be available.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Hellingsworth, B — *Higher National Computing* — (Newnes, 2002) ISBN: 0750652306
- Hughes, B and Cotterell, M — *Software Project Management* — (McGraw Hill, 2002) ISBN: 0077095057
- Ould, M — *Software Engineering* — (US Imports, 1999) ISBN: 047199782X
- Pfleeger, S L — *Software Engineering — Theory and Practice* — (Prentice Hall) ISBN: 0130812722
- Pressman, R S — *Software Engineering — A Practitioner's Approach* — (McGraw Hill, 2000) ISBN: 0077096770

Unit 11: Financial Systems

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

The unit covers the structure of financial systems in an organisation and the auditing of those systems. Learners will learn how both manual and computerised accounting systems operate and how they are controlled and safeguarded. They will be introduced to the concept, principles and techniques of auditing.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Analyse the functioning of an organisation's **financial systems**
- 2 Understand the **uses and limitations of financial statements**
- 3 Compare different **software** for creating financial systems
- 4 Understand the principles of **auditing**.

Content

1 **Financial systems**

Systems: structure of organisations and their effect on systems, organisation of the accounting function; manual, computerised

Financial records: capital ledger, purchase ledger, nominal ledger, stock records, trial balance, financial statements

Fundamental accounting concepts: double entry, prepayments and accruals, going concern, prudence, consistency

2 **Uses and limitations of financial statements**

Uses and limitations: budgeting, costing, variance analysis, decision making

Financial statements: ledgers, balances; company financial accounts, management accounts

3 **Software**

Software: spreadsheets, financial packages (eg Sage, Byzantium)

Comparison techniques: ease of creation of systems, security, adaptability

4 **Auditing**

Auditing: verification techniques, physical examination, re-performance, third party confirmation, vouching, documentary evidence, identifying unusual items, compliance testing, substantive testing, sampling, confidence levels, selection techniques (random numbers, interval sampling, stratified sampling)

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Analyse the functioning of an organisation's financial systems	<ul style="list-style-type: none"> • analyse the structure of financial systems in organisations • explain the purpose and use of the different financial records • explain the importance and application of the fundamental accounting concepts
2 Understand uses and limitations of financial statements	<ul style="list-style-type: none"> • describe the financial statements produced • explain the uses of financial statements • discuss the limitations of the information produced in financial statements
3 Compare different software for creating financial systems	<ul style="list-style-type: none"> • create a financial system using a spreadsheet • use an application package to manage a financial system • compare the effectiveness of computerised financial systems
4 Understand the principles of auditing	<ul style="list-style-type: none"> • describe the auditing techniques available within organisations • perform an audit based on information contained within an organisation's records • discuss the outcomes of this audit

Guidance

Delivery

Learners should be exposed to a variety of accounting systems and it may be possible for them to visit a local organisation to see the accounting system in operation. Unless learners are in employment and able to use financial information from their own organisation, it is unlikely that they will be able to use real business entities for auditing purposes. Case studies and role plays should be used to cover auditing practices and procedures. It is recognised that centres will not necessarily have access to computerised accounting packages and hands-on experience of such packages would benefit the learner. Learner should have an understanding of the operation and advantages of computerised accounting packages.

Assessment

Evidence may be in the form of assignments, investigations of specific business organisations or case studies. Learners will need to provide evidence that they understand the functioning of an accounting system and that they have the ability to audit such a system. Owing to the sensitive nature of financial and auditing information, it is likely that evidence will come from simulations and case studies rather than real-life situations.

Links

The production of the financial system using a spreadsheet within this unit can be linked with any unit requiring operation of a spreadsheet.

Resources

Companies such as Video Arts produce a variety of videos which may be useful in covering financial topics.

Worldwide websites can be useful in providing information and case studies (eg www.bized.ac.uk which provides business case studies appropriate for educational purposes).

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Curwin, J and Slater, R — *Quantitative Methods for Business Decisions* — (Thomson Business Press, 1996) ISBN: 1861520271
- Wood, F — *Frank Wood's Business Accounting* — (FT Prentice Hall, 2002) ISBN: 0273655523

Unit 13: Data Analysis and Design

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

An understanding of databases is fundamental to the development of any significant information system. Database systems are predominant in the world of IT and continue to demand more complex data structures as applications get increasingly sophisticated. The aim of this unit is to provide an essential knowledge of database systems including design principles, practical implementation and development skills for both system designer and software engineer.

The importance of structured query languages should be stressed, and once created, databases will be used or demonstrated for a variety of tasks including querying and report writing.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Understand **data models and database technology**
- 2 **Design a relational database** to meet user requirements
- 3 Use **manipulation and query tools and techniques**
- 4 **Implement and test** database design.

Content

1 Data models and database technology

Models: identify a range of data models and explain their structure and contribution to past, current and future database developments. Examine why certain models have become obsolete and been superseded by newer models

Types: hierarchical, network (CODASYL), relational

Technology: look at 'File Based Approach' systems and DBMS (database management systems) and the contribution they have made to database technology

New developments: look at how databases have evolved to allow for more dynamic storage and search facilities eg data mining and data warehousing

Approaches: top-down — entity analysis techniques, entities, attributes, key identifiers, relationship types and enterprise rules, entity relationship diagrams (ERDs), degrees of relationships. Bottom-up — introduction to problems of redundancy, update anomalies, purpose of normalisation, functional dependency, determinacy diagrams and identification of un-normalised data structures, development of first, second and third normal forms

2 Design a relational database

Designs: select suitable data types, entity and referential constraints, convert logical database design to physical implementation using appropriate visual tools and structured query languages

Relational requirements: database must be fully relational with evidence of linked tables that are accurate and appropriate to the context of data within the design

Application links: database applications, identification and use of data sources and access via 4GL programs

3 Manipulation and query tools and techniques

Data manipulation: use of query languages and visual tools for database maintenance, inserts, updates and amendments of data

Query and reporting: query languages and query by example (QBE) to extract meaningful data, including formatting and use of functions/formulae, report writing tools, links to stored queries, design and format of reports, including graphical output

4 **Implement and test**

Data analysis: identification of data requirements from different user perspectives, comparison of top-down and bottom-up approaches to data analysis, their strengths and weaknesses

Data definition: documenting results from data analysis, data models/notations, data dictionaries, use of supportive software including database products and data modelling software tools

Testing procedures: carry out tests for reliability and consistency within the database. Look at issues such as verification and validation techniques. Look at different ways of testing

Control mechanisms: examine a range of procedures that could be used to ensure data integrity and to reduce error at the input, processing and output stage

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Understand data models and database technology	<ul style="list-style-type: none"> • provide evidence to support an understanding of different data models. compare and contrast different data model structures and examine their contribution to database development • examine case material that focuses on developments such as data mining and data warehousing • analyse the different approaches to database design
2 Design a relational database to meet user requirements	<ul style="list-style-type: none"> • apply data analysis and design techniques to develop a fully relational database with minimum of six tables • verify that a design meets user requirements and provide justification of the database design • use a range of database tools and techniques to demonstrate a more advanced level of understanding and application
3 Use manipulation and query tools and techniques	<ul style="list-style-type: none"> • incorporate a query language/languages into the database design • use a range of visual tools to enhance the database design • demonstrate the extraction of meaningful data through the use of query tools
4 Implement and test database design	<ul style="list-style-type: none"> • provide documentation to support the database implementation • demonstrate ways in which the database has considered the areas of verification and validation • evaluate a range of testing techniques and apply one to your own database design

Guidance

Delivery

This unit builds upon the introductory database unit and it is therefore assumed that learners have the knowledge and skills to produce a more complex relational database. There should be a strong emphasis on the practical application of database design and development skills.

Assessment

Evidence is likely to be in the form of a practical assignment or case study which provides enough scope to fulfil all the learning outcomes and gives learners the opportunity to design an advanced relational database. Learners should be introduced to data manipulation, query and reporting tools so that they can be incorporated into their own designs. Evidence will also include draft designs and written evaluations of testing techniques.

Links

This unit is intended to be linked with the core *Unit 2: Systems Analysis* and *Unit 4: Database Design Concepts*.

Resources

Appropriate database software with a standard structured query language facility should be available, a client-server database is strongly recommended. Suitable programming languages/4GLs should be available for use or demonstration.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Bowman, J et al — *The Practical SQL Handbook: Using Structured Query Language* — (Addison-Wesley, 1996) ISBN: 0201447878
- Dowling, N — *Applying Software: Database Design and Management* — (Continuum, 2000) ISBN: 0826453902
- Richie, C — *Relational Database Principles* — (Letts Educational Ltd, 1998) ISBN: 1858053633

Unit 14: Management in IT

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

The unit aims to provide the generic skills and knowledge required by a manager in the information technology sector. Such managers have additional pressures of having to deal continuously with change and participate effectively with management at all levels, including senior management, in the development of strategy.

In addition to techniques for staffing and budgetary control, the unit also covers techniques for keeping abreast of developments in information technology.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Apply principles of **staff management**
- 2 Satisfy **organisational requirements**
- 3 Participate in **strategic planning**
- 4 Identify **current developments in information technology**.

Content

1 Staff management

Staff recruitment: job descriptions, selection criteria, preparation for interview, administrative and induction processes, line management structure

Motivation of staff: current theories, leadership, participation, management of change, team structure and management

Staff administration: scheduling including links with project management, monitoring performance, appraisal, implications for contract staff

2 Organisational requirements

Organisation charts: roles and responsibilities of employees, organisation charts for IT departments and other functional areas

Financial planning and control: investigation of an organisation's budgetary procedures, bidding procedures, budgetary monitoring systems, production of financial reports

Software tools for management: investigation of available tools (eg diary systems, spreadsheets, intranet, decision support systems), identification of tools with appropriate applications, project management software, management information systems

3 Strategic planning

Strategic planning: the aim of strategic planning, the role of IT developments in strategic planning

Maintaining currency: research methods (eg periodicals, internet, conference etc), networking (human contacts), accreditation

Senior management links: production of necessary documentation (reports, briefs etc), the role of service level agreements, the need for security and disaster planning

4 Current developments in information technology

Impact issues: how developments in information technology affect strategic planning

Developments: identify a range of new developments in information technology and also examine the role that the internet has had on organisational environments and strategic planning

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Apply principles of staff management	<ul style="list-style-type: none"> • produce the documentation necessary for staff selection • evaluate theories concerning staff motivation and the management of change • generate staff administration documentation
2 Satisfy organisational requirements	<ul style="list-style-type: none"> • recommend an implementable organisational structure • produce reports associated with financial planning and control • effectively use a software tool for decision support
3 Participate in strategic planning	<ul style="list-style-type: none"> • critically evaluate the role of it in strategic planning • report on the effectiveness of a typical it development • produce documentation to assist management in strategic planning
4 Identify current developments in information technology	<ul style="list-style-type: none"> • state how developments in information technology impact on strategic planning • evaluate the importance of embracing new developments in technology • evaluate the impact that the internet has had on strategic planning and decision making

Guidance

Delivery

The unit has to be delivered within a realistic management context. Learners should be placed in the role of a computer manager in an organisation and set the tasks identified by the assessment criteria. Centres should provide the management tools, theories and systems to support the learner in satisfying the requirements of the unit.

Assessment

Centres are advised to generate most of the evidence through real-life or simulated exercises. A day-release learner working in a computer environment should be able to obtain details of the procedures and tools used for computer management in their workplace. Others will require visits or input from external speakers to provide context. Case studies will be appropriate for much of the delivery.

It would be most appropriate for the evidence to be in the form of reports and presentations. Learners should be encouraged, wherever possible, to use appropriate computer-based tools.

Links

Centres should ensure that learners taking this unit have significant knowledge of the context of computers within organisations.

Although it can be delivered as in a stand-alone unit, centres would benefit from combining the study of this unit with *Unit 23: Project Management*.

Resources

Centres are advised to build up a stock of appropriate scenarios and case studies to set the context for the topics covered. Centres should have appropriate software tools for budgetary control, and presentations. There should also be materials to help learners keep abreast of current developments in information technology.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Cameron, S — *The Business Students Handbook* — (FT Prentice Hall, 1999) ISBN: 0273630830
- Stokes, D — *Marketing: A Case Study Approach* — (Continuum, 2000) ISBN: 0826454062

IMIS journals are an excellent reference material for this subject (www.imis.uni-osnabrueck.de/english)

Unit 15: End-User Support

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

Users need training in the systems they use and since problems always occur, they also need support from knowledgeable and sympathetic staff within a formal framework of systems support. A major element of support is the provision of a service to install the hardware and software to satisfy changed requirements. This unit supplies the framework for developing the knowledge and skills needed by those who aim to provide this important service.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Deal with **user problems**
- 2 **Install software** for an end-user
- 3 **Install/upgrade hardware** for an end-user
- 4 Train an end-user to use new **software products**.

Content

1 User problems

Analysis of problem: ability to identify a user's requirements from a computer system, ability to analyse or determine a problem from a user's description

Evaluation of possible solutions: immediate response, advice on access to manuals, help systems etc, obtaining additional support

Human factors: appreciation of user frustration, appropriate communication techniques, situations requiring communication eg changes/amendments

User support systems: role of help desks, logging systems for faults and solutions, service level agreements

Support: demonstration of support for specific areas of the organisation such as sales

2 Install software

Installation planning: analysis of users' requirements, installation schedules, acceptance standards, user involvement

Installation programs: installation and testing of software, device drivers, support files etc, configuring software to suit specified user needs and the machine operating environment

Re-configuration of installed software: re-configuration of software to suit changes in user requirements or to solve problems, testing of re-configuration

3 Install/upgrade hardware

Installation planning: justifications for upgrades (eg new OS requires more RAM, new application needs larger hard-disc, need DVD instead of CD drive etc), new task needs new hardware (eg CD writer), keeping track of new developments

Installation of hardware: installing and configuring supplied hardware to a manufacturer's standard instructions (hardware may include single or multiple circuit boards, memory modules, storage of I/O devices etc), adherence to health and safety procedures

Testing: testing new installation against specified acceptance standards, taking remedial action

4 Software products

Training areas: applications, security, routine maintenance

Training tools: a survey of tools eg manuals, guides, multimedia, courses etc, evaluation of appropriateness of different training tools

Training plans: identifying different training needs, producing a training schedule, evaluating training

Individual training: analysis of requirements of user, identify capability of user, employing appropriate tools with necessary support, delivering tailored training

Individual education: developing user responsibility (eg accuracy, prevention of viruses), encouraging users to increase knowledge of computing

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Deal with user problems	<ul style="list-style-type: none"> • accurately analyse user reported faults • provide a solution in a considerate and helpful way • comply with the requirements of help desks and fault logging systems • evaluate the degree of compliance with a service level agreement • provide examples of support for specific areas of the organisation
2 Install software for an end-user	<ul style="list-style-type: none"> • plan for installation • install and successfully test software • re-configure and thoroughly test software to satisfy a user's requirements
3 Install/upgrade hardware for an end-user	<ul style="list-style-type: none"> • prepare justification for upgrade/installation of new hardware • plan for installation • install and successfully test hardware
4 Train an end-user to use new software products	<ul style="list-style-type: none"> • evaluate training tools • produce and evaluate a training plan for a selected product • produce materials to support training • train and educate a user to use an unfamiliar software product

Guidance

Delivery

There should be an emphasis on the practical skills and human aspects of user support. Where real-life situations are not available, closely controlled role-play would be necessary. The learners should be given ample opportunity to practise dealing with end users both in training and in solving problems.

Assessment

Evidence is likely to be obtained from simulations or from evidence obtained in the workplace.

The assessment of outcomes could take the form of solving installation and re-configuration problems within a defined environment.

Logbooks must be employed to capture evidence of satisfactory completion of outcomes. The ability to deal effectively and sympathetically with end users should be emphasised. Emphasis should also be placed on using systems to solve problems rather than the application of detailed technical knowledge. User statements and supervisor observation reports would also provide useful evidence for this unit.

Links

This unit can be offered as a stand-alone and is particularly relevant to those who wish to become computer technicians. This unit has links with *Unit 3: Programming Concepts* and also with each of the specialist project units 8, 9 and 10.

Resources

Centres will require an environment within which simulations may occur. They will require a range of training and support materials including examples of service level agreements and fault logging systems.

Computers or computing systems and software, which give learners sufficient access to be able to install and configure hardware and software will also be required. The use of obsolete equipment or software would be unsuitable.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Dick, D — *The PC Support Handbook* — (Dumbreck Publishing, 2002)
ISBN: 0954171101
- Tourniaire, F and Farrell, R — *The Art of Software Support* — (Prentice Hall, 1997)
ISBN: 0135694507

Unit 17: MS Office Solution Development

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

This unit focuses on the use of Visual Basic for Applications to extend the capability of Microsoft Office in the development of solutions that automate business processes access data and publish information to an intranet or the internet.

The unit develops Visual Basic skills for use in Office and looks at building solutions in Excel, Word, PowerPoint, Access and Outlook. The unit also looks at the use of FrontPage 2000 to design, create and publish Office solutions to the internet and intranets.

The unit requires a thorough knowledge of the Microsoft Office suite together with an intermediate level of skills in using Visual Basic such as gained from studying *Unit 39: Visual Programming Fundamentals*.

This unit presents opportunities to demonstrate key skills in problem solving, information technology and improving own learning and performance.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Apply **Visual Basic skills**
- 2 **Understand design issues** of Office solutions
- 3 **Build solutions** in Office applications
- 4 Use FrontPage to **publish Office solutions**.

Content

1 Visual Basic skills

Visual Basic editor: macros, procedures, writing and running code, setting properties, environment options

Debugging and error handling: types of errors. Break mode. Debugging techniques: break points, step through, Watch expressions, Locals window, Call stack, use of Immediate window. Error handlers

Variables and constants: declaration and use of variables. Scope of variables. Data types (String, Integer, Long, Single, Double, Currency, Boolean, Variant). Conversion between data types. Use of pre-defined constants

Control flow structures: If...Then...Else, Select Case, Do...Loop, For...Next, For...Each

Working with forms: forms, toolbox, controls, events, menus, command bars, toolbars

Communication with users: MsgBox, InputBox functions. Validation

Object models: objects, properties, methods, Office Object models, type libraries, Object Browser

2 Understand design issues

Office solutions: Office, programmability, designing solutions

Deploying solutions: package and deployment wizard, setup files, exe files, custom templates, security

Principles of user interface design: user control, modal interactions, simplicity, consistency, personalisation, feedback, user assistance

3 Build solutions

Excel: Excel Object Model, workbooks, worksheets, ranges, charts, pivot tables, publishing as html

Word: Word Object Model, documents, templates, ranges, selections, autotext, table objects

PowerPoint: PowerPoint Object Model, presentation object

Office Assistant: the Office Assistant Object Model, balloons

Access: the Access Object Model, databases, reports, web reports. ADO Object Model, connections, commands, recordsets, navigating, filtering. OLE DB. Querying data using Access Query Wizard, SQL. Handling errors

Outlook: the Outlook Object Model, items, events, messages

COM Addins: designing, creating, registering

4 **Publish office solutions**

FrontPage: FrontPage webs, server extensions, page editor, publishing

Managing a Website: reports and tasks, categories

FrontPage solutions: FrontPage Object Model, Web Object Model, Page Object Model

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Apply Visual Basic skills	<ul style="list-style-type: none"> • start, pause and stop program execution • use the standard control tools to create the user interface • set properties of forms and controls at design time • create menus and implement menu functionality • use the visual basic debugging tools • access and set properties of controls from code • declare and use variables • get and validate data from users • use data types correctly • use control flow statements of selection and iteration • create and use procedures and functions
2 Understand design issues of Office Solutions	<ul style="list-style-type: none"> • identify when programmed solution is required • analyse benefits and disadvantages of programmed solution • discuss and implement security requirements • use the package and deployment wizard • install applications • demonstrate use of principles of user interface design
3 Build solutions in Office applications	<ul style="list-style-type: none"> • design and build programmed solutions in excel • design and build programmed solutions in word • design and build programmed solutions in access • design and build programmed solutions in PowerPoint • design and build programmed solutions in outlook • design and build programmed solutions for office assistant • build and use com addins in solutions

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
4 Use FrontPage 2000 to publish Office 2000 solutions (or later versions)	<ul style="list-style-type: none"> • create a FrontPage web page • use the FrontPage editor to design and create web pages • publish the web to a server • manage the website • program in FrontPage

Guidance

Delivery

The focus of this unit is the achievement of a solid grounding in the use of developer tools in Microsoft Office. It requires a clear understanding of what can be achieved and the benefits of programmed solutions. To this end, assessment should include the ability to consider alternative solutions and justify selection of solutions. Implementation of the chosen solution should demonstrate attention to design and security aspects and where appropriate should present an effective user interface.

The unit can be used as preparatory material for the Microsoft Certified Professional examination 70–091 although it is anticipated that only a small proportion of learners will reach this standard.

Assessment

The main evidence for this unit is likely to be in the form of business solutions built in Office 2000 applications (or later versions) and demonstrating the achievement of the learning outcomes. At least one of the applications in the unit should be of sufficient complexity to simulate a real-world application.

Learners should demonstrate the use of user interface design principles and effective documentation and testing.

Links

Learners should have working skills and knowledge in basic programming techniques so that the principles presented here are delivered in context. Learners without significant programming experience are advised to complete *Unit 3: Programming Concepts* and *Unit 39: Visual Programming Fundamentals*. The unit forms a grounding for more advanced units in visual programming, for example, *Unit 22: Human Computer Interface*, *Unit 35: Distributed Design and Development*, *Unit 36: OOP Programming*, *Unit 37: VB Enterprise Development* and *Unit 38: Visual Programming Development*.

Resources

A copy of Microsoft Office 2000, Premium Edition (or later versions) needs to be available to learners. Internet Explorer 5, Office Developer Tools and Microsoft Outlook should be installed. MSDN Office Developer Help is recommended.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Aitken, P — *Developing Solutions with Office 2000 Components and VBA* — (Prentice Hall, 2000) ISBN: 01302 63062
- Jacobson, R — *Microsoft Excel 2000 Visual Basic for Applications: Fundamentals* — (MS Press, 1999) ISBN: 0735605939
- *Microsoft Office 2000 Visual Basic Language Reference* — (MSPress, 1999) ISBN: 1572319550
- *Microsoft Technologies Series*
- Smith, R and Sussman, D — *Beginning Access 97 VBA Programming* — (Wrox Press, 1997) ISBN: 1861000863

Websites

Websites that support the development of this unit include those of computing associations and employers. The following may be useful:

- <http://msdn.microsoft.com/vba> — Microsoft VBA site
- www.vbatutor.com/vbatutor.htm — online VBA Tutor
- www.vb-bookmark.com/vba.html — VBA resources
- www.vbapro.com/ — VBA resources

Web pages provide access to a further range of internet information sources. Learners must use this resource with care, justifying the use of information gathered.

Unit 18: Multimedia Design and Authoring

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

Through this unit learners will learn to design and evaluate a prototype multimedia system using an iterative approach. Through research and practice learners will identify users' needs and content. Learners will design the structure, interaction and components of the interface. A psychological understanding will be encouraged to give learners a broad understanding of the use of colour, metaphors and navigational systems. Prototypes will be designed through exploration of software prototyping tools and techniques.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Research and define users' needs through **task analysis**
- 2 Originate and plan a structure for **interaction and interface design**
- 3 Assemble audio and visual components of **multimedia prototype**
- 4 Evaluate, **develop and present prototype**.

Content

1 Task analysis

Research: literature, publications, journals, electronic data, observation, questionnaire, interview, survey

Users' needs: content, existing systems or methods, other similar systems, environmental issues, location, social context, tasks, constraints of a system, delivery platform, input, output devices

Task analysis: observations, task being performed, difficulties encountered, hesitations, question expectations, question requirements and opinions, visual perception, attention span, dexterity, confusion, organisation, learning, memory constraints

Prototype system: user-centred design, storyboards, flow diagrams, scripts, musical scores, structure map, design standards and guidelines, copyright laws

Cultural and contextual sensitivity: political, sexual, ethnic, minority groups, religious, cognitive and physical special needs, disabilities, discrimination awareness

Audio components: sampled sound, generated sound, digital audio, synthesised sound, audio feedback (sounds made in response to the users' expectation of an everyday object or interaction with an element on screen, eg camera click, light switch clicking on and off, turning a page over, to reinforce an action), speech feedback, environmental sound, music for example

Prototyping tools: proprietary drawing and painting software, for example

Originate: production of original source materials, production of appropriated source materials with particular attention paid to copyright licensing laws, scanned material, digital photography, digital video, cultural sensitivity, political propriety

2 Interaction and interface design

Screen design: quantity of information presented, grouping and prioritising of information, highlighting techniques, standardisation of screen display, presentation of text, use of typography, use of graphics, use of colour for highlighting, prioritising and drawing attention. Screen metaphors, navigation systems, video, guides or agents, animation, visual feedback, language and dynamics of screen design, innovation and creativity. Intrinsic and extrinsic rewards, feedback and playback

Communication styles: menus, windows, navigation systems, direct manipulation, form-filling, question and answer dialogues

3 Multimedia prototype

Plan structure: system diagram, flow chart, storyboard animation sequences, video, sound track, screen design, interaction, navigation system, flow chart of the system, to indicate depth and breadth of system, linking of screens, of information, information flow indicating input elements and output elements

4 **Develop and present prototype**

Evaluate with: target users, computer users and non-computer literate users

Evaluate for: cross-platform file compatibility using Macintosh file formats, using Windows file formats, browser friendly palettes, file size, file economy, file quality, and file compression techniques, frames (Java), internet browsers (Debabeliser), assessing, evaluating, checking, requirements, usability, accuracy

Develop: improve, amend edit, rearrange, replace, as a result of evaluation

Presentation considerations: file size, format, compression techniques, stand-alone applications, compiling, screen-based, point of sale, educational, entertainment, information kiosk, CD-Rom pressing techniques, worldwide web publishing

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Research and define users' needs through task analysis	<ul style="list-style-type: none"> • research and identify user needs, context, environment, and possible constraints • observe and record target users engaged in existing methods or practices
2 Originate and plan a structure for interaction and interface design	<ul style="list-style-type: none"> • design a basic structure from which to build a multimedia prototype • create, design or collect audio and visual components of a multimedia prototype
3 Assemble audio and visual components of multimedia prototype	<ul style="list-style-type: none"> • produce multimedia prototype • assess screen design, audio and interaction and adjust if necessary
4 Evaluate, develop and present prototype	<ul style="list-style-type: none"> • evaluate multimedia prototype with a range of users • develop multimedia prototype • produce a written evaluation of working methods and the prototype

Guidance

Delivery

Encouraging learners to experiment will help them to broaden their creativity and become familiar with the tools and technology. However, learners will need considerable support and guidance to overcome the obstacles and difficulties they will face.

Centres may wish to identify a person on the course team to act as a learning coach to all the learners. This is a relatively new role in higher education. The learning coach could hold regular weekly seminars with learners to discuss general progress and point out common problems. Learners need to face real problems, as preparation for those they will meet throughout their careers. Open dialogue and critical reflection will make this a positive learning experience.

With the ever-increasing demand for multimedia on the web, in education and industry, learners should be aware that not everyone uses the same delivery hardware. Development for the web brings a host of complicated issues for the Mac-based developer. This unit addresses the key cross-platform issues. Wherever possible learners should be encouraged to design generally for the lowest technical baseline and specifically for the users' needs.

Assessment

Managing an interactive multimedia project, whether for education, training, or entertainment purposes, requires careful consideration of the various elements. Learners should demonstrate the ability to consider and produce a multimedia prototype from concept through to completion.

Concept designs should be provided in the form of sketches, notes, scripts, flow diagrams, charts, screen designs, storyboards, animatics, visual and audio materials. The overall flow of the system should be completed, particularly if the prototype is incomplete.

The prototype may not be complete in all aspects. However, there should be a good interactive structure in place together with a consistent navigational system. Samples of screen design should show: consistency, organisation and prioritisation of information, usability and appropriate use of colour and text. The system should show effective use of audio feedback, music and/or speech, visual feedback, animation and/or video, overall aesthetic appeal, innovation and creative thought.

Research techniques may include: the library, the internet, CD-Rom, databases, specialist publications, galleries, exhibitions, observations, evaluations, questionnaires and interviews with practitioners. Learners should record sources carefully and accurately citing authors, titles of books, articles, journals and publications, date of publication, place of publication and country of publication. Learners should be encouraged to check facts by cross-referencing.

Intellectual property rights are at the heart of any professional multimedia production. This unit will provide a basic understanding of the various forms of intellectual property rights (for example, copyright, patent, and trademark). It will enable learners to investigate and understand how these rights are created, protected, acquired and exploited. Evidence may be presented as a part of a written assignment.

Consideration must be given to the cultural and contextual sensitivity of the content.

Links

Subject to approval, *Unit 22: Sound Production and Editing* which can be borrowed from the BTEC Higher National in Multimedia would enable the learner to study the application of sound in a multimedia context. Similarly, BTEC HN *Unit 23: Multimedia Video Post Production and Editing* would enable the learner to study the application of video in a multimedia context. Also subject to approval, centres may also choose *Unit 25: Project Management for Learning* from the BTEC HN in Multimedia to reinforce and complement the recommended approach to delivery.

From the Computing HN, *Unit 23: Project Management* will provide the necessary skills needed for learners to undertake a multimedia project. *Unit 8: Information Systems Project* would also be a relevant link.

This unit offers the opportunity to demonstrate key skills, in particular application of number, information technology and problem solving.

Resources

Software

An industry standard authoring application such as Macromedia's Director, plus software to create and edit images and to create animation and sound elements.

Support materials

Textbooks

Tutors should be aware that textbooks and websites are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Christ, R E — *Review and Analysis of Colour Coding Research for Visual Displays Human Factors*, Vol 17, no 6, pp 542-70
- Cope, P — *Teach Yourself Digital Video & PC Editing* — (Teach Yourself, 2003) ISBN: 0340857323
- Crawford, C — *The Art of Interactive Design: A Euphonious and Illuminating Guide to Building Successful Software* — (No Starch Press, 2002) ISBN: 1886411840
- Doney, A/Seton, J and Rubin, T (editors) — *Using Colour: User Interface Design for Computer Systems* — (Ellis Horwood, Chichester, 1988)
- Gould, J D and Lewis, C — *Designing for Usability: Key Principles and What Designers Think* — *Communications of the ACM*, Vol 28, no 3, pp300-11

Websites

Websites that support the development of this unit include those of Computing associations and employers. The following may be useful:

- Usability standards: HUSAT, Loughborough (<http://info.lboro.ac.uk/research/husat/use/usabilitystandards.html>)
- Usability Issues in Website Design: HUSAT, Loughborough (<http://info.lboro.ac.uk/research/husat/inuse/webpaper.html>)
- Disabled users and the Web (www.useit.com/alertbox/9610.html)
- Lynch P J — Visual design for the Interface
- Part 1: Design Fundamentals (<http://info.med.yale.edu/caim/manual/papers/gui1.html>)
- Part 2: Graphics in the Interface (<http://info.med.yale.edu/caim/manual/papers/gui2.html>).

Web pages provide access to a further range of internet information sources. Learners must use this resource with care, justifying the use of information gathered.

Unit 19: Website Design

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

This unit will facilitate the development of an awareness and understanding of the technical and creative skills required to design, construct and manage an effective e-business website interface. Learners will evaluate existing e-business sites, in the context of cross-platforms and a range of browsers. They will analyse a range of commercially available web authoring software and be required to create a viable, interactive website interface, which meets contemporary web design principles.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Assess the **design and functionality** of existing and established e-business sites
- 2 Examine a range of **web authoring tools** for creating multimedia websites
- 3 Develop an integrated set of **web pages/frames**
- 4 Develop **interactive applications** on a web server.

Content

1 Design and functionality

The users: range of users (eg expert, regular, occasional, novice, special needs), needs of user (psychological, cultural, social and environmental considerations, including health and safety)

Site analysis: purpose of site (educational, promotional, informative, commercial), correspondence of site objectives with organisational objectives, planning the site (eg storyboarding, grouping tasks into logical sets, hypermedia linkage, structure, key wording for search engine spiders, graphical design, audio capture/edit, video sources, animations, text design), updating and maintenance plan, testing plan

Design: rules and heuristics for good website design, protection and infringement of copyright, review of proprietary examples, evaluating functionality of design (timings, navigation, ease of use, effort, user satisfaction), design tools and software for evaluating design (eg Web Garage). Management of website content (content management applications), conformity with software standards (ie TickIT)

Environment: review of current internet browser software and introduction of features — URLs, HTML, Javascript, Java applets, plugins, PERL protocols etc Hardware and operating environments — computer platforms, operating systems, design implications

Browsers: differences between current browsers and protocols, locating internet sites with freely available applets and CGIs for incorporation into individual sites, differing browser treatment of CSS (cascading style sheets), scripting languages

2 Web authoring tools

Mark-up and scripting languages: relationship between different mark-up languages (SGML, XML, HTML, DHTML), structure of ML, ML tags and their documentation, current ML features (tables, frames etc), current changes to ML standards, use of CSS (Cascading Style Sheets) and scripting languages

Development: selection of software, design of solution, development of application

Software: evaluation of suitability of a range of commercial web development software: Macromedia products (Dreamweaver, Flash, Fireworks), Adobe products (GoLive, PhotoShop, Acrobat) and other products (eg HoTMetal). Awareness of e-commerce solution providers

3 Web pages/frames

Page elements: development of skills in the use of mark-up language (eg HTML etc) — headings, rules, frames, buttons, text and list boxes, hyperlinks/anchors, graphical images, clickable images, maps etc

Accessing images: using scanner, digital and conventional cameras, video camera (stop motion), transparencies, clip art, graphics tablets and images on the internet

Image handling: file and compression formats for different applications (eg EPS, PICT, GIF, PSD, JPEG), save with attachments, layers and channels, image transformation, canvas sizing, resolution issues for screen and print and colour modes (eg GREYSCALE, RGB), streaming for video production

4 **Interactive applications**

Server side interaction: accepting data from users and responding with appropriate actions and responses based using the CGI (common gateway interface) or equivalent, cookies

Database connectivity: the common methods of using/accessing databases from CGI applications eg ODBC, JDBC, SQL

Server interaction: linking via a web server/internet with a range of back-end systems including databases using current protocols

Hardware: computer platforms, advanced input and storage devices (disc technology, disc writers, additional storage hardware), archiving and compressing data

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Assess the design and functionality of existing and established e-business sites	<ul style="list-style-type: none"> • evaluate existing e-business websites according to established rules of web design • apply software for evaluating design to existing sites and own site(s)
2 Examine a range of web authoring tools for creating multimedia websites	<ul style="list-style-type: none"> • briefly describe the different mark-up and scripting languages • investigate the features of a range of commercial web authoring tools • evaluate the suitability of a selected range of commercial web authoring tools
3 Develop an integrated set of web pages/frames	<ul style="list-style-type: none"> • produce a complex set of linked interactive pages, using a range of authoring tools, including mark-up languages and drawing from existing scripting language resources • use a range of devices to collect graphical data • use a range of software tools to manipulate graphical data and incorporate it into linked pages
4 Develop interactive applications on a web server	<ul style="list-style-type: none"> • use a web server to host an e-business website interface • design, write and test an interactive application in a suitable language • manage the integrity of files on the server

Guidance

Delivery

This unit is best delivered in a network environment. The delivery should be mainly practical and centres are advised to use both simple and complex web specifications. In addition to technical aspects, learners should be guided in ensuring that the web pages produced are user friendly.

Assessment

Learners will provide a range of evidence. This will include a report detailing learner experiences of adapting to new hardware and software. Assessment needs to be included which shows learners' ability to evaluate websites. Learners should also be required to produce a portfolio of documentation of website applications produced.

Links

Learners need to be familiar with standard business applications and be able to navigate the internet without difficulty. The unit links with the *Unit 30: Java Programming* and *Unit 42: Visual Programming*. Learners may wish to enhance their own knowledge of CGI languages (scripts, Java, Perl).

Resources

Resources required are:

- *Hardware:* access to appropriate computers, image recording equipment, an LAN and suitable web server
- *Software:* ML tool, Macromedia and Adobe web authoring software, relevant server operating system and appropriate CGI compatible language
- *Library:* operating system manuals, ML reference.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. Web design software is supported by many hundreds of books including the software houses themselves. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Bruce, E — *Teach Yourself Macromedia Dreamweaver* — (Sams, 2002)
ISBN: 067232346X
- Buchanan/Lukaszewski — *Measuring the Impact of Your Website* — (Wiley,1997)
ISBN: 0471172499
- Cato, J — *User Centered Web Design* — (Addison Wesley, 2001) ISBN: 0201398605
- Stauffer, T — *HTML by Example* — (Que,1999) ISBN: 0789722283

Websites

Websites that support the development of this unit include those of computing associations and employers. The following may be useful:

- www.macromedia.com
- www.tips-tricks.com
- www.builder.com
- www.webreview.com
- <http://msdn.microsoft.com/workshop>
- www.reallybig.com
- www.webopedia.com
- www.webmonkey.com
- www.webreference.com

Web pages provide access to a further range of internet information sources. Learners must use this resource with care, justifying the use of information gathered.

Unit 20: Internet Server Management

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

As more organisations adopt internet-aware software there is an increasing need to understand the implications of internet technologies. In addition many organisations are now creating their own internet and intranet sites and therefore the successful management of sites and servers is becoming fundamental to network managers. The aim of this unit is to provide an introduction to internet server management within the context of a network operating system. This unit will link server management with other major operating system topics such as administration, security and networking concepts, with particular emphasis on the TCP/IP protocol stack. Learners will be able to identify the necessary network infrastructure that must be in place, the administrative tasks required and security implications and possible solutions to hosting a secure internet site.

The unit focuses on an appropriate network operating system, such as Microsoft Windows.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Perform **administrative tasks** to manage network users and resources
- 2 Apply architectural concepts to the **design/evaluation of networks**
- 3 Apply appropriate **security** to safeguard network resources
- 4 **Configure an internet server.**

Content

1 Administrative tasks

Administration of a computer network: workgroups (peer to peer) and domains, the benefits of networks, the role of servers, domain controllers and workstations, features of a network operating system, features and benefits of a domain, the role and benefits of directory services (Active Directory), logging on and the user authentication process, introduction to routine administrative tasks such as users, groups, printers, security, network events, resources, integrity, backup and restore, and discs, the available administrative tools

Creating and managing user accounts: local accounts and domain accounts, the scope of accounts, granting rights to users, creating accounts with many commonalities by using templates (domain controllers only), replication of user accounts between domain controllers, using multiple domain controllers for fault tolerance and load balancing, provision for accounts for users logging on from other Microsoft operating systems (mixed mode versus native mode), matching email addresses to user account names (user principle name), logon scripts to define the user's environment

Managing access to resources by using groups: groups on local computers and domain controllers, built-in, user-defined and special groups, the scope of groups (local, domain local, global and universal), rights assigned to built-in groups, the benefits of managing groups rather than users, brief introduction to the NTFS filing system with an overview of permissions, benefits of managing groups rather than individual users

2 Design/evaluation of networks

Examining the network: scope of networks (LAN and WAN), network topologies eg bus, star, ring, mesh and hybrid, network technologies, eg Ethernet, Token Ring, ATM, FDDI and Frame Relay, Ethernet frame structure and the role of MAC addresses, connectivity devices and technologies ie network interface cards, cabling, repeaters, hubs, bridges, switches, routers, gateways, remote access (dial-up and VPN), PSTN, ISDN, X.25 and ADSL

Examining network protocols: open and vendor-specific protocols, the OSI 7-layer model and its role and evolution, ie encapsulation, interfaces between related layers, link communication devices to the appropriate layer, the need for protocols to facilitate communication between disparate systems, non-routable protocols ie NetBEUI, routable protocols, ie TCP/IP, AppleTalk and IPX/SPX (NWLink), showing their relationship to the ISO 7-layer model, protocol binding on clients and servers, dial-up protocols, eg PPP and SLIP, VPN protocols, eg PPTP and L2TP with IPsec, communication methods, ie unicast, multicast and broadcast with an evaluation of the benefits and disadvantages of each

Examining TCP/IP: the TCP/IP layers (application, transport, internet and network) and their relationship to the ISO 7-layer model, the concept and nomenclature of a classful IP address, the core protocols ie HTTP, FTP, TCP, UDP, IP, ICMP, IGMP, ARP, the use of port numbers to identify an application, a socket as a combination of IP address and port number, diagnostic utilities, ie Arp, Hostname, Ipconfig, Nbtstat, Netstat, Ping, Tracert, Pathping, address resolution from IP address to MAC address and the role of routers, the need for user-friendly names as opposed to numbers, host names, NetBIOS names, name resolution techniques using hosts file, Lmhosts file, DNS, WINS, DNS and WINS combined, the transfer of data by division into segments, packets and frames and how this flows through the protocol stack, the role of routers and routing protocols, RIP v1, RIP v2 and OSPF, the basics of how routing tables are propagated to other routers (overview only, an in-depth treatment is outside the scope of this unit), how subnet masks are used to assist the locating of hosts on a routed network

Examining IP addressing: classful IP addressing, the components of an IP address ie network ID and host ID, IP address classes, ie class A, B, C, D and E and the number of available networks/hosts in each, binary and dotted decimal notation (DDN), identifying classes from the significant bits, default subnet masks, determining network and host IDs, subnetting a network by assigning separate network IDs to each subnet, how to identify local and remote hosts, rules for IP addresses, private network IDs, methods of assigning IP addresses, ie static and dynamic and a justification for each eg specialised servers requiring static addresses and the inherent problems of assigning and documenting thousands of IP addresses

Optimising IP address allocation: describe the problems with classful addressing ie depletion of IP addresses and capacity restrictions of routing tables containing many class C network IDs, the impact on network bandwidth of periodic broadcasting of large routing tables, binary IP addressing by the classless inter-domain routing (CIDR) technique and binary subnet masks, the CIDR notation using a number to specify the number of bits in the network ID, converting CIDR to DDN, using Boolean ANDing to identify the network ID, how to identify local and remote hosts using CIDR, bit patterns of binary subnet masks, calculate the number of available host IDs, supernetting to combine multiple addresses into a single network ID to reduce the size of routing tables, subnetting to segment a single network ID into sub networks in order to reduce noise on a network

3 Security

Managing data by using NTFS: an outline of FAT (and FAT32) as linear lookup tables as opposed to NTFS as a tree structure, inability to assign permissions to individual files on a FAT/FAT32 volume, NTFS security ie file and folder permission, inheritance, allowing and denying of permissions, comparison of NTFS 4 with NTFS 5 and the need for service packs in an NT4/Windows 2000 dual booted system, access control lists (ACL) and access control entries (ACE), combining multiple NTFS permissions when a user is a member of more than one group, the effect on NTFS permissions of copying and moving files

Providing network access to file resources: shared folders, share permissions, allowing and denying shared folder permissions, combining shared folder permissions, how users connect to shared folders, combining shared folder with NTFS permissions, administrative shares, publishing shared folders in active directory to facilitate searching, web sharing of folders including aliases and permissions, an outline of distributed file systems (stand-alone and domain-based), using DFS for fault tolerance and load balancing, replication of DFS links

Implementing security in an NOS: encrypted file system, recovery agent, securing the recovery agent certificate, using local group policy to secure desktops and services to prevent unauthorised use or access, predefined security templates, the security configuration and analysis tool to compare the security configuration with a template and to rapidly configure local group policy, auditing access to resources

Installing, configuring and troubleshooting certificate services: public key infrastructure, the content and purpose of certificates, certificate authorities ie enterprise, subordinate and standalone CAs, issuing and revoking certificates, mapping certificates to user accounts

4 **Configure an internet server**

Examining internet services: the role of TCP/IP on the internet, the need for public IP addresses, review of email, the worldwide web, chat programmes, internet news, FTP and Telnet, intranets for internal use, extranets to connect intranets, the function of DNS, browsers, URLs, internet information services (IIS)

Controlling internet site access: TCP port numbers, access permissions ie read, script source access, write and directory browsing, execute permissions, authentication methods ie anonymous, basic, digest and integrated Windows authentication, filtering IP addresses and domain names, server certificates and secure sockets layer (SSL), client certificates

Configuring internet access for a network: using routers and Proxy servers as components of a firewall, network address translators ie NAT, ICS and Proxy server or IAS, configuring RRAS for point to point and demand dial routing; these aspects need only be treated at a level sufficient to give learners an insight into the issues

Configuring an internet server: the need for TCP/IP and a static IP address, a valid domain name, NTFS security, default and additional websites, home directories, assigning default documents, using IIS to remotely manage servers

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Perform administrative tasks to manage network users and resources	<ul style="list-style-type: none"> • for a case study produce: <ul style="list-style-type: none"> - account naming convention - log on hours - terminal restrictions - password change policy - structure of global, universal and domain local groups - assignment of users to built-in groups - rights of specific users • implement and test domain user accounts in accordance with plan • shut down a domain controller, add some domain user accounts, restart domain controller and view replication
2 Apply architectural concepts to the design/evaluation of networks	<ul style="list-style-type: none"> • design a LAN for a specific purpose or assess an existing network for fitness of purpose • identify the various parts (software and hardware) of a network system and relate it to the 7-layered model • differentiate between different kinds of network, network topologies and network operating systems • diagnose connectivity problems using utilities • for a company requiring 2000 computers in 20 segments, optimise IP addressing using class b and c IP addresses

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
3 Apply appropriate security to safeguard network resources	<ul style="list-style-type: none"> • for a case study produce: <ul style="list-style-type: none"> - file/folder security for network access - web sharing for a folder - a domain based DFS root - EFS security and identify the circumstances where certificates need to be exported - define local group policy - implement the plan and use the security configuration tool • write a report on the suggested usage of DFS for a specific installation eg a large call centre client database • install CA, issue certificates for specific purposes
4 Configure an internet server	<ul style="list-style-type: none"> • install IIS • for a case study produce appropriate access restrictions • install, configure and test NAT(or ICS)

Note: the case studies referred to above may be either one single case study or separate case studies.

Guidance

Delivery

This unit may be delivered as a stand-alone package or alongside other units and in particular as a precursor to other Microsoft mapped units.

Most learner effort should be spent in practical activities in this unit. It may be that the major part of these could be achieved in groups, each learner developing a different department in an organisation or managing a different domain, for instance. In addition, if learners intend to pursue vendor certification status then exposure to multiple choice style questions would be beneficial. There are many good examples available on the internet and in 'exam cram' style books; however, emphasis should be placed on gaining sound practical experience rather than providing textbook answers.

Assessment

There is an obvious need to combine practical and theoretical assessment. The theory can be delivered by using lectures, demonstrations and case studies that consider existing networks. Learners can produce reports that describe features and show an understanding of the principles and definitions. The practical aspects provide an opportunity for learners to design, install and maintain a computer network. It is essential that a logbook is maintained for recording both progress and effectiveness.

Links

There are links to the other units that focus on networking and network operating systems such as, *Unit 5: Networking Concepts*, *Unit 12: Networking Technology* and *Unit 31: Networking Infrastructure*.

Resources

In order to deliver this unit centres must have a number of computers that can be configured as servers or advanced servers with Active Directory ie domain controllers for a Microsoft system or equivalent for other vendors' systems. Refer to the Microsoft hardware compatibility list (HCL) on the installation CD or at:

- www.microsoft.com/windows2000/default.asp

The domain structure should consist of a domain tree with a root domain and child domains; each child domain should ideally contain two domain controllers to demonstrate fault tolerance and replication. A router (or RRAS) would be desirable but not essential. As learners will be configuring IP addresses, care must be taken if connected to the internet or the institute's intranet due to learners being granted administrative rights.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- *ALS Networking Essentials Plus 3rd Edition* — (Microsoft Press, 2001) ISBN: 0735609128
- Maione, D — *MCSE, MCSA Training Guide 70-215* — (Pearson, 2003) ISBN: 0789728818
- *Microsoft Official Curriculum Course 2151AC* Microsoft Corporation

Unit 21: Work Experience

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

Work experience and work placements are considered to be a vital part of the learning process, providing learners with an opportunity to apply skills and knowledge gained within the qualification, to a practical working scenario.

This unit aims to formalise the structure of work experience/placements by offering a comprehensive insight into the process of planning, working within a set framework and evaluating the work experience.

This unit will provide an overview of organisational cultures, theories of management and leadership styles and organisational structures. This unit will also provide practical assessments for learners to enhance the work/placement experience.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Understand set **theories on organisations and management styles**
- 2 **Plan the work/placement experience**
- 3 **Document activities** and developments of work/placement experience
- 4 **Evaluate the work/placement experience.**

Content

1 Theories on organisations and management styles

Organisation structures: examine a number of organisational structures to include flat and hierarchical and apply these structures to given organisational contexts

Organisation behaviour: examine theories of motivation (Herzberg, McGregor, Maslow) why people work better in certain environments. Look at the formation of groups (group dynamics)

Management styles: bureaucratic, human relations and classical school

2 Plan work/placement experience

Research: identify in depth the type of organisation where placement is to be taken up. Examine the core business of the organisation and any subsidiary elements. Gather a range of organisational statistics on the size, geographical span, status etc

Aims and objectives: identify own expectations of the work placement/experience to include what you expect to learn and achieve over the set period

3 Document activities

Documentation: provide a portfolio of evidence to include reports, evidence of attending any meetings, or taking part in any discussions or practical task based activities. Provide a diary or action plan of day-to-day tasks undertaken

Progress reports: throughout the placement provide feedback to both employers and college/university on tasks completed with evidence to support achievement

4 Evaluate work/placement experience

Evaluation: provide an overview of the success or failure of the placement through the identification of how aims and objectives were met and if not why not. Problems encountered and a self-evaluation of what was learned during the placement

Critique: identify a range of information resources used throughout the placement and critique how they have contributed to the overall success or failure of the placement. Provide a recommendation as to the quality of the placement

Delivery: provide a written report and an oral presentation of the work placement/experience

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Understand set theories on organisations and management styles	<ul style="list-style-type: none"> • identify developments in management and organisational behaviour • outline the characteristics of formal and informal organisations • examine theories of motivation
2 Plan the work/placement experience	<ul style="list-style-type: none"> • identify a clear plan for the work placement/experience • set out aims and objectives of work placement/experience and own expectations • provide evidence of work placement research
3 Document activities and developments of work/placement experience	<ul style="list-style-type: none"> • provide evidence of tasks undertaken at work placement • identify information sources/resources used at the work placement • design a portfolio which outlines progress made and developments which impacted positively and negatively on the work placement
4 Evaluate the work/placement experience	<ul style="list-style-type: none"> • discuss any problems, difficulties encountered at the work placement • provide a self-evaluation of personal development during the work placement • deliver the evidence collected at your placement in a suitable format

Guidance

Delivery

This unit should initially focus on providing learners with information about management and organisational behaviour that they can then apply to their own experience of work placement. Learners should also collect their own evidence about the organisation they are doing their placement with. It is expected that learners might need some initial guidance in terms of preparing plans and setting objectives prior to their placement and will need further assistance to support them through their placement (visit learner within the organisation).

Assessment

Evidence is likely to be in the form of a portfolio that contains written evidence, plans, schedules, aims, objectives and a breakdown of the tasks carried out during the placement. Learners should also include initial research evidence of the organisation prior to the placement. The work experience unit can be linked in with the specific project units in each stream so that learners can provide a more detailed account of their work experience placement. Learners should be encouraged to retain all pieces of evidence collected during the placement as these will help in the preparation of the final evaluation.

Links

This unit is intended to consolidate all learning within the entire qualification, it provides learners with the opportunity to practice what they have learned in a real organisational context. This unit also links in well with a number of level 4 key skills including communications, information technology, improving own learning and performance, problem solving and working with others.

Resources

A number of resources can be used to support this unit, including traditional textbooks on management and organisational behaviour.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Cameron, S — *The Business Students Handbook* — (Pearson, 2002) ISBN: 0273655272
- Longson, S — *Making Work Experience Count: How to Use Work Experience to Increase Your Job Prospects* — (How To Books, 1998) ISBN: 1857032470
- McAuley — *Learning from Work Experience* — (Pfeiffer Wiley, 1999) ISBN: 0787945072
- Mullins, L — *Management and Organisational Behaviour* — (Prentice Hall, 2001) ISBN: 0273651471

Journals

- *International Journals* (www.academicpress.com/ijhcs)

Unit 22: Human Computer Interface

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

As technology moves forward, new methods of communicating with computers are becoming possible. Software developers are required to determine whether software is developed with new techniques or traditional tried and tested methods. The developer also needs to measure how well a computer interacts with a user.

This unit aims to give learners a full understanding of the human computer interface (HCI) and the part it plays in the construction of software that is usable, attractive, efficient and effective. The learner is encouraged to explore how well software interacts with the user, fulfils the user's needs and makes allowances for different users. The learner should develop a critical appreciation of the advantages and disadvantages of various interfaces currently available and experience the production of a prototype.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Discuss **HCI-related developments and their application**
- 2 Determine the **issues related to a chosen HCI**
- 3 **Develop an HCI prototype**
- 4 **Evaluate an HCI prototype.**

Content

1 HCI-related developments and their application

HCI: historical development, motivation, principles and techniques

Developments in technology: workstation environment, screens, keyboards, pointing devices, other I/O devices (speech), related processing and storage requirements

Developments in HCI: virtual machines, command line input (command sets), menu selection and the methods of selection, graphical interfaces, speech, screen design for intensive data entry, intelligent HCIs, virtual personas (engaging with the computer within a virtual reality), concept of 'look and feel'

Developments in the concept of the user: range of users (expert, regular, occasional, novice, special needs), needs of user

Development of systems: new developments (hypertext, event driven systems, use of multimedia), modelling techniques, implication of new developments on user interfaces, implications of developments on hardware (storage, processing requirements etc)

Applications: range of applications, selection of HCIs for specific applications

2 Issues related to a chosen HCI

Models of user: human memory, knowledge representation, perception, attention, reasoning, communication, skills and skills acquisition, user's cognitive model, use of metaphors and the consequences on the design of HCI

Health and safety considerations: ergonomics and the surrounding environment (lighting, seating, RSI, legal implications)

Information considerations: necessity for information-rich environment, examples of systems (share trading rooms or combat environments)

Cost implications in the choice of HCI: training, effectiveness of system, architectural requirements (hardware, software, communications)

User considerations: high-speed interactive interfaces (games), special needs (implications for colour blind, partially sighted, blind, physically incapacitated, slow learners)

Implications: analysis of an HCI selection

3 Develop an HCI prototype

Modelling the interface: mapping the system functionality to the conceptual model, grouping of the tasks into logical sets

Design: rules and heuristics for good HCI design, review of proprietary examples, context sensitive help, online help/documentation, design tools

Production: selection of tools, production of prototype

4 Evaluate an HCI prototype

Analysis: task analysis (storyboarding, user needs analysis), evaluation of HCI complexity

Measuring the functionality of an HCI: keystroke effort per task, ability to navigate within the system, time to perform a task, ability to configure the HCI, user satisfaction. Use of metrics such as Fitt's Law and Keystroke Level Method

Usability objectives: criteria and performance

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Discuss HCI-related developments and their application	<ul style="list-style-type: none"> • outline HCI developments with examples • describe examples of HCI applications • identify the impact of HCI on the workplace
2 Determine the issues related to a chosen HCI	<ul style="list-style-type: none"> • report on the issues concerning implementation of an HCI • justify the selection of an HCI for a particular user group and environment • describe in detail the use of HCI for a particular user group
3 Develop an HCI prototype	<ul style="list-style-type: none"> • design an HCI for a specified application • build an HCI prototype • explain the importance of the user interface in your design
4 Evaluate an HCI prototype	<ul style="list-style-type: none"> • describe the design process • evaluate the design process • state the limitations of the design

Guidance

Delivery

This unit should be a balance between theory and practical experience. Learners should be exposed to as wide a range of HCIs as possible, and be encouraged to criticise them. Where possible, tools for developing software prototypes should be used to allow the rapid production of HCIs. Where possible the design of the HCI should be seen as an integral part of the software development process.

Assessment

Evidence can be obtained from investigating a wide range of HCI applications. Learners should show that they are capable of identifying the main features of a given HCI, that they can diagnose the failings of the interface and propose improvements in the light of user needs.

An HCI prototype can be chosen for any suitable application.

Evidence can be generated in parallel with other units concerned with software development.

Links

It is clear that the subject area impinges on many other topic areas and can be easily linked with the other topics related to software development. The production of relevant prototypes may be performed in collaboration with programming and multimedia development units, for example, *Unit 18: Multimedia Design and Authoring* and programming visual interfaces, for example, *Unit 42: Visual Programming*.

Resources

Learners should have access to a cross-section of applications on differing platforms presenting a range of HCIs. Learners should also have access to a development environment that allows rapid prototyping.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Dix, A et al — *Human Computer Interaction* — (Prentice Hall Europe 1997)
ISBN: 0132398648
- Mandel, T — *The Elements of User Interface Design* — (Wiley, 1997) ISBN: 0471227307
- Preece, J — *Human Computer Interaction* — (Addison Wesley, 1994) ISBN: 0201627698
- Shneiderman, B — *Designing the User Interface* — (Addison Wesley, 1998)
ISBN: 0201694972

Journal

- *International Journal of Human Computer Studies*

Website

- www.hcibib.org

Unit 23: Project Management

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

The aim of this unit is to provide a basic knowledge of project management principles, methodologies, tools and techniques that may be used in any industry, the professions and the public sector. Organisational and human resource factors are also included.

Learners will develop an understanding of what constitutes a project and the role of a project manager. They will be able to analyse and plan the activities needed to carry out the project, including how to set up a project, how to control and execute a project, and how to carry out project reviews. They will also understand how the project fits into the company or other organisational environment.

It is intended that this unit will support the knowledge and understanding requirements for the NVQ in Project Management at level 4.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Investigate **project management principles**
- 2 Examine project **organisation and people**
- 3 Examine project **processes and procedures**.

Content

1 Project management principles

Project management: principles of engineering projects, project management and the role of the project manager (eg management of change, understanding of project management system elements and their integration, management of multiple projects, project environment and the impact of external influences on projects), identification of the major project phases and why they are required; an understanding of the work in each phase; the nature of work in the lifecycles of projects in various industries

Success/failure criteria: the need to meet operational, time and cost criteria, and to define and measure success (eg develop the project scope, product breakdown structure (PBS), work breakdown structure (WBS), project execution strategy and the role of the project team); consideration of investment appraisal (eg use of discount cash flow (DCF) and net present value (NPV); benefit analysis and viability of projects); determine success/failure criteria; preparation of project definition report; acceptance tests

Project management systems: procedures and processes, knowledge of project information support (IS) systems, how to integrate human and material resources to achieve successful projects

Terminating the project: audit trails, punch lists, close-out reports and post-project appraisals; comparison of project outcome with business objectives

2 Organisation and people

Organisational structure: functional, project and matrix organisational structures (eg consideration of cultural and environmental influences, organisational evolution during the project lifecycle), job descriptions and key roles (eg the project sponsor, champion, manager, integrators), other participants (eg the project owner, user, supporters, stakeholders)

Control and co-ordination: the need for monitoring and control (eg preparation of project plans, planning, scheduling and resourcing techniques, use of work breakdown structure to develop monitoring and control systems, monitoring performance and progress measurement against established targets and plans, project reporting, change control procedures)

Leadership requirements: stages of team development (eg Belbin's team roles, motivation and the need for team building, project leadership styles and attributes), delegation of work and responsibility, techniques for dealing with conflict, negotiation skills

Human resources and requirements: calculation, specification and optimisation of human resource requirements; job descriptions

3 Processes and procedures

Project management plans: the why, what, how, when, where and by whom of project management (eg contract terms, document distribution schedules, procurement, establishing the baseline for the project)

Project organisation: the product breakdown structure (PBS) and the work breakdown structure (WBS), project execution strategy and the organisation breakdown structure (OBS) (eg preparation of organisation charts, task responsibility matrix, statement of work (SOW) for project tasks)

Scheduling techniques: relationship between schedules, OBS and WBS, bar charts, milestone schedules, network techniques, resourcing techniques, computer-based scheduling and resourcing packages, project progress measurement and reporting techniques, staff-hours earned value and progress 'S' curves, critical path analysis and reporting, milestone trending

Cost control: cost breakdown structure (eg types of project estimate, resources needed, estimating techniques, estimating accuracy, contingency and estimation, bid estimates, whole-life cost estimates, sources of information, cost information sensitivity, computer-based estimating)

Techniques: allocation of budgets to packages of work, committed costs, actual costs, cash flow, contingency management

Performance: cost performance analysis (eg budgeted cost for work scheduled (BCWS), budgeted cost for work performed (BCWP), concept of earned value, actual cost of work performed (ACWP), cost performance indicators)

Change control: the need for formal control of changes (eg project impact of changes, principles of change control and configuration management; changes to scope, specification, cost or schedule), change reviews and authorisation, the formation of project teams, project initiation and start-up procedures

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Investigate project management principles	<ul style="list-style-type: none"> • describe the background and principles of project management • appraise the viability of projects and develop success/failure criteria • understand the principles behind project management systems and procedures • identify the key elements involved in terminating projects and conducting post-project appraisals
2 Examine project organisation and people	<ul style="list-style-type: none"> • identify the most appropriate organisational structure, roles and responsibilities of participants within a project • control and co-ordinate a project • identify project leadership requirements and qualities • plan and specify human resources and requirements for a project
3 Examine project processes and procedures	<ul style="list-style-type: none"> • prepare project plans and establish the project organisation • apply project scheduling, estimating and cost control techniques • describe the methods used to measure project performance • describe project change control procedures

Guidance

Delivery

This unit is largely freestanding without reference to other units, although it could be integrated with general business management units or with operations management courses.

A practical approach should be adopted where possible. However, it is important that learners do not spend too much time doing numerical work, preparing or analysing large quantities of data. The analysis of data is an inevitable aspect of project management life, which is best learned using pre-prepared examples in electronic form that enable the principles to be quickly demonstrated without oversimplifying the complexity of everyday project operations.

A case study workshop approach with groups of learners would provide an excellent learning medium.

For the operation of complex proprietary computer software systems, project managers should know what to expect from such facilities, but are not necessarily expected to be able to operate them.

The project management principles and techniques are all important, together with an appreciation of how the various operations within the project integrate with one another.

Assessment

Evidence of outcomes may be in the form of assignments, analysis of case studies, completed tests or examinations. Evidence should be provided at unit level in order to ensure proper integration of all the outcomes within the unit.

Links

This unit could be studied in parallel with, and complement, the project units in all the three pathways, which could provide many of the skills necessary for the successful completion of this unit. This unit will also provide a foundation for many of the developmental units or units that require the learners to create a working solution to a problem.

Resources

Appropriate software packages should be used to demonstrate project control and reporting techniques. Packages might include:

- time and cost scheduling packages
- documentation and procurement control packages
- spreadsheet packages
- graphic presentation packages.

Other packages for items such as risk analysis, project accounting and procurement control could be used to illustrate particular techniques in specific industries.

Access to real project data in electronic spreadsheet form would be an advantage.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Buttrick, R — *Project Workout 2nd Edition* — (Financial Times Prentice Hall, 2000)
ISBN: 027364436X
- Lock, D — *Project Management 8th Edition* — (Gower Publishing, 2003)
ISBN: 0566085518
- Lock, D — *The Essentials of Project Management 2nd Edition*— (Gower Publishing, 2001) ISBN: 0566082241
- Smith, N J — *Project Cost Estimating* — (Thomas Telford Publications, 1995)
ISBN: 0727720325
- Smith, K — *Project Management and Teamwork 2nd Edition* — (McGraw Hill, 2000)
ISBN: 0070122962
- Turner, J R — *The Handbook of Project-Based Management 2nd Edition* — (McGraw Hill, 1998) ISBN: 0077091612

Unit 24: e-Business Strategy

Learning hours: 60

NQF Level 4: BTEC Higher National — H2

Description of unit

This unit starts by considering customers' expectations of e-business, because these dictate implementation priorities. It is first necessary to assess the status of the business information and logistics systems, because they will provide the foundation for e-business. Preparations will be necessary to meet the standards of support that e-customers expect. Marketing, promotion and supply chain management must be considered, alongside the website, when developing the implementation strategy. Protecting the intellectual property of the business and maintaining the integrity of its website require considerations of risk and appropriate security precautions. Finally future developments in e-business are examined to help maintain a competitive edge.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Analyse the **impact on the business**
- 2 Plan **implementation strategy**
- 3 Explain measures for **protection of the business**
- 4 Examine **future developments** in e-business.

Content

1 Analyse the impact on the business

Planning and implementation: bricks and mortar companies may have to adapt existing systems to facilitate additional channel; 'pure play' company may have fewer systems to adapt

Customer expectations: the internet raising the expectations of customers for quick and efficient service; the importance of recognising the importance of accurate information, timely responses to customer communications and quick delivery of the product, or service

Integrity of data: necessity of assessing the integrity of data in existing business system database and measuring the accuracy and currency of database information; total reliance of customers on this information, as they do not have access to the informal information contacts which are available within the organisation

Logistics processes: how quickly customer demands can be serviced; the service and quality of existing logistics processes needs to be examined in order to meet customers' expectations for quick and efficient delivery of products and services

Customer support: customers also expect timely responses to their enquiries; need to plan resources to provide this level of customer response; necessity to keep the website fresh with up-to-date information, particularly if news, or newsletters, form part of the strategy

Competitor analysis

Financial and risk evaluation

2 Plan implementation strategy

Planning the website: designing the website requires a level of expertise, which may justify using a design service; maintaining 24/7 access to your website (24 hours per day, for 7 days per week) throughout the year, places considerable demands on IT resources, particularly when security and backup are included; the services of an internet Service Provider (ISP) to 'host' your website, may be an attractive proposition

Marketing and promotion strategy: the internet offers access to a wider geographic customer base, which allows targeting market segments and interest groups; by encouraging interactions between customers, the internet allows the development of electronic 'web-communities'; promotion strategies must be developed to target specific market segments and to develop web-communities

Supply chain strategy: satisfying customer demand, with accuracy and speed, requires a responsive supply chain; it may be possible for most of these activities to be executed in-house, however this requires competence in a broad range skills; these skills may be more readily available from outside the organisation, by using suppliers; effectively exploiting the capabilities (and financial resources) of suppliers is the challenge of supply chain management; developing 'partnership' relationships with suppliers and integrating them with your business electronically, so that both can benefit from serving your customers, is the challenge of your supply chain strategy

Electronic payment systems: doing business with customers is only worthwhile, as long as you get paid for your services; it is vital to consider what payment systems you will use and the payment terms you will offer to your customers; business is conducted on the basis of trust, as there are risks to both the supplier and the customer; what assurances can you give to your customers that you will not take payment until the products, or services, have been supplied? similarly, what assurances can you give to your suppliers, that they will get paid, especially if they offer you deferred payment terms

Implementation priorities: successful business in about buying and selling at a profit; you need customers and suppliers and a means of processing transactions with each of them; it will take time and money to develop your web-site and to make it available for customers; you will need to establish relationships with your suppliers; when you are ready you will need to promote your business, to make potential customers aware of your presence and what you have to offer; until you start generating revenues, you will be burning up your initial investment capital; a business plan will help make these issues clear, so that you can plan your implementation priorities

Metrics: how will planning and implementation be assessed

Exit strategy: why one is required, how it will be invoked

3 **Protection of the business**

Intellectual property: protecting the domain name, company name, trade marks and intellectual property

Assessment of security risks: review the risks of linking your business systems to the internet

Security measures: propose security measures to minimise risks; firewalls and use of intranets or extranets

4 **Future developments in e-business**

Mobile technology: review developments in mobile technology and assess their impact on e-business

Impact of XHTML: consider the impact of XHTML on e-business.

Supply chain integration: examining the implications of supply chain integration through use of the internet

International competitiveness: assessing the impact of e-business on international competitiveness

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Analyse the impact on the business	<ul style="list-style-type: none"> • analyse the expectations of internet customers • assess the integrity of data in existing business system database • analyse service and quality of existing logistics processes • plan resources for on-going website maintenance and support
2 Plan implementation strategy	<ul style="list-style-type: none"> • plan for website design, site hosting, ASP or use of in-house services • develop an e-marketing and promotion strategy • develop an e-supply chain management strategy • assess priorities for implementation and integration with existing systems
3 Explain measures for protection of the business	<ul style="list-style-type: none"> • explain protecting the domain name, company name, trade marks and intellectual property • review the risks of linking your business systems to the internet • propose security measures to minimise risks
4 Examine future developments in e-business	<ul style="list-style-type: none"> • monitor developments in mobile technology • explain the impact of XHTML on e-business • examine the implications of supply chain integration using the internet • assess the impact of e-business on international competitiveness

Guidance

Delivery

This unit needs to be taught with learners exploring website application of the theories, either working individually, or in pairs, around an internet access point (usually a personal computer).

The preferred pattern for a teaching session would be for instruction to be given on some topic, or concept, then for learners to review its application for selected websites, followed by some discussion of their findings to consolidate learning.

The use of e-business case studies would be appropriate for this unit.

Learners would also be expected to explore the use of these techniques by independent research of texts and websites.

Assessment

Assignments that require learners to demonstrate their understanding of theories and concepts by reviewing e-business websites are recommended. These are most suitable for coursework assignments where learners have more scope to develop their ideas, but can also be used for examination questions.

Learners could be encouraged to develop their own implementation strategy for an e-business proposal, as a coursework assessment.

Links

This unit links to *Unit 19: Website Design*, *Unit 25: e-Business Development*, *Unit 26: e-Business Technology* and *Unit 27: e-Business Project*. This unit also links to several units in the HN for Business (e-business Strategies pathway) including: *Introduction to the Internet and e-Business*, *Internet Marketing*, *e-Business Operations* and *Information Systems*.

Resources

Texts should be supported by the use of websites and case studies. For those part-time learners working in business, their experience of work should be made use of in comparing approaches adopted.

Websites can be useful in providing information and case studies (eg www.bized.ac.uk which provides business case studies appropriate for educational purposes).

Support materials

Textbooks

Sufficient library resources should be available to enable learners to achieve this unit. Texts that are particularly relevant are:

- Chaffey, D — *E-Business and E-Commerce Management* — (Prentice Hall, 2002) ISBN: 0273651889
- Laudon, K C and Traver, C G — *E-Commerce: Business, Technology, Society* — (Addison Wesley, 2002) ISBN: 032112202X
- Morath, P — *Success @ eBusiness* — (McGraw Hill, 2000) ISBN: 0077096258

Other useful texts

- Cumming, T — *Little e, Big Commerce* — (Virgin Publishing, 2001) ISBN: 0753505428
- Salter, B and Langford-Wood, N — *A Simple Guide to e-Commerce* — (Prentice Hall, 2001) ISBN: 0130286494
- Schneider, G P — *Electronic Commerce* — (Course Technology, 2002) ISBN: 0619063114
- Sleight, S — *Moving to E-Business* — (Dorling Kindersley, 2001) ISBN: 0751312150
- Turban, E et al — *Electronic Commerce* — (Prentice Hall, 2002) ISBN: 0130984256

Journals/newspapers

Useful articles regularly appear in the business pages of quality newspapers.

Websites

The websites supporting textbooks with learning materials, also include plenty of examples of good commercial websites. The BBCi Business and Technology sites offer useful articles about e-business.

- www.booksites.net
- www.LearnE-Commerce.net
- www.course.com

Unit 25: e-Business Development

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

The aim of this unit is to understand how business organisations operate and to explore the issues involved in the development of e-business by either an established business or a new business. It looks at the importance of market research and financial planning, culminating in the development of a business plan. It represents the practical application of many of the issues and concepts introduced in associated units.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Understand the **structure and aims** of business organisations
- 2 Evaluate the **impact of e-business** on business and consumers
- 3 Examine the **development of an online business**
- 4 Devise a **business plan** for an online business.

Content

1 Structure and aims

Types of organisations: private, public, voluntary, charitable business organisations

Aims of organisations: profit, market share, return on capital employed (ROCE), sales, growth, levels of service, customer/user perceptions

Stakeholders: identification of stakeholders, satisfying stakeholder objectives, pluralist perspectives, the concept of corporate mission

Business functions: key internal business functions (marketing, sales, accounting, administration, MIS, operations), company roles and structures

2 Impact of e-business

Consumer impact: empowered customers, improved convenience, greater choice, lower prices, increased rate of innovation, availability of new products, global markets, direct communication with customers, new marketing models, new selling chains, global markets, revenue streams, online sales, online advertising

Business impact: the challenge of new technology, re-engineering the business, lower barriers to entry, new distribution channel, greater competition, challenge to monopoly power, significant new market segment, global business and consumer markets, re-training of staff, new skills, technology growth rates, new storefronts, lower overheads, new selling chains, immature markets, product development funnels, product life cycles, global business and consumer markets

3 Development of an online e-business

Market research: purpose of research, identifying information sources, online and offline competition, types of research, secondary and primary data sources, targeted research, marketing intelligence systems

Formation and ownership: incorporated and unincorporated businesses, legal structures (limited companies, partnership, sole trader), formation procedures, registration and responsibilities

Finance: start-up capital, working capital, funding sources, banking services

Advisers: accountants, lawyers, marketing agencies, application service providers (ASP), business archangels, incubators, boutique incubators

4 **Business plan**

Objectives: the business idea, business-to-business opportunities, business-to-consumer markets, the marketing mix, the unique selling proposition

Key processes: technology requirements, back end systems, supply sources, distribution channels and plans for fulfilment

Target markets: identification of market, size, characteristics, dynamics, competitors, historical background, emerging trends, market share, market analysis, market segmentation

Marketing planning: marketing mix, pricing, sales plan, advertising plan

Management and team: organisation structure, identification of skills, staff roles and responsibilities, management plan, type of company, strategic alliances, curriculum vitae

Financial forecasts: funding requirements, revenue streams, break even analysis, risk evaluation, cash flow investment proposals, forecast statements (profit and loss statements, balance sheets)

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Understand the structure and aims of business organisations	<ul style="list-style-type: none"> • explain the types of business organisations and their aims • identify the different stakeholders in an organisation • appreciate the key internal functions of a business organisation
2 Evaluate the impact of e-business on business and consumers	<ul style="list-style-type: none"> • evaluate the significance of the development of e-business for consumers • evaluate the significance of the development of e-business for existing businesses • assess the opportunities for the development of an online business • evaluate the significance of the development for new businesses
3 Examine the development of an online business	<ul style="list-style-type: none"> • conduct market research into forming an online business using a range of information sources • analyse and evaluate research outcomes • identify a range of funding sources for an online business • recognise the pattern of costs associated with business ventures
4 Devise a business plan for an online business	<ul style="list-style-type: none"> • establish clear purposes and objectives • identify target markets • provide forecast financial data • present a comprehensive business plan

Guidance

Delivery

Delivery should emphasise the need for sound business systems and procedures to underpin the e-business enterprise. Current trends, issues and innovations should be used to identify the expanding and emerging nature of this new development which may have major implications for industry and every form of business.

Assessment

Evidence of outcomes may be in the form of written (including data submitted on disc) or oral assignments or tests. The assignments may focus on real problems or case studies.

Links

The unit underpins other e-business and internal units eg *Unit 11: Financial Systems*.

Resources

Access should be available to a learning resource centre with a good range of texts, trade journals, videos, case studies and documented examples of current practice.

Websites can be particularly useful in providing up-to-date material. Suggested sites include:

- www.FT.com
- www.bnet.co.uk
- www.businessweek.com
- www.ecommercetimes.com
- www.zdnet.com
- <http://ecademy.com>

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Fellenstein and Wood — *Exploring E-Commerce, Global E-business and E-societies* — (Prentice Hall, 2000) ISBN: 0130848468
- Harpin, S (editor) — *Kick-Starter.com* — (Macmillan Press, 2000) ISBN: 0333945824
- Korper, E — *The E-Commerce Book* — (Academic Press, 2000) ISBN: 0124211615
- Morath, P — *Success@e-business* — (McGraw Hill, 2000) ISBN: 0077096258
- Read, C — *The Internet Start-up Bible* — (Random House, 2000) ISBN: 0712669663
- Treleven, P — *Sunday Times E-Business start-up* — (Kogan Page, 2000) ISBN: 0749431458

Key monthly magazines

- *Revolution* (Haymarket)
- *Internet Business* (Haymarket)
- *E-Business* (Crimson)
- *Webspace* (Forme)
- *Internet World* (Hillgate Communications)

Unit 26: e-Business Technology

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

The aim of this unit is to introduce the learner to some of the technologies which underpin trading on the internet. This includes an introduction to databases and to connectivity of databases as well as the technical requirements to trade on the internet. This is a very practical unit in which learners have the opportunity to apply their knowledge.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Understand how to **create and manipulate databases** in e-business
- 2 Examine **internet technology**
- 3 Identify and apply the main **technical requirements** that support e-business
- 4 Manage **security issues in e-business**.

Content

1 Create and manipulate databases

Concepts: relational and object-oriented models, schema design, query processing, file systems, multimedia databases. Ensuring integrity, availability, successful transactions, recovery and authentication

Manipulation: use of query languages and visual tools for database maintenance, inserts, updates and amendments of data

Analysis: identification of data requirements from different user perspectives, comparison of top-down and bottom-up approaches to data analysis, their strengths and weaknesses. Theory of inference engines

Connectivity: linking via a web server/internet with databases using current protocols (eg get, post mailto, isindex, query, ODBC), archiving, the common methods of using databases from CGI applications eg ODBC (object data base connectivity), JDBC (Java Database Connectivity (DBC)), SQL, Microsoft ASP (Active Server Pages)

2 Internet technology

Protocols: use, TCP/IP (Transfer Connectivity Protocol), FTP (file transfer protocol), HTTP (hypertext protocol), S-HTTP (secure hypertext), Telnet (remote access)

Data transmission: use/purpose, ISDN (integrated services digital network), ASDL (asymmetric digital subscriber line), wireless broadband services, baud, transfer rates, bandwidth required for given applications including text, graphics, video, speech

Communication technology: hardware components (eg modems, cable modems, fast internet routes, etc)

3 Technical requirements

Servers and communication tools: website software, server operating system, server performance and loading, structure of services (eg www, ftp, gopher), structure of data, areas, aliases, management and performance analysis tools, portability

Networks: principles and application definition of a network, evolution of network uses, from simple file and print networks, through small office computing, to client-server architectures, remote access. Network architecture and design, LANs and WANs, hardware and software components of internet, extranet, virtual private networks (VPN) and intranet systems, ISO standards, knowledge of bandwidths of communication infrastructures (eg ISDN, cable, fibre optic)

Performance factors: evaluation of acceptable network quality and performance, cost of providing and monitoring performance. The trade-off between ideal and acceptable performance, user requirements versus business needs

Development costs: including hardware, software, staff training, data conversion from previous systems, acceptance trials, pilot schemes

Future costs: of repetitive hardware and software upgrades, comparison of server and workstation based application software in terms of hardware and infrastructure, installation costs, licensing charges, external costs (eg line rental), maintenance contract costs and the costs of providing user help facilities

E-commerce applications: out-of-the-box, server based, intelligent agent software, push-pull technology

4 **Security issues in e-business**

Security and integrity: backup, user access rights, file management, testing integrity of third party supplied web pages, intrusion detection and countermeasures, copy and counterfeit detection, protection against aggressive attack eg firewalls, encryption methods, SSL (secure sockets layer) and SET (secure electronic transactions) standards, purchaser identification software, secure email

User certification: validation, asymmetric encryption, public keys, digital signatures, certificate chains/hierarchies

Internet security: secure socket layer (SSL), secure hypertext transfer protocol (S-HTTP)

Secure payment: secure electronic transactions (SET), payment processing

Firewalls: purpose, use, design and location.

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Understand how to create and manipulate databases in e-business	<ul style="list-style-type: none"> • create a multimedia database that will support an e-commerce system • link mark-up language requests to database(s) to provide an interactive service to users
2 Examine internet technology	<ul style="list-style-type: none"> • show an understanding of the various internet protocols in use • select a data transmission service that meets/exceeds anticipated system performance requirements
3 Identify and apply the main technical requirements that support e-commerce business	<ul style="list-style-type: none"> • determine the main technical requirements to enable satisfactory operation of e-commerce applications • use web server technology to provide a service to a range of users • evaluate web server performance
4 Manage security issues in e-commerce	<ul style="list-style-type: none"> • manage the security of data exchanged through an e-commerce service • manage the security and currency of files on the server • evaluate the effectiveness of purchaser identification software

Guidance

Delivery

This unit is best delivered in a network environment. The delivery should be mainly practical with a high level of web server use. It is likely that discrete networks offer ideal environments in which to develop and experiment with web server hard/software. In addition to technical aspects, learners should be guided in ensuring that their e-commerce knowledge is complemented by understanding the business processes that drive the technology.

Assessment

Learners should provide a range of evidence. Learners should produce a complete e-business site with links to database(s), shopping cart software and inclusion of security technologies. They will need to complete an evaluation of risks and implications of e-payment, and an evaluation of current e-business technologies, particularly those relating to payment. Learners will need to incorporate facilities for payment. This needs to be supported by documentation justifying the payment route selected.

Links

Learners need to be familiar with standard business applications and be able to navigate the internet without difficulty. The unit links with *Unit 4: Database Design Concepts*, *Unit 5: Networking Concepts* and *Unit 13: Data Analysis and Design* and the other e-business and networking units in this specification. Learners may wish to develop further database design skills, ranging from using Microsoft Access to more advanced structured query language (SQL) systems.

Resources

- *Hardware:* access to appropriate computers, a local area network (LAN) and suitable web server
- *Software:* ML tool, relevant server operating system and appropriate CGI compatible language, database for connectivity, access to shopping cart and e-payment software
- *Library:* operating system manuals, ML reference, database manuals.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Ahuja, V — *Secure Commerce on the Internet* — (Academic Press, 1996)
ISBN: 0120455978
- Hall, E — *Internet Core Protocols* — (O'Reilly, 2000) ISBN: 1565925726
- Kosiur, D — *Understanding Electronic Commerce* — (Microsoft Press, 1997)
ISBN: 1572315601
- Naik, D — *Internet Standards and Protocols* — (Microsoft Press, 1998)
ISBN: 1572316926

Websites

Web pages provide access to a further range of internet information sources. Learners must use this resource with care, justifying the use of information gathered. Websites that support the development of this unit include those of computing associations and employers. The following may be useful:

- www.reallybig.com
- www.microsoft.com
- www.macromedia.com
- www.actinic.co.uk
- www.cgi-resources.com
- <http://webreview.com>

Unit 27: e-Business Project

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

The aim of this unit is to enable learners to integrate the skills and knowledge they have acquired during the course to produce a viable and realistic e-commerce project. The project undertaken should show as much integration as possible across units already completed or currently under way. This may vary from one learner to the next, and the project should be tailored to the interests and aspirations of the learner.

This is a major piece of work that should demonstrate the performance expected at this level and reflect the unit value in both workload and content.

The problem may be work-based, college-based or a learner interest, but it must be developed in accordance with the unit's frameworks and constraints.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Select, specify and **plan an appropriate project**
- 2 **Develop the project** to the agreed specification and plan
- 3 **Monitor and control** the progress of the project
- 4 Present and critically **evaluate the completed project**.

Content

1 Plan an appropriate project

Project selection: identification of existing and future e-business trends/ideas, research and review areas of interest, select and appraise the feasibility of the chosen project in terms of workload, level of ability required, costs, estimates of timescale and resources available

Project specification: identify, structure and develop a list of user requirements relevant to the chosen project specification to be in a form appropriate for presentation to management (such as venture capitalists) in a real or simulated work environment. The aim is to allow prospective funders/managers to have sufficient information to make an informed decision about the viability of the project

Project plan: produce a plan for the project including timescales, deliverables, milestones etc for an e-commerce project including quality assurance systems and quality plans, and monitoring progress

2 Develop the project

Resources: identification, evaluation and selection of both human and physical resources suitable for the project

Development: monitor development against the agreed project plan and take appropriate action if the project does not go to plan for any reason

Documentation: document all aspects of the project to agreed standards

3 Monitor and control

Project management: monitor and control techniques, tracking, planning, estimating, resource allocation, budgeting, Gantt charts

Project measurement: assessing progress, effectiveness, strategies, impact, content navigation

Project control: adjust development to correct variance

4 Evaluate the completed project

Presentation: writing styles, report writing and presentation techniques, use of graphics/illustrations, demonstrations, use of appropriate software

Critical evaluation: detailed analysis of results, conclusions and recommendations, planned versus actual costs, opportunities for further studies and developments

Documentation: content will differ according to the specific project but in each case it should include complete relevant documentation of all stages of the project to agreed standards and the completion of the critical evaluation

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Select, specify and plan an appropriate project	<ul style="list-style-type: none"> • identify and agree an e-business project • produce a project specification and detailed project plan • gain management approval of the project, specifications and project plan
2 Develop the project to the agreed specification and plan	<ul style="list-style-type: none"> • evaluate and select suitable human and physical resources needed to complete the project • develop the project using the selected approaches to meet the agreed specification to the agreed timescales or take appropriate action if the project fails to meet agreed milestones • document to agreed standards
3 Monitor and control the progress of the project	<ul style="list-style-type: none"> • recognise and handle project management problems • monitor the progress of the project • assess the effectiveness of the project
4 Present and critically evaluate the completed project	<ul style="list-style-type: none"> • present in a professional manner, a detailed report of the project outcomes and their development • demonstrate the outcomes of the project in a structured format to a critical and relevant audience • present clear evidence of the path for future development and the limitations in the current project that will be overcome or improved by these developments

Guidance

Delivery

Learners must work individually but be closely supervised by tutors. Key aspects of project management should be covered at the start of this unit. The tutor's role will be one of motivating and advising rather than directing. Each stage of the development will be agreed, monitored and verified. Following final delivery, sufficient time should be available for learners to receive feedback from tutors, work-based supervisors/clients and colleagues. It is considered good practice to involve a few employers in the presentation/demonstration.

Assessment

Material generated for this unit will depend on the nature of the project. An e-business may sell services as well as goods. Whatever the format, each business idea must involve the selling of something whether it is for the business-to-business or business-to-consumer sectors. Learners are encouraged to consult with external clients such as small to medium sized enterprises to generate ideas or to work on actual business proposals.

All project materials must be individually written and assessed including an initial proposal, an interim progress report and a final report and presentation.

Links

This unit provides an opportunity for learners to develop a specialist e-business interest and at the same time integrate knowledge and skills from related units. Learners should be aware of the opportunities to satisfy key skills. This unit links to *Unit 24: e-Business Strategy*, *Unit 25: e-Business Development* and *Unit 26: e-Business Technology*.

Resources

Learners should have access to a wide variety of relevant e-business software and web development tools and resources. Acknowledgement and support should be given for the use of relevant software tools not usually used in the centre. Centres should try to involve organisations to bring realism and relevance to the project.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Doucette, M — *Microsoft Project 98 for Dummies* — (Wiley, 1998) ISBN: 0764503219
- Harpin, S (editor) — *Kick-Starter.com* — (Macmillan Press, 2000) ISBN: 0333945824
- Jay, R — *How to Write Proposals and Reports* — (Prentice Hall, 1999) ISBN: 0273644971
- Morath, P — *Success at E-Business* — (McGraw Hill, 2000) ISBN: 0077096258
- Read, C — *The Internet Start-Up Bible* — (Random House, 2000) ISBN: 0712669663

Unit 28: Professional Development

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

This unit is designed to enable the learner to assess and develop a range of professional and personal skills in order to promote future personal and career development. It also aims to develop learners' ability to organise, manage and practise a range of approaches to improve their performance as self-organised e-learners in preparation for management.

The emphasis is on the needs of the individual but within the context of how the development of self-management corresponds with effective team management in meeting objectives.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Undertake responsibility for own **personal and career development**
- 2 **Evaluate progress** and achievement of personal development and learning targets
- 3 Develop a range of **interpersonal and transferable skills**
- 4 Demonstrate **self-managed learning** in a professional context.

Content

1 Personal and career development

Self appraisal: skills audit, evaluating self-management, leadership and interpersonal skills

Development plan: career and personal development, current performance, future needs, aims, objectives, targets, review dates, achievement dates, learning programme/activities, action plans

Portfolio building: developing and maintaining a personal portfolio

Constructing a CV: writing, maintaining and presenting

2 Evaluate progress

Evaluate progress: against original aims, objectives, targets, responding to feedback, re-setting aims, objectives and targets

3 Interpersonal and transferable skills

Problem solving: problem analysis, brainstorming, mind mapping, generating solutions, choosing a solution, creative thinking

Verbal communication: effective listening, respect of others' opinions, interviewing techniques, negotiation, persuasion, presentation skills, assertiveness

Time management: prioritising workloads, setting work objectives, using time effectively, making and keeping appointments, working steadily rather than erratically, time for learning, estimating task time (partitionable tasks, non-partitionable tasks)

4 Self-managed learning

Targets: aims and requirements, preferences, personal orientation achievement goals, identification of what has to be learned, dates for achievement

Learning styles: activist, pragmatist, theorist, reflector, Kolb's learning cycle

Effective learning: skills of personal assessment, planning, organisation and evaluation

Online research method: use of the internet, use of bulletin boards, newsgroups

Assessment of learning: improved ability range with personal learning, evidence of improved levels of skill, learning achievements and disappointments

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Undertake responsibility for his/her own personal and career development	<ul style="list-style-type: none"> • identify, review and assess own performance of current management skills • conduct a self-assessment inventory • devise and maintain a current cv and/or portfolio of work • devise a personal development plan to achieve personal targets and short and long-term learning objectives
2 Evaluate progress and achievement of personal development and learning targets	<ul style="list-style-type: none"> • evaluate learning and development with original aims and objectives set in the development plan • reset objectives in the light of evaluation and feedback
3 Develop a range of interpersonal and transferable skills	<ul style="list-style-type: none"> • create or identify solutions to a range of work based problems • communicate in a variety of styles and appropriate manner at various levels • identify a range of effective time management strategies
4 Demonstrate self-managed learning in a professional context	<ul style="list-style-type: none"> • apply an awareness of how people learn to identify suitable methods for development • suggest ways in which lifelong learning could be encouraged • use a range of research methods and sources • give a presentation evaluating progress in achieving learning objectives outlined in the personal development plan

Guidance

Delivery

This unit would benefit from a series of skills-based workshops or a residential period to facilitate personal development. Guest speakers from internet businesses would be helpful in describing their job roles and identifying the skills needed to run and work in an e-environment.

Assessment

For the personal profile, the learner should self evaluate their current skills and experiences using a skills audit and then construct a personal portfolio.

Assessment for the career development could be via a personal journal or skills log compiled throughout the programme. It should be based on the learner's own personal and career aims and needs. Evidence for interpersonal and transferable skills should involve role play and use examples of 'real-life' situations. Learners should also analyse qualities of existing e-business entrepreneurs.

Links

This unit will be developed throughout the course in order to influence the selection of an appropriate 'e-business Project' and career route. This unit links well with *Unit 23: Project Management* and *Unit 27: e-Business Project*

Resources

Lecture theatre/classroom; regular access to specialist magazines and newspapers.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Adair, J — *Effective Leadership* — (Capstone, 2001) ISBN: 1841121401
- Adair, J — *Effective Time Management* — (Pan Books, 1988) ISBN: 0330302299
- Dubrin, A — *10 Minute Guide to Leadership* — (Wiley, 1997) ISBN: 0028614062
- Godefroy and Clark — *The Complete Time Management System* — (Piatkus, 1996) ISBN: 0749916869
- Glass, N — *Management Masterclass* — (Nicholas Brealey, 1996) ISBN: 1857881079
- Hartley, P — *Interpersonal Communication* — (Routledge, 1993) ISBN: 0415013852
- Jay, R — *How to Write Proposals and Reports* — (Prentice Hall, 1999) ISBN: 0273644971
- Mullins, L — *Management and Organisational Behaviour* — (Prentice Hall, 2001) ISBN: 0273651471
- Perkins, G — *Killer CVs and Hidden Approaches* — (Pearson, 2000) ISBN: 027365246X

Unit 29: Knowledge Systems

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

The aim of this unit is to develop the learner's ability to select and use expert systems and artificial intelligence solutions for a range of commercial needs.

This area is rapidly developing and the skills that appear advanced and beyond the scope of this unit today, may well be reality in the future. In order to ensure the unit remains relevant, no specific languages and software are included in the content but many exist, as discussed in the guidance. The outcomes remain quite generic, supported by several options for delivery so that centres can use this to take advantage of existing resources.

Summary of outcomes

To achieve this unit a learner must:

- 1 Investigate the **concepts of expert systems**
- 2 Develop an application using an **artificial intelligence language**
- 3 Develop an application using a **knowledge-based system/shell**
- 4 Investigate a current **artificial intelligence technique**.

Content

1 Concepts of expert systems

Techniques: identify a range of tools and techniques, which are used in expert system technology

Verification and validation: identify the importance of verification and validation procedures in expert system technology

Definition of an expert system: purpose, description, areas of use, examples

2 Artificial intelligence language

Language elements: development of a range of appropriate skills for the language used

Design/plan: consideration of alternative design methods/techniques, integration into a structured design/plan

Development: use of the language to create an application

Verification: testing techniques for artificial intelligence language, applying testing techniques to artificial intelligence

Documentation: documenting of the application to set standards

3 Knowledge-based system/shell

Shell/system elements: development of skills in the shell/system used

Design: use of an appropriate design method (this will vary with the structures used by the software eg rules, frames, nets etc) to create a structured design

Development: develop an application using the system/shell

Verification: testing techniques for artificial intelligence shells, applying testing techniques

Documentation: documenting of the application to set standards

4 Artificial intelligence technique

Techniques survey/selection: research and review of current techniques/applications, selection of a current application or development technique

Design: plan for overall evaluation

Evaluation: investigation of the technique/application, develop criteria for evaluation, evaluate against these criteria

Demonstration: a well-structured demonstration of the application or evaluation delivered by the learner or group of learners

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Investigate the concepts of expert systems	<ul style="list-style-type: none"> • describe what is meant by an expert system • provide examples of expert systems • evaluate the importance of verification and validation techniques in expert systems
2 Develop an application using artificial intelligence language	<ul style="list-style-type: none"> • program in a selected artificial intelligence language • design and develop an application using the language • verify and document the application
3 Develop an application using a knowledge-based system/shell	<ul style="list-style-type: none"> • design and develop an application for the system/shell • verify and document the application • use testing techniques for artificial intelligence shells
4 Investigate a current artificial intelligence technique	<ul style="list-style-type: none"> • identify an appropriate application/technique • evaluate the application/technique against relevant criteria • demonstrate the evaluation in a structured format

Guidance

Delivery

Learners will be expected to use existing software tools/products rather than develop new ones. It is envisaged that learners would work individually to satisfy outcomes 1 and 2. However, outcomes 3 and 4 could be either individual or group-based. Outcome 4 is particularly important in keeping the unit up-to-date and centres should use the information from it to improve their facilities, feeding back the material into the other outcomes as the unit develops. Examples of this would be:

- vision systems
- intelligent agents
- security systems
- medical diagnosis.

Assessment

For the investigation elements of the unit, learners will be expected to perform research and provide the demonstrations or reports for their findings. They will need to produce well-documented software for the practical elements of the unit.

Links

Although the unit can be taught as a stand-alone, substantial experience of computing and software development is advisable as a pre-requisite and can be linked to the appropriate units in the specification.

Resources

Learners should have access to a wide variety of relevant software tools and resources including:

- a recognised artificial intelligence language eg Prolog, LISP etc
- a knowledge based development tool such as Goldworks, Leonardo, Crystal etc.

Suggested materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Jackson, P — *Introduction to Expert Systems* — (Addison Wesley, 1999)
ISBN: 0201876868

Unit 30: Java Programming

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

Object-orientated programming is becoming more and more popular. One development environment that uses this object approach is Java.

The unit will enable learners to use selected tools to design a variety of programs, these will range from standard programs to those that can be used and implemented on the internet.

Summary of outcomes

To achieve this unit a learner must:

- 1 Understand **Java concepts**
- 2 Design a variety of **Java programs**
- 3 Create **web pages** using Java
- 4 Use Java tools to create **enhanced web pages**.

Content

1 **Java concepts**

Concepts: these will include an understanding of the basic concepts involved in Java programs in terms of classes, objects, polymorphism

2 **Java programs**

Variety of Java programs: a number of different programs will need to be created that involve the basic concepts of Java to demonstrate an awareness of how each concept is used. This is where the learners can demonstrate the knowledge that they have learned, by generating programs on their own

3 **Web pages**

Web pages: this is basically creating web pages that are a further extension of Javascript techniques to create interesting web pages. Buttons and other graphics should be used

4 **Enhanced web pages**

Applets: these need to be used to create a dramatic effect; games could be written at the most detailed level, there should be at least moving graphics that stand out, normally some form of animation

User interface: there will need to be a user interface created that will enable web users to interact with the web

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Understand Java concepts	<ul style="list-style-type: none">• demonstrate an understanding of how Java varies from other programming languages• demonstrate a knowledge of the various concepts that are related to Java
2 Design a variety of Java programs	<ul style="list-style-type: none">• identify the various elements in a Java based program• develop programs using Java programming concepts• demonstrate an appropriate use of relevant concepts in a number of Java programs
3 Create web pages using Java	<ul style="list-style-type: none">• create web pages using Java• demonstrate an understanding of how Java can be used in web pages• create graphics on web pages using Java
4 Use Java tools to create enhanced web pages	<ul style="list-style-type: none">• create basic applets• create applets to produce animation of graphics• create a user interface on the web using Java

Guidance

Delivery

The focus of this unit is the clear understanding of Java programming, the use of appropriate design methods, and plenty of experience in creating programs using a Java programming language. To this end, assessment should include the ability to design objects in a coherent manner and the ability to write programs using those objects. Learners should also show an awareness of the theory underlying object-oriented software production.

Learners would not be expected to create classes with virtual functions, but should be able to use and extend these classes.

The learners could work towards creating an enhanced web page to demonstrate the knowledge they have acquired in this unit.

Assessment

Evidence will be in the form of being able to design programs using Java constructs and then creating a variety of Java programs. These programs will need to be both as stand-alone and also within the generation and implementation of web pages.

Links

Java is an object language and therefore it has its strongest and closest links with *Unit 36: OOP Programming*; other links are with *Unit 3: Programming Concepts*, *Unit 10: Software Development Project* and *Unit 39: Visual Programming Fundamentals*. All of these programming units will add to the knowledge that can be gained here.

Resources

Java development software is essential for this unit. Different versions of Java are available; any version is acceptable. Access to an internet browser will also be needed.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Coad, P and Mayfield, M — *Java Design : Building Better Apps & Applets* — (Prentice Hall, 1999) ISBN: 0139111816
- Deitel, P and Deitel, H — *How to Program* (3rd Edition with CD-Rom) — (Prentice Hall, 2001) ISBN: 0130341517
- Flanagan, D — *Java Examples in a Nutshell* — (O'Reilly, 2000) ISBN: 0596000391
- Goody, R — *Intro Visual J++ Appl Applets Ver 6.0* — (Pearson, 1999) ISBN: 0139178996

Unit 31: Networking Infrastructure

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

To maintain effective communication and connect remote locations, organisations need to set up and manage computer networks in a multi-vendor environment. The aim of this unit is to provide learners with a sound knowledge of the standards-based networking protocols and technologies that enable a reliable and secure interoperable network environment. The unit focuses on an appropriate network operating system, such as Microsoft Windows.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Implement **name resolution services**
- 2 Configure and **troubleshoot network connectivity**
- 3 Configure and **support routing and remote access**
- 4 **Configure network security.**

1 Name resolution services

Understand the need for name resolution: review IP addressing, the TCP/IP suite of protocols, understand the difficulty in using numbers (IP or MAC addresses) to refer to computers, introduce the concept of names for computers as used on the worldwide web (domain names), the need for static IP addresses, the difficulty in manually maintaining static IP addresses

Automatic IP addressing by using DHCP: the lease generation process (ie request, offer, selection, acknowledgement, renewal, duration), using ipconfig to manually request and release, install and authorise the DHCP service, DHCP clients, IP address scopes, scope options and reservations (eg for special servers and printers), vendor and user-defined classes, superscopes (eg for non-contiguous addresses), multicast addresses and the MADCAP protocol, DHCP in a routed environment (ie relay agents and BootP forwarders), monitoring and troubleshooting DHCP

Domain Name System: DNS as a distributed hierarchical name resolution system, forward lookups, reverse lookups, fully qualified domain name (FQDN), zone files, authoritative servers, iterative and recursive queries, the query process, root name servers on the internet and intranet, the DNS cache, install and configure DNS server and clients, types of zones (standard primary, standard secondary (for backup and load balancing), Active Directory Integrated (Windows 2000), caching-only servers, compare static and dynamic DNS, the Hosts files, zone transfer (ie master and secondary servers, dynamic updates, incremental zone transfer, security, zone transfer request process), sub domains and zone delegation, zone file naming conventions (eg domain_name.DNS, z.y.x.w.in-addr.arpa.dns, cache.dns), integration of DNS with DHCP (dynamic update protocol), configuring dynamic updates, resource record types (eg SOA, NS, CNAME, MX etc), verifying and troubleshooting DNS with nslookup, troubleshooting DNS with ipconfig

Windows internet Name Service: NetBIOS names and dynamic registration, browsing on Microsoft networks (Master, backup and potential browsers), name discovery and release, NetBIOS cache and broadcasting, limitations of NetBIOS names in a routed network, NetBIOS node types, the LMHosts file, WINS naming (registration, renewal, query and release), install and configure WINS (Windows 2000 or NT), support for non-WINS clients (ie integrating DNS with WINS, static mappings and WINS proxy), multiple WINS servers for backup, load balancing and routed networks, replication of the WINS database (pull and push partners), maintaining, verifying and troubleshooting WINS, backup and restore of WINS database

2 Troubleshoot network connectivity

Deploying network clients using remote installation: network requirements for RIS (ie DHCP service, Active Directory service for Windows 2000, DNS service, PXE compliant network adaptor card or RIS startup disc), RIS security eg authorised RIS server and permissions to install via RIS, automating computer naming, load balancing with pre-staging (GUID of client computer), client setup options (eg automatic and custom), creating and modifying images for remote installation, CD based images with answer file for basic OS installation, RIPrep images for OS and applications installation

Managing a network: review terminal services as a remote administration tool, SNMP ie management system, agent, get and set operations, trap messages, Management Information Base (MIB), hierarchical name tree of MIB object namespace, communities, security by filtering packets, SNMPUTIL to confirm the SNMP configuration

Troubleshooting network services: describe the three phases of troubleshooting ie researching the symptoms of network problems, identifying the causes of network problems, resolving network problems, interpretation of error messages through the help utility, trouble-shooters, event viewer or support tools, be aware that many network services are interconnected therefore problems with one network service may be symptomatic of a problem with a different network service, TCP/IP problems (name resolution, invalid IP addresses, IP to MAC address resolution via ARP, both static and dynamically assigned, ipconfig, ping to test each connection starting with the source TCP/IP stack through routers, sub-networks and the destination host, interpret ping error messages ie TTL expired, destination host unreachable, request time out, unknown host, use tracert to check the path from source to destination and path ping to detect packet loss over multiple-hop trips), name resolution problems (hosts and lmhosts file, Nslookup to test DNS, NetDiag to diagnose connectivity, Nostat and Net View to troubleshoot NetBIOS names, network service problems (check status and startup type, valid service account if appropriate, recovery techniques provided by each service eg restart or reboot computer), investigate dependency services, monitoring the network (capture packets from local and remote computers, display and filter packets), be aware of packet structures

Configuring connectivity between different operating systems: the need for different operating systems to connect in a modern multi-vendor network as each OS can provide specific resources and facilities, the concept of a gateway as a translator (eg Gateway Services for Netware — GSNW translates from Microsoft's SMB to Novell's NCP), GSNW (and CSNW) in a mixed Netware/Microsoft environment, Services for Netware to integrate Netware into Windows 2000, Services for Macintosh to integrate Apple Macintosh computers into other vendors' networks, connecting PC networks to IBM mainframes via SNA gateway, Services for UNIX to connect non-UNIX computers to a UNIX network, how Ethernet, IPX/SPX, TCP/IP and AppleTalk protocols can be integrated via gateways and routers

Network address translation: review the depletion of IP addresses resulting in the need to conserve addresses and the high cost of purchasing a public IP address, examine the security issues when a company's IP address is known to the world, NAT as an IP address translator allowing for many private internal IP addresses mapped to a few public IP addresses, use of port numbers to uniquely identify internal clients, DHCP and DNS integrated with NAT, configuration of inbound ports to restrict external users to specific servers or applications, ICS is a reduced version of NAT for small networks

3 Support routing and remote access

Configuring remote access: remote access provides remote clients with an entry point into a network and provides full routing functionality, the remote access methods ie dial-up and VPN, data transport protocols used by remote access ie PPP, SLIP, Microsoft RAS, AppleTalk ARAP, VPNs as a secure means of using the internet for remote access, VPN protocols ie PPTP, L2TP and IPSec, inbound connections through VPN ports, modem ports and direct cable, permissions defined at the remote access server to define the level of user access via policies, caller ID to verify the caller's telephone number, callback to limit the telephone numbers a user can use, assigning user's IP address by remote access server and applying static IP routes to the remote access server's routing table, outbound connections through PSTN, ISDN, cable modem, X25 and direct cable, connecting to a VPN, multilink connections allowing a number of connections to be aggregated to facilitate increased bandwidth, authentication protocols to determine the identity of users eg PAP, SPAP, CHAP, MS-CHAP, MS-CHAP v2, MD5-CHAP, TLS for smart cards and third party protocols, distinguish between standard and extensible authentication protocols, encryption protocols to provide security eg MPPE, 128, 56, 40-bit encryption and IPSec as a framework for open standards in security, DHCP integration with remote access to provide clients with IP addresses when connecting

Remote access policies: remote access policies provide settings to be assigned to a connection to control the level of remote access granted to a user, the control is dictated by the policy which has three essential components ie conditions such as time of day and group membership, permissions such as allow or deny access, and profile such as authentication and encryption protocols that are applied to the connection, as multiple policies can be applied to all affecting the same user rules for evaluating multiple policies and these must be clearly understood

Troubleshooting remote access: use event logs and modem logs to view connectivity data, tracing of remote access connections can be initiated by registry settings, modems have a diagnostics option which can assist the tracing of modem hardware problems, test telephone lines before connecting a modem to eliminate a common source of problems, name resolution can affect the correct function of a VPN as can TCP/IP, DNS and WINS configurations

Extending remote access by using RADIUS: Remote Authentication Dial-In User Service (RADIUS) is used to manage many remote access points from one single administrative point facilitating a central user authentication system for many remote access servers, RADIUS also provides accounting information in a standardised format across many remote access servers

IP routing protocols: the need for routers to break a large network into smaller segments and to combine small networks into a larger network infrastructure, default gateway address is the address of a router, ICMP used to inform sending hosts of a better route, routing tables contain network addresses and the cost of using a particular network segment enabling routers to calculate the best path, RIP is a simple routing protocol using a distance-vector algorithm using a hop count (a hop is defined as the step from one router to the next), RIP broadcasts the routing tables on the network causing heavy network traffic and leads to poor convergence of routing tables, RIP uses fixed length IP addresses (class A, B and C), RIP v2 uses multicasting to minimise broadcasts, allows for variable length (classless) addresses and includes authentication to increase security, OSPF uses a link-state algorithm and allows for routers to be combined into hierarchical areas so further reducing broadcasts, problems with routing algorithms include count-to-infinity, latency in routing table updates, limitations of the hop count method, some of the solutions include split horizon, poison reverse and triggered updates, learners need to appreciate the difference between routing and routable protocols and be aware that a routing protocol can support many routable protocols, compare static routing (small networks or rarely changing

large networks) with dynamic routing (large networks or infrastructure undergoing frequent changes), routing and remote access combined provide demand-dial routing which reduces connection costs and increases security, compare hardware routers (eg CISCO) with software routers (eg Microsoft's Windows 2000 RRAS) for speed, flexibility and cost, use the Route command to add, view or modify routing tables, together with proxy servers routers are an important component of a firewall due to IP filtering capabilities, authentication and encryption

4 **Configure network security**

Public key infrastructure: security is such an important aspect of networks that learners must understand the underlying principles of key encryption, however, detailed analysis of encryption techniques is beyond the scope of this unit, the goal of encryption is to obscure the data from all but the intended parties, a private key is known only to the recipient of the data and used to unencrypt data, a public key is freely available and is used to encrypt the data, in addition the sender of data must be verified as being authentic by using digital signatures, hash algorithms are used to convert plain text into cipher text, keys and signatures are encrypted in digital certificates issued by a certificate authority (CA), CAs can be external (eg Verisign) or internal to an organisation, certificates contain not only the keys and signatures but also the intended purpose of the certificate (eg internet access, file encryption etc), CAs are implemented via network servers and in a large organisation several CA servers are linked in a hierarchy, a Root CA issues certificates to authenticate Subordinate CAs which in turn issue certificates, SSL and IPSec are the two primary security protocols used, certificates can be revoked when it has expired or a security breach has occurred using a certificate revocation list (CRL)

Configuring network security by using IPSec: IPSec is a framework for open standards for ensuring secure and private communications over IP networks by using cryptography security services, learners should be aware of the common types of network attacks (eg monitoring, data modification, stolen passwords, address spoofing, exploitation of weaknesses in server OS, man-in-the-middle, denial-of-service, IPSec enhances network security by mutual authentication, establishing security associations and encrypting exchanged data, there are two modes transport mode where data is secured between two computers and tunnel mode where data is secured between two routers, authentication is performed by SHA and MD5 algorithms and encryption by 56-bit, 40-bit and 3DES algorithms, ping can be used to test a secure connection

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Implement name resolution services	<p>For a case study:</p> <ul style="list-style-type: none"> • design an automatic IP address assignment plan to accommodate a routed network environment <ul style="list-style-type: none"> - install and authorise a DHCP server - create and configure appropriate scopes and scope options - create and test client reservations - install DHCP relay agents or enable BootP forwarders • design a domain naming strategy <ul style="list-style-type: none"> - install the DNS service - create forward and reverse lookup zones - delegate authority for a zone - enable dynamic updates - add appropriate resource records • design a NetBIOS name resolution strategy <ul style="list-style-type: none"> - install WINS - add static WINS records for non-WINS clients - configure push/pull replication partners • evaluate the alternative strategies for automatic IP addressing in a routed network and alternative name resolution techniques

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
2 Configure and troubleshoot network connectivity	<p>For a case study:</p> <ul style="list-style-type: none"> • produce a troubleshooting strategy for a routed environment to include: <ul style="list-style-type: none"> - IP addressing problems - name resolution problems - automatic IP addressing problems - a backup strategy for DNS, WINS and DHCP • capture and analyse network data using network monitoring tools • provide connectivity solutions for a multi-vendor networking environment • the report should include an outline of the type of network connectivity issues that could be encountered in a large multi-vendor networking environment and propose solutions using available utilities and services. Some evidence should be presented of learner's attempt at solving connectivity problems
3 Configure and support routing and remote access	<p>For a case study:</p> <ul style="list-style-type: none"> • configure inbound and outbound VPN connections • configure remote access policies to control the access of various groups via RRAS • configure a RADIUS server to log all accounting requests from one or more RRAS servers and to monitor remote access • describe the benefits to an organisation of using a VPN as a viable alternative to a dedicated line and research the practical applications of remote access
4 Configure network security	<p>For a case study:</p> <ul style="list-style-type: none"> • outline the security threats faced by modern computer networks • produce a security strategy for issuing certificates in a large organisation using an Enterprise certificate authority hierarchy • configure IPSec policies to encrypt data between computers

Note: the case studies referred to above may be either one single case study or separate case studies.

Guidance

Delivery

This unit may be delivered as a stand-alone package or alongside other units. Learners should already have studied introduction to networking units such as *Unit 5: Networking Concepts* and *Unit 12: Networking Technology* or have equivalent knowledge.

Most learner effort should be spent in understanding the concepts of network services through practical activities designed to support the acquisition of knowledge and understanding. In addition, if learners intend to pursue vendor certification status then exposure to multiple choice style questions would be beneficial. There are many good examples available on the internet and 'exam cram' style books, however, emphasis should be placed on gaining sound practical experience through realistic scenarios rather than providing textbook answers.

Assessment

There is an obvious need to combine practical and theoretical assessment. The theory can be delivered by using lectures, demonstrations and case studies that consider the goals of effective system administration. Learners can produce reports that describe features and show an understanding of the principles and definitions. The practical aspects provide an opportunity for learners to plan and implement network connectivity. It is essential that a logbook is maintained for recording both progress and effectiveness.

Links

Unit 5: Networking Concepts should be studied in preparation for this unit. Ideally, learners should have knowledge of computer networks, protocols and operating systems, prior to attempting this unit.

Resources

In order to deliver this unit centres must have a number of computers that can be configured as servers or advanced servers with Active Directory ie domain controllers for a Microsoft system or equivalent for other vendors' systems with the capabilities of forming multiple network segments. It is recommended that some computers have at least two network cards so that they can be configured as routers. Refer to the Microsoft hardware compatibility list (HCL) on the installation CD or at:

- www.microsoft.com/windows2000/guide/platform/overview/default.asp

As learners will be configuring IP addresses, care must be taken if connected to the internet or the institute's intranet due to learners being granted administrative rights.

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- *Microsoft Official Curriculum Course 2153AC* — (Microsoft Corporation)
- Melber, D — *MCSE Windows 2000 Network Infrastructure* — (Que, 2003)
ISBN: 078972863X
- Sirockma, J — *MCSE Training Guide: Windows 2000 Network Administration* — (Pearson, 2000) ISBN: 0735709661

Request for comments (RFC)

RFCs drive the development of the internet and networking in general. Learners should be encouraged to become aware of RFCs and they can be found at www.rfc-editor.org

Unit 32: Maths for Software Development

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

This unit is an introduction to some of the mathematical concepts and techniques that will be required by software engineers. To develop the mathematical skills necessary for software engineering learners must gain a range of mathematical skills. The unit aims are to allow the learner to appreciate the mathematical knowledge required for software engineering and prepare them for more advance concepts of mathematics in relation to software engineering.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Develop the **mathematical skills** necessary for software engineering
- 2 Demonstrate an understanding of **linear algebra**
- 3 Apply the fundamentals of **formal methods**
- 4 Employ **statistical techniques** to analyse data.

Content

1 Mathematical skills

Algebra: basic notation and rules of algebra, multiplication and factorisation of algebraic expressions involving brackets, algebraic equations and simultaneous linear equations, quadratic equations involving real roots

Geometry: angular measure, types and properties of triangles, Pythagoras' Theorem, geometric properties of a circle, sine, cosine and tangent functions

2 Linear algebra

Relations: domain, range, Cartesian product, universal relation, empty relation, inverse relation, reflexive, symmetric and transitive properties, equivalence relations

Functions: dependent variable, independent variable, domain, codomain, injective, surjective and bijective functions

Matrices: addition and subtraction, scalar multiplication, matrix multiplication, properties of addition and multiplication of matrices, transpose of a matrix, determinant, identify matrix, inverse of a matrix, condition for a matrix to be singular, solution of simultaneous linear equations

Vectors: representation of a vector by a straight line, equal and parallel vectors, magnitude of a vector, vector addition and subtraction, scalar multiplication, linear transformations — rotations, reflections, translations, inverse transformations, axioms of a vector space

3 Formal methods

Sets: definitions of set and element, representation of sets using Venn diagrams, universal and empty sets, finite and infinite sets, \mathbb{N} , \mathbb{Z} and \mathbb{R} , operations on sets (union, intersection, difference), subsets, laws of set theory (idempotent, associative, commutative, distributive, identity, involution, complement, De Morgan's laws), notation, predicates

Propositional calculus: simple and compound propositions, conjunction, disjunction, negation, implication and bi-implication, truth tables, Boolean laws of propositional calculus (idempotent, associative, commutative, distributive, identity, involution, complement, De Morgan's Laws), validity, principle of mathematical induction, logical argument and deductive proof

4 Statistical techniques

Techniques: frequency distribution, mean, median, variance, deviation, correlation probability, factorial notation, permutations and combinations, laws of probability, conditional probability, Baye's Theorem

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Develop the mathematical skills necessary for software engineering	<ul style="list-style-type: none"> • solve sets of simultaneous linear equations and make use of the formula to solve quadratic equations • solve problems in geometry using the sine, cosine, tangent and/or Pythagoras' Theorem
2 Demonstrate an understanding of linear algebra	<ul style="list-style-type: none"> • decide whether a set of simultaneous linear equations has a unique solution, no solution or infinitely many solutions • solve sets of simultaneous linear equations using matrix methods • construct matrices to effect transformations of the types rotation, reflection and translation • specify the type of a relation
3 Apply the fundamentals of formal methods	<ul style="list-style-type: none"> • employ the laws of propositional calculus to simplify compound statements • perform a proof by induction
4 Employ statistical techniques to analyse data	<ul style="list-style-type: none"> • ascertain different frequency distribution • calculate a variety of measures for data • calculate correlation between sets of data • solve problems involving probability

Guidance

Delivery

The unit can be delivered by traditional lectures or distance learning. The focus should be on helping learners become confident in handling the mathematical concepts to support software development rather than on a rigorous understanding of mathematical solutions. Therefore, learners should have the opportunity to select appropriate mathematical tools and methods for stated problems and to explain results from their use.

Assessment

Evidence is likely to be in the form of solutions to prepared exercises that cover both the mathematical concepts and the implementation of software tools. The emphasis of the exercises should be acquaintance with notation and principles rather than the solution of complex problems.

Links

This unit is implemented as part of a software development. It relates to *Unit 3: Programming Concepts* and *Unit 4: Database Design Concepts*.

Resources

No exceptional resources are required except access to suitable software packages. Centres are advised to generate many examples to provide a familiarity with the mathematical concepts and their applications in computing.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following.

- Haggarty, R — *Discrete Mathematics for Computing* — (Addison Wesley 2001) ISBN: 0201730472
- Jordan, D and Smith, P — *Mathematical Techniques* — (OUP, 2002) ISBN: 0199249725

Unit 33: Formal Methods

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

Specification of secure and well-engineered computer systems requires the unambiguous, concise and provable language of mathematics. This unit aims to acquaint learners with the mathematical concepts and notation that underpin formal methods, such as 'Z', set theory and propositional and predicate logic and functions.

The unit also gives learners experience of proof by induction (a principle of functional programming) and relationship matrices. The latter, as well as reinforcing set and logic theory, will provide an alternative application of the rules of matrix algebra.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Employ the laws of **set algebra, propositional logic and predicate logic**
- 2 Solve problems using **mathematical induction, relationships and functions**
- 3 Understand **formal methods schema**
- 4 Understand the use of **formal specifications**.

Content

1 Set algebra, propositional logic and predicate logic

Set theory: notation (null, universal, complement, subset, element), set operations (union, intersection, subtraction), laws of set algebra, Venn diagrams, power set

Logic: definition of proposition, propositional logic laws (and, or, not, eor, equivalence, implication), laws of propositional logic, tautologies, truth tables for compound statements, simplification of logic expressions, predicate logic (universal and existential qualifier)

2 Mathematical induction, relationships and functions

Mathematical induction: principles of induction, sigma notation, solution of induction problems linked to recursion

Functions: notation for relation, definition of a function, mappings of functions, function domains, inverse functions, two state (Boolean) matrix representation and solutions

3 Formal methods schema

Schema layout: predicate and signature, schema notation

Schema conventions: expressions

Schema interpretation: the production of written descriptions/pseudocode that represent a formal methods specification

4 Formal specifications

Use of formal specifications: benefits, features, reliability

Importance in critical systems: human safety, high cost related systems

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Employ the laws of set algebra, propositional logic and predicate logic	<ul style="list-style-type: none"> • solve set theory problems using Venn diagrams • simplify compound logic statements using truth tables and appropriate simplification techniques • apply universal and existential qualifiers
2 Solve problems using mathematical induction, relationships and functions	<ul style="list-style-type: none"> • perform mathematical induction • produce combinations of Boolean relationship matrices • understand functional notation
3 Understand formal methods schema	<ul style="list-style-type: none"> • apply formal methods schema • apply set theory, logic and function notation • evaluate the importance of using formal methods schema
4 Understand the use of formal specifications	<ul style="list-style-type: none"> • identify suitable use of formal specifications • justify the use of formal specification

Guidance

Delivery

This unit can be delivered by traditional lectures or distance learning. The focus should be on becoming confident handling the mathematical notation and concepts to support software development rather than a rigorous understanding of mathematical solutions.

Assessment

Evidence is likely to be in the form of solutions to prepared exercises that cover both the mathematical concepts and the interpretation of schema. The emphasis should be on acquaintance with notation and principles rather than the solution of complex problems. Learners would not be expected to produce their own formal methods schema but interpret simple examples.

Links

Ideally, learners taking this unit should have knowledge of software development so that they can identify the need for formal methods in implementing secure and safe computer systems.

The end product of a formal methods schema could be a piece of software. A pre-requisite for this unit would be *Unit 32: Maths for Software Development*.

Resources

No exceptional resources are required except access to appropriate formal method schemas such as Z.

Centres are advised to generate many examples to provide a firm familiarity with the mathematical concepts and their applications in computing.

CASE tools that handle formal method notation would be useful.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Bell, D et al — *The Essence Of Program Design* — (Pearson, 2002) ISBN: 0877788472
- Wordsworth, J B — *Software Development with Z* — (Addison Wesley 1992) ISBN: 0789728818

Unit 34: Supporting NOS and OS

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

As many organisations extensively use complex network operating systems there is an increasing need for system administrators to be able to manage all aspects of such systems. The aim of this unit is to provide learners with a sound knowledge of the techniques to install, configure and troubleshoot a network operating system and to ensure that they acquire the skills to make the network operating system available at all times. As data has become vital to modern commerce, it is imperative that learners understand the techniques for ensuring that data is constantly available and the methods used to ensure that availability, as well as the planning and actions needed in the event of a catastrophic failure.

The unit focuses on an appropriate network operating system, such as Microsoft Windows.

Summary of outcomes

To achieve this unit a learner must:

- 1 **Install, configure and test a network operating system**
- 2 Plan and apply **disaster recovery techniques**
- 3 **Implement network clients and servers**
- 4 **Monitor and optimise performance** of a network operating system.

1 Install, configure and test a network operating system

Installing or upgrading a network operating system: identify system requirements for each version of the operating system, preparing disc partitions and file system (FAT, FAT32 or NTFS), determine licensing mode and requirements, understand the characteristics of workgroups and domains, the importance of the hardware compatibility list (HCL), identify upgrade paths from previous versions of the operating system

Configure a network operating system: installing devices, updating drivers and driver signing options, creating hardware profiles, configuring display options for single and multiple monitors, environment variables, startup and recovery options and the boot.ini file, configuring the desktop (regional options and accessibility options), understand that some existing applications may not function on the latest version of the operating system and how to determine software compatibility ie visit vendor's website and test software, install applications and be aware of the security restrictions faced by users when attempting installation, configure the internet options of a web browser

Connecting clients to networks: review network protocols and adaptors, examine network services (ie client services, file and print services) and understand their role when connecting clients to servers, understand how the binding order can affect the performance of a client, install TCP/IP and make use of both static and dynamic addressing via DHCP, be aware of automatic private IP addressing in the event of a DHCP failure, verify and test TCP/IP connectivity, connect to network resources through various methods (ie web browser, run command, mapping a network drive, browsing with my 'network places' and searching from the start menu, connecting Microsoft networks to Novell networks via CSNW, GSNW and NWLink (IPX/SPX), understand how Novell networks are configured ie network numbers and frame types

Configuring printing: understand the terms used in printing such as printing device, printer driver, local and network printing devices and print server, adding a printer, sharing printers, configuring TCP/IP printers, setting up print clients, printer pools, priorities, permissions, internet printing via a web browser, managing print queues, managing spool files

Configuring a network operating system for mobile computing: hardware profiles for mobile users, docking stations, power management for mobile computers, configure offline files to allow users to connect to network resources whilst online and be able to use the resource offline, synchronise offline files to ensure the correct version of the file is used, connect via a dial-up connection through a phone line or ISDN line, connect via a private network using a VPN

Configure and manage discs: understand the partition scheme of basic discs (ie primary and extended partitions with logical drives), be aware of the partition and disc numbering scheme and of the impact of adding partitions and logical drives on the boot.ini file, limitations of basic discs such as no access to software RAID technology (Windows 2000), partitions must be in contiguous disc space and the limit on the number of drive letters, backward compatibility of basic discs with previous versions of the operating system, understand the volume scheme of dynamic discs, the benefits including non-contiguous disc space, no limit to the number of volumes, partition information stored on disc rather than in the registry (as basic disc partition information is), access to software RAID technologies, be aware that dynamic discs are not compatible with any other operating system, understand the techniques of creating basic and dynamic discs and partitions and volumes and the upgrade process from basic to dynamic, how to repair and delete volumes, the process of adding new discs, how dynamic disc volumes are identified (by drive letter or mount points), manage a disc remotely from another computer and perform defragmentation

Running programs: understand that 32-bit programs use a particular sub-system (WIN32 for Windows 2000) and are native to the operating system and each program runs in its own memory space, preventing one program from interfering with another (pre-emptive multi-tasking), whereas 16-bit programs all run in the same memory space with the potential for conflict (co-operative multi-tasking), Windows 2000 (and NT) allows for 16-bit applications to run in separate memory spaces, start 16-bit programs in separate and shared memory spaces, change the priority of a program, understand the different priority levels (low, normal, high and real time), use task manager to view and control processes

2 Disaster recovery techniques

Disaster protection: learners must understand the importance of computers in today's world and therefore the need for sound disaster protection mechanisms to guard against total loss, hardware can be replaced (at cost) but data can be neither replaced nor insured, so it is important that a regime of disaster protection is implemented and tested so that a computer system can be restored to a fully operational state

Fault tolerance: defined as the ability of a computer or operating system to respond to a catastrophic event (such as a power outage or hardware failure), uninterruptible power supplies can guard against loss of power, RAID (redundant array of independent discs) systems can guard against the loss of a hard disc, hardware RAID is more expensive but more efficient than software RAID but is less flexible, three levels of RAID commonly used are RAID 0 (volume striping but no redundancy), RAID 1 (mirrored volumes — often used to protect boot and system volumes), RAID 5 (striped volumes with parity — used for data volumes), characteristics of different RAID levels ie the number of discs used, the efficient use of storage and the relative read and write performance, disc duplexing via multiple disc controllers, creation of RAID volumes, recovering failed volumes, learners should understand that fault-tolerant systems are not a replacement for backups which are required when multiple discs in a RAID set fail, some business-critical systems use multiple servers (eg clusters) to ensure that one server continues in the event of a server failure

Backup and restore of data: an effective backup system is imperative to the safety of data, both user and system data eg registry settings, backup types ie normal, copy, differential, incremental and daily, permissions required to perform backup and restore operations, backup media, the need for a regular backup schedule based upon how often data is changed, automatic scheduling of backup jobs, offsite storage of backup media, recovery techniques, starting a computer using advanced startup options to enable an administrator to rescue a system that would otherwise fail to start eg safe mode, safe mode with command prompt, last known good configuration, and directory services restoration, emergency repair discs to repair registry files, system files, partition boot sector and the startup environment

3 **Implement network clients and servers**

Installing and configuring terminal services: running applications from a central server, thereby allowing for clients with reduced hardware specifications, centralised management and control of users and applications, Remote Desktop Protocol (RDP over TCP/IP), centralised deployment of applications, access to a later version of the operating system than is available on the client, remote administration of servers, software compatibility issues ie terminal services require applications that run in a multi-user environment, additional licensing requirements of both the client operating system and the application, application compatibility scripts to aid installation of applications

Implementing network clients: examine the different installation methods (CD, network installation, command line options, setup manager, disc duplication (eg sysprep), remote installation (RIS), attended and unattended installations, PXE (Pre-Boot Execution Environment) network interface cards, configuring a Net PC, troubleshooting operating system installation

Implementing network servers: examine the various roles played by servers in a network and the characteristics of each, file servers, print servers, web servers, application servers, domain controllers (directory service servers), DNS servers, WINS servers, DHCP servers, remote access servers, balancing workloads by matching available hardware with the server's role (eg memory, processor, disc), consideration on performance of RAID volumes, data structures, permissions, shared folders, groups, application distribution, disc size, number of processors, static IP addresses, documentation of network environment to facilitate changes and recovery from disaster, documentation should include installation configuration, user and group account information, stop errors and corrective action taken, security violations, virus checkers and violations, service pack upgrades and hardware failures

4 **Monitor and optimise performance**

Monitoring event logs: monitor events to identify and track security events, resource usage, system and application errors, limiting the size of event logs to preserve disc space, archiving event logs to track trends over time

Monitoring programs: use Task Manager to view currently running applications, end an unresponsive application, identify which program(s) are associated with an application, change an application's priority, view a snapshot of system performance

Monitor system performance: computer systems need to be monitored to diagnose how the system and applications are functioning to enable an administrator to optimise the performance. Objects are the major components such as processor or hard disc, counters are specific aspects of an object to be measured such as processor time, instances are multiples of the same object eg multiple processors can be monitored separately or collectively, counter data can be viewed as charts, histograms or reports, alerts are used to set a threshold for a counter so that an administrator can be informed when the threshold is reached, establishment of a baseline after installation or a major change takes place against which all subsequent performance can be compared. It is important for learners to realise that monitoring a system involves a great deal of subjective analysis based on experience and that there are no hard and fast rules, guidelines should be given for the major components eg memory, processor, disc and network adapter card with a warning that poor performance of one component may be the result of another component malfunctioning or acting as a bottleneck

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Install, configure and test a Network Operating System	<ul style="list-style-type: none"> • ensure hardware compatibility <ul style="list-style-type: none"> - check the operating system vendor's website and/or hcl for hardware compatibility • install a server operating system <ul style="list-style-type: none"> - create boot partition - install from CD - configure a static IP address for the server - configure the DHCP server service to issue IP addresses • install a client operating system <ul style="list-style-type: none"> - configure the client to obtain an IP address automatically - create hardware profiles to selectively boot the client as a standalone computer and as a network client - add new hardware and/or update existing hardware • configure the server as a print server <ul style="list-style-type: none"> - test the print server by printing from clients - create a printer pool - create different printers connected to the same printing device to demonstrate priorities • configure a mobile computer <ul style="list-style-type: none"> - (note a desktop could be used to simulate a mobile computer) - configure power-saving options - configure and test offline folders

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
2 Plan and apply disaster recovery techniques	<ul style="list-style-type: none"> • For a case study produce a disaster recovery plan to include: <ul style="list-style-type: none"> - use of RAID levels 0, 1 and 5 - UPS - backup regime - multiple servers - protection of operating system data and startup environment • the report should include a cost analysis, specialised devices and an outline of key personnel and their roles and take account of a catastrophic failure
3 Implement network clients and servers	<p>For a case study produce:</p> <ul style="list-style-type: none"> • a case for terminal services to allow for sharing of applications and reduced cost of ownership • outline the roles of different types of servers eg file, print, etc, and the necessary hardware required to support the role of the server • install terminal services and terminal services client and conduct remote administration of users and servers • perform a network installation of client computers including network install of a service pack
4 Monitor and optimise performance of a network operating system	<ul style="list-style-type: none"> • monitor the performance of the print server over time to identify: <ul style="list-style-type: none"> - processor usage - memory usage - disc utilisation - network usage - (ideally the server should have few hardware resources ie slow processor, small amount of RAM etc) • view and archive event logs • search for specific events • archive an event log and demonstrate searching through a saved log file • load an archived log into a database or spreadsheet program and format the output

Note: the case studies referred to above may be either one single case study or separate case studies.

Guidance

Delivery

This unit may be delivered as a stand-alone package or alongside other units that look at operating systems. Most learner effort should be spent in practical activities in this unit. In addition if learners intend to pursue vendor certification status then exposure to multiple choice style questions would be beneficial. There are many good examples available on the internet and in 'exam cram' style books, however, emphasis should be placed on gaining sound practical experience rather than providing textbook answers.

Assessment

There is an obvious need to combine practical and theoretical assessment. The theory can be delivered by using lectures, demonstrations and case studies that consider the goals of effective system administration. Learners can produce reports that describe features and show an understanding of the principles and definitions. The practical aspects provide an opportunity for learners to plan, install and maintain a client/server network. It is essential that a logbook is maintained for recording both progress and effectiveness.

Links

Learners should have knowledge of basic computer hardware such as CPU, discs, RAM, ROM, BIOS and drivers for hardware devices as well as a thorough understanding of computer networks by studying *Unit 5: Networking Concepts*.

Resources

In order to deliver this unit centres must have a number of computers that can be configured as servers or advanced servers with Active Directory, ie domain controllers for a Microsoft system or equivalent for other vendors' systems. Refer to the Microsoft hardware compatibility list (HCL) on the installation CD or at:

- www.microsoft.com/windows2000/guide/platform/overview/default.asp

Learners should install the operating systems in either a workgroup (peer-to-peer) or domain environment. The domain environment is preferable as it more realistically represents the environment in common use in business. It is desirable, but not essential, that at least one computer has three hard disc drives to enable RAID 5 to be demonstrated. To give learners a realistic view of the results from performance monitoring, centres should have a range of computers with varying levels of resources in order to understand the effect of limited resources. Alternatively centres may wish to allow learners to upgrade computers to see at first hand the effect on performance of increased resources. As learners will be configuring IP, addresses care must be taken if connected to the internet or the institute's intranet due to learners being granted administrative rights. An application that can be deployed via terminal services (eg Microsoft Office 2000) and a 16 bit program to examine co-operative multi-tasking.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Barker, G and Harrison, D — *MCSE Windows 2000 Professional* — (Que, 2002)
ISBN: 07897277X
- Maione, D — *MCSE Windows 2000 Server* — (New Riders Publishing, 2003)
ISBN: 0789728818
- *Microsoft Official Curriculum Course 2152BC* — (Microsoft Corporation)

Unit 35: Distributed Design and Development

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

This unit introduces design techniques, tools and technology required in creating enterprise-level applications using the development tools and technologies offered by Microsoft Visual Studio. Visual Studio Enterprise Edition includes Microsoft Visual Basic 6.0, Visual C++ 6.0, Visual J++ 6.0 and Visual FoxPro 6.0 and Visual InterDev 6.0. Visual InterDev 6.0 provides easy integration with the internet and a web page authoring environment. Visual Studio Enterprise Edition also offers support for distributed applications and large systems

Visual Studio 6.0 includes new versions of the Microsoft Visual Tools, enabling developers to build component-based solutions. These tools provide support for building multi-tier solutions based on Windows Distributed InterNet Applications (Windows DNA) architecture. This includes building cross-platform Web applications, as well as client/server Windows operating system-based applications

The unit assumes an intermediate level of skills and knowledge of Visual Basic applications including ActiveX components, using the ActiveX Data Objects model to access data sources such as Access or SQL Server, COM DLLs and COM EXEs equivalent to that gained in *Unit 37: VBI Enterprise Development* and *Unit 39: Visual Programming Fundamentals*. The unit covers aspects of Windows NT, including MTS, IIS and MSMQ. The unit can be used as preparatory material for the Microsoft Certified Professional examination 70-175 Visual Basic Distributed Applications, although it is expected that only a small proportion of learners will reach this standard. The unit also covers material for MCP examination 70-100 Analysing Requirements and Defining Solution Architectures.

This unit presents opportunities to demonstrate key skills in information technology, improving own learning and performance and problem solving.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Understand **Microsoft architecture for enterprise applications**
- 2 **Design** a distributed application
- 3 **Build** a distributed application
- 4 Build and use **components**.

Content

1 Microsoft Architecture for Enterprise applications

Enterprise applications: business rules, business requirements, business systems, benefits of distributed systems, Windows DNA framework

NT platform services: COM, MTS, IIS, MSMQ, SQL Server

Application performance: review performance factors (delays, resource contention, congestion, complexity). Performance monitor. Visual Analyzer

2 Design

Designing distributed systems: application development process, analysing requirements, determining business goals, customer requirements, designing applications architecture, defining business logic, defining presentation logic, determine technical requirements. Visual Modeler

Design goals: reusability, scalability, reliability, efficiency

3 Build

Data tier: logical design, physical design, components. Database schema

Data access: Universal Data Access, OLEDB, ODBC, ActiveX Data Objects (ADO). Query Designer

Logical design: entities, attributes, identifiers, keys (primary, foreign), entity relationship modelling, normalisation, optimisation

Physical design: Visual database tools, Data Designer, Data View window

Business tier: MTS, transactions, packages, state, security (declarative, programmatic)

Presentation tier: HTML, scripting, VBScript, Jscript, Active Server Pages, DHTML, Visual Interdev. Design principles, forms, controls, properties

4 Components

Components: in process, out-of-process. Objects, classes, interface, GUIDs, ClassID, type libraries. Binding, early, late. Granularity, versioning

Language tools: comparison of capabilities of Visual Studio language tools for creating components

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Understand Microsoft architecture for enterprise applications	<ul style="list-style-type: none"> • explain distributed systems and their characteristics and benefits • describe windows operating systems services that support distributed applications • describe the use of performance monitor and visual analyser to monitor and review performance of a distributed application
2 Design a distributed application	<ul style="list-style-type: none"> • define business and customer goals • analyse business requirements • explain the benefits of transactions and MTS in distributed applications • use Visual Modeler to create a model of a distributed application
3 Build a distributed application	<ul style="list-style-type: none"> • describe data, business and presentation layers of a distributed application • create an entity relationship diagram for a distributed system • define a database schema that maps a logical design to a physical design • use visual data tools to create data structures, view data and design queries • describe the roles and benefits of Universal Data Access, OLEDB and ActiveX Data Objects model • create and compare user interfaces in HTML and DHTML • use Visual InterDev (or equivalent) to create a web-based user interface
4 Build and use components	<ul style="list-style-type: none"> • design and create COM objects • compare Visual Studio component tools • use MTS to create packages and deploy components

Guidance

Delivery

The focus of this unit is the use of Visual Studio in a multi-user client server environment. Learners should gain an appreciation of the specific issues involved in enterprise development and the benefits of component-based development strategy in such environments. Learners should be given an appreciation of the applications and tools that comprise Visual Studio in order to make reasoned comparisons of their features. Learners should gain experience of creating applications for the internet.

Assessment

The main evidence for this unit is likely to be in the form of simple Visual Basic application programs demonstrating the achievement of the learning outcomes. At least one of the applications in the unit should be of sufficient complexity to simulate a real-world application.

Links

Learners should have intermediate level skills and knowledge in Visual Basic programming techniques and have developed a number of Visual Basic desktop applications. Learners without these skills are recommended to study *Unit 37: VB Enterprise Development*, *Unit 38: Visual Programming Development* and *Units 39: Visual Programming Fundamentals*. Learners should also be familiar with the NT environment and tools such as Microsoft Transaction Server, Internet Information Server and Microsoft Message Queue.

Support materials

A copy of Visual Studio 6 Enterprise Edition or later editions needs to be available to learners. The MSDN help library and search features should be installed. Access to Excel 97 is required. Learner computers should be running NT4 Server. Microsoft Transaction Server, Internet Information Server and Microsoft Messaging Queue should be installed from the NT4 Option Pack.

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- *Distributed Applications with Microsoft® Visual Basic® 6.0 MCSD Training Kit* — (MSPress)
- *Distributed Applications with Microsoft® Visual C++® 6.0 MCSD Training Kit* — (MSPress)
- Mueller, J — *Visual Studio 6: The Complete Reference* — (Osborne McGraw Hill, 1998) ISBN: 0078825830

Websites

Websites that support the development of this unit include those of computing associations and employers. The following may be useful:

- <http://msdn.microsoft.com/vstudio/> — Microsoft Visual Studio home page
- www.microsoft.com/mspress/devtools/vstudio/ — Visual Studio MSPress books and resources
- <http://msdn.microsoft.com/vstudio/centers/solution.asp> — Visual Studio Solutions centre
- www.vb-bookmark.com/ online — Visual Basic resource directory
- www.programmersheaven.com/zone16/ — Programmers' Heaven Development Tools Zone
- Web pages provide access to a further range of internet information sources. Learners must use this resource with care, justifying the use of information gathered.

Unit 36: OOP Programming

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

Many development platforms use objects as reusable software components and although we know that object-oriented programming is not a panacea, it will remain a major element in the construction of large systems for some time to come.

The range of languages supporting object-oriented programming continues to grow. Many of these languages restrict the control that the programmer has over the class, such as not allowing generic types (eg templates allowed in C++ but not in Java). This module will concentrate on the common ground that most object-oriented programming languages share.

Future languages may provide other features that could also be profitably explored within this module.

The module leaves room for development into advanced templates, exception handling, RTTL or 'patterns' for example.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Understand **object-oriented concepts**
- 2 Assimilate and use basic **object-oriented programming concepts**
- 3 Use an **object-oriented programming design method**
- 4 Reuse system components using **object-oriented programming principles**.

Content

1 Object-oriented concepts

General trends in software engineering: modularity, encapsulation, reuse, complex systems, iterative development, interactivity, event-driven systems, greater client involvement in design

Characteristics of object-oriented systems: identity of objects, classification, inheritance, polymorphism

Methodologies and methods: data-centric, process-based, responsibility-based, patterns

2 Object-oriented programming

Classes: objects, attributes, methods, representation of Abstract Data Types, the control of scope of attributes (member data) and messages (member functions) within a class, constructors and destructors, inheritance, dynamic Binding, virtual functions and polymorphism, parameter-based types (templates)

Implementation: implementation of classes, making instances of objects, using objects with a program, building a system with classes

3 Object-oriented programming design

Design strategy: formulation of strategy identifying the differences in data driven vs functions decomposition in design

Design method: familiarisation with a formal (eg OMT) or informal (eg CRC cards) object-based design method to clarify the roles of the objects within the system

Design refinement: clarification of a design using principles of maximum coherence and minimum coupling between the classes

4 Object-oriented programming principles

Class libraries: use of classes from libraries to produce off-the-shelf solutions to typical software problems eg encapsulated file system object or other current uses such as Java applets, databases or visual components

Class modification: extension of functionality of a supplied class using inheritance (this is an opportunity to use windows objects, elements of the C++ STL or other class libraries relevant to the language development platform and environment in use)

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Understand object-oriented concepts	<ul style="list-style-type: none"> • apply principles of good practice evolved as culmination of various trends in software engineering • determine whether a system is fully object-oriented • identify opportunities for applying inheritance • identify opportunities for utilising polymorphism • select an appropriate pattern
2 Assimilate and use basic object-oriented programming concepts	<ul style="list-style-type: none"> • identify the various elements in an object based program • develop programs using object-oriented programming concepts • construct and use basic objects
3 Use an object-oriented programming design method	<ul style="list-style-type: none"> • clearly identify classes and associated methods from a program specification • identify ways of involving the client in decisions • justify selection of suitable classes, and allocation of features to classes • create an object-based design using a specified design method
4 Reuse system components using object-oriented programming principles	<ul style="list-style-type: none"> • incorporate elements from a class library into simple programs • modify a class to develop new classes based on a (possibly supplied) base class, to a specification

Guidance

Delivery

The focus of this unit is the clear understanding of object-oriented programming, the use of appropriate design methods, and plenty of experience in creating programs using an object-oriented programming language. To this end, assessment should include the ability to design objects in a coherent manner and the ability to write programs using those objects. Learners should also show an awareness of the theory underlying object-oriented software production.

Learners would not be expected to create classes with virtual functions, but should be able to use and extend these classes.

The specific content given for this unit is not exhaustive, and will differ according to the language and development platform being used eg Eiffel, C++, Java, Smalltalk, Delphi, Visual Basic.

Assessment

Evidence is most likely to take at least three forms:

- identification of components within a supplied program and an extension of its functionality
- production of an object-oriented design to a given specification
- production of a simple program which uses components from a supplied library to demonstrate the principle of component-based software.

Exploration of the range of applicability of object-oriented methods could well be carried out as small-group investigations into particular areas, assessed using presentations which ensure that the entire class benefits from the research.

Links

Learners should have working skills and knowledge in basic programming techniques so that the principles presented here are delivered in context. Learners will draw on their knowledge and skill derived from *Unit 3: Programming Concepts*.

Much of the work done here will link to *Unit 33: Formal Methods*, and could provide a good starting point for an individual programming project. If delivered using Java, then the *Unit 30: Java Programming* will be of use, other links include *Unit 20: Internet Server Management* and *Unit 39: Visual Programming Fundamentals*.

There are also links with the *Unit 41: Data Structures and Algorithms*.

Beyond that, the principles delivered in this unit provide links across many other units.

Resources

A language translator capable of object-oriented programming and its supporting environment needs to be available to learners, together with support in a selected object-oriented design method. The CASE tools used in other modules may help. Software that could be used are Java, Visual Basic, C++ and Delphi

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Deitel, H — *C++ How to Program 3rd Edition* — (Prentice Hall, 2002)
ISBN: 0131118811
- Flanagan, D — *Java Examples in a Nutshell* — (O'Reilly, 2000) ISBN: 0596000391
- Flanagan, D — *Java in a Nutshell 3rd Edition* — (O'Reilly, 2002) ISBN: 0596002831
- Schildt, H — *C++: The Complete Reference* — (Osborne McGraw-Hill, 2002)
ISBN: 0072226803
- Seed, G — *An Introduction to Object-orientated Programming in C++* — (Springer-Verlag Berlin and Heidelberg, 1996) ISBN: 3540760423
- Snaith, P — *The Complete Idiot's Guide to C++* — (Alpha, 1998) ISBN: 0789718162

Websites

Websites that support the development of this unit include those of computing associations and employers. The following may be useful:

- www.programmersheaven.com/

Unit 37: VB Enterprise Development

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

Systems that serve a corporate enterprise commonly employ a client server model to separate the user interface, the business rules and the data. This unit focuses on how to build three-tier client server solutions in Visual Basic and how Visual Basic will assist in implementing and managing such systems. The unit covers strategies for enterprise development, COM components which are deployed using Microsoft Transaction Server (MTS), Visual Basic features such as Active X components, SQL Server and NT Server.

The unit assumes a good knowledge of creating applications in Visual Basic, including techniques such as ActiveX controls, using the ActiveX Data Objects model to access data sources such as Access or SQL Server, creating and using COM DLLs and COM EXE components and classes equivalent to that gained in *Unit 38: Visual Programming Development*. The unit assumes familiarity with creating Visual Basic applications for the single user desktop environment and familiarity with Visual Basic coding at a level as gained in *Unit 39: Visual Programming Fundamentals*. The unit can be used as preparatory material for the Microsoft Certified Professional examination 70–175 Visual Basic Distributed Applications, although it is expected that only a proportion of learners will reach this standard.

This unit presents opportunities to demonstrate key skills in information technology, improving own learning and performance and problem solving.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Understand the **concepts of enterprise development strategy**
- 2 Create and **use COM components**
- 3 Use **Microsoft Transaction Server**
- 4 Access data using **ActiveX Data Objects and SQL Server**.

Content

1 Concepts of enterprise development strategy

Enterprise development strategy: client server, three tier, internet, interoperability, integration, COM, message queuing, MSMQ, synchronous/asynchronous communication, clustering

Microsoft Solutions Framework: process model, application model, user services, business services, data services

2 Use COM components

COM components: classes, types of components, interfaces, IUnknown, IDispatch, type libraries, GUIDs

Creating COM components: properties, methods and events. Instanting property. Raising errors from components. Versions. Testing

Using components: setting references, instantiating, early binding, late binding, setting properties, responding to events and errors, testing, registering, registry keys

3 Microsoft Transaction Server

MTS architecture: components, packages. MTS Explorer, exporting, installing, registry. State, activation, connection pooling

MTS transaction services: managing transactions, properties, transaction events, enabling, committing and aborting transactions, context object, instancing property, debugging and error handling

4 ActiveX Data Objects and SQL Server

Architecture: Universal Data Access, OLEDB, ODBC, RDS, ADO

ActiveX Data Objects: data source, connections, commands, recordsets, parameters. Navigating recordsets, updating data sources. SQL Execute methods. Cursors (type, location), record locking, disconnected recordsets, conflicts. Error handling

SQL Server: overview, data integrity (declarative, procedural), creating stored procedures from Visual Basic, using parameters (input, output) and return codes, debugging and error handling, T-SQL Debugger. SQL transactions, Transact SQL (variables, control flow statements). Security (standard, integrated, mixed, users, roles, groups, MTS, package security, component security)

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Understand the concepts of enterprise development strategy	<ul style="list-style-type: none"> • discuss requirements and strategies of solutions for enterprise systems • describe the Component Object Model (COM) and its advantages • describe the features of the Microsoft Solutions Framework and the Process and Applications Models
2 Create and use COM components	<ul style="list-style-type: none"> • create COM objects for MTS • create properties, methods and events for the COM object • raise errors in the COM object • test the COM object • describe the issues of early and late binding • create occurrences of COM objects in an application
3 Use Microsoft Transaction Server	<ul style="list-style-type: none"> • describe transaction processing in MTS • use MTS to manage COM objects that are used by multiple clients • apply debugging, error handling, and security techniques in a three-tier application
4 Access data using ActiveX Data Objects and SQL Server	<ul style="list-style-type: none"> • create Microsoft SQL Server stored procedures to implement business services • create Microsoft SQL Server stored procedures to implement data services • use ActiveX Data Objects (ADO) code to access data • maintain SQL Server data integrity • implement SQL Server security

Guidance

Delivery

The focus of this unit is the use of Visual Basic in a client server environment. Much of the unit is concerned with the management of access to data sources, typically SQL Server, and the maintenance of data integrity and security. Learners should gain an appreciation of the specific issues involved in enterprise development and the benefits of component-based development strategy in such environments. They should gain a clear understanding of the data, business and presentation tiers and the Microsoft Solutions Framework.

The unit requires a clear understanding of the use of data within Visual Basic, specifically understanding of ADO programming and basic SQL. Some knowledge of SQL Server such as gained in *Unit 37: VB Enterprise Development* will be useful.

Assessment

The main evidence for this unit is likely to be in the form of Visual Basic application programs demonstrating the achievement of the learning outcomes. Applications should illustrate the advantages offered by three-tier architecture. Typically applications will implement business rules in COM DLLs and use ADO to access data services provided by SQL Server stored procedures.

Links

Learners should have good skills and knowledge in Visual Basic programming techniques so that the principles presented here are delivered in context. Some knowledge of Windows NT and SQL Server is recommended. Learners without significant programming experience are advised to complete both *Unit 38: Visual Programming Development* and *Unit 39: Visual Programming Fundamentals*.

Resources

A copy of Visual Basic 6 Enterprise Edition including Enterprise Tools needs to be available to learners. The MSDN Visual Basic help library and search features should be installed. The unit also requires access to SQL Server Developer Edition with service pack 5 and the SQL Server Debugger. Microsoft NT4 (SP3) and NT4 option pack (FrontPage98 server extensions, IIS, MSMQ, MMC, Data Access components, Transaction Server) are required.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Lhotka et al — *Professional Visual Basic Enterprise Development* — (Wrox Press, 1999) ISBN: 1861003455
- Fox, D — *Pure Visual Basic* — (Sams, 1999) ISBN: 1572312165
- Chappell, D — *Understanding ActiveX and OLE* — (Microsoft Press, 1996) ISBN: 15723112165

Websites

Websites that support the development of this unit include those of computing or IT associations and employers. The following may be useful:

- <http://msdn.microsoft.com/> — MSDN online library/knowledge base
- <http://mspress.microsoft.com/prod/books/901.htm> — Microsoft Publications
- <http://msdn.microsoft.com/vbasic/> — Product information, Microsoft knowledge base
- <http://SearchVB.com> — Portal for Visual Basic developers
- www.programmersheaven.com/zone1/index.htm — Links to many other Visual Basic sites
- www.microsoft.com/com/ — Microsoft COM website
- <http://msdn.microsoft.com/library/default.asp?url=/library/enus/ado270/htm/mdconintroduction.asp> — Microsoft ADO Programmers' Guide.

Web pages provide access to a further range of internet information sources. Learners must use this resource with care, justifying the use of information gathered.

Unit 38: Visual Programming Development

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

Prior to the launch of Visual Basic in 1991, developing for the Windows environment was typically a difficult and time-consuming task. Visual Basic enabled programmers to create Windows applications in a graphical environment by using a graphical interface. Since its launch, Visual Basic has gained new features, enhancements and performance improvements that have made it a leading tool in the development of Windows-based systems. The current version, version 6, provides many features that enable developers to create user-friendly applications that take advantage of today's technologies such as the internet.

This unit focuses on the component model of software development using Visual Basic 6. The unit covers the more advanced Visual Basic features, including database access, visual data tools, ActiveX, object orientation, component-based development (COM) and internet applications.

The unit assumes familiarity with creating Visual Basic applications using forms and controls and familiarity with Visual Basic coding at a level as gained in *Unit 39: Visual Programming Fundamentals*. The unit can be used as preparatory material for the Microsoft Certified Professional examination 70-176 Visual Basic Desktop Applications although it is expected that only a small proportion of learners will reach this standard. The unit prepares learners for further Visual Basic study as in *Unit 35: Distributed Design and Development* and *Unit 37: VBI Enterprise Development*.

This unit presents opportunities to demonstrate key skills in information technology, improving own learning and performance and problem solving.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Understand and use **relational databases in Visual Basic**
- 2 Create and use **ActiveX controls**
- 3 Build and use **components**
- 4 Create **Visual Basic internet projects**.

Content

1 Relational databases in Visual Basic

Relational database concepts: tables, rows, columns, relations, queries, referential integrity, security

SQL: SQL SELECT commands, building WHERE criteria, using SQL Builder, stored procedures, parameters

Database programming: Universal Data Access, OLEDB, ODBC, ActiveX Data Objects model, connections, commands and recordsets. Types of recordsets, cursors, locking and security, disconnected recordsets. Navigating recordsets (MoveFirst, MovePrevious, MoveNext, MoveLast), EOF and BOF, updating recordsets (AddItem, Update, Delete). SQL Execute command (INSERT INTO, UPDATE, DELETE). Error handling. Dynamic recordsets. Data integrity. Security. Transactions

Visual Data Access Tools: ADO data control. Data Environment Designer, Data View window, Data Report Designer. connections, commands, parameters, grouping, aggregates. Presenting data, bound forms, navigation. Data Form wizard

2 ActiveX controls

Create ActiveX controls: using constituent controls, ActiveX control interface wizard, creating properties, methods and events, creating help pages. Property procedures. Ambient properties. Creating property pages, Property Page wizard. Persisting properties, PropertyBag object. Compiling controls. Testing. Data bound controls

Use ActiveX controls: Visual Basic ActiveX controls, party ActiveX controls, setting properties, calling methods, responding to events

3 Components

Class modules: Class Builder add-in, class module events, adding component properties, methods and events. Raising errors. Adding component information, help. Using the Object Browser. Data bound class modules. Declaring and instantiating the class. Using class properties, methods and events

Creating COM components: in-process, out-of-process, properties, methods and events, instancing property. Error handling, styles, raising errors. Testing. Compiling and registering internal and external components. Using Visual Component Manager. Object models, collections

Using COM components: setting references, using properties, methods and events. Declaring and instantiating objects. Binding, (early, late). Releasing objects. Using Object Browser. Type libraries. Internet Explorer type library

Creating an executable: Project Properties dialog, versions, compile options. Resource files. Help files. Optimisation considerations

4 **Visual Basic internet projects**

Internet projects: WebBrowser control. Active Documents, UserDocument object, migrating forms to Active Documents. DHTML applications. IIS applications, WebClass Designer, Response object, writing code

Package and deployment: package and deployment wizard, scripts, types of packages, installation locations, SetUp files, CAB files. Internet deployment, HTML object tag. Licensing and signing controls

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Understand and use relational databases in Visual Basic	<ul style="list-style-type: none"> • access an OLEDB data source (MS Access and SQL Server) from Visual Basic • use the ActiveX data control to display data from a data source on a form • use the Visual Basic visual data designers: Data Environment, Data View window, Data Report Designer and Data Form wizard • write ADO code to create connections, commands and recordsets • display data in controls on a form • write code to navigate around the recordset • use recordset methods to update data in a data source • use SQL Execute methods to update data in a data source • handle database errors programmatically
2 Create and use ActiveX controls	<ul style="list-style-type: none"> • build an ActiveX control using standard Visual Basic controls • create an About form for an ActiveX control • create Property Get and Let procedures for an ActiveX control • create methods and events for an Active X control • add property pages for an ActiveX control • test the control within a project group • implement data capabilities of an ActiveX control • use an ActiveX control as a component in another project

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
3 Build and use components	<ul style="list-style-type: none"> • create classes • create properties, methods and events of a class • declare and instantiate an occurrence of a class • create properties, methods and events for ActiveX DLL and EXE components • raise errors from a COM component • test the COM component • set references to COM components in Visual Basic projects • use the object browser to check properties, methods and events of the COM component • use the exposed properties, methods and events of the COM component in a Visual Basic project
4 Create Visual Basic internet projects	<ul style="list-style-type: none"> • use the WebBrowser control • create an Active Document project • create a DHTML project • create an IIS project • use package and deployment wizard to create an internet deployment package

Guidance

Delivery

The focus of this unit is the database and ActiveX component features of Visual Basic 6. It requires a clear understanding of event-driven programming, the use of appropriate design methods, and a range of experience in writing Visual Basic programs. Learners should have practical experience of as many of the features introduced in the unit as possible and should gain solid experience in using Visual Basic to access data sources together with an appreciation of the benefits of component-based development. The unit covers advanced Visual Basic topics such as classes, ADO, ActiveX and components and learners will require good programming skills.

Assessment

The main evidence for this unit is likely to be in the form of Visual Basic application programs demonstrating the achievement of the learning outcomes. At least one of the applications in the unit should be of sufficient complexity to simulate a real-world application. This application will be a database application that displays and updates data from a relational database implemented in SQL Server or MS Access. Learners should have opportunities to create and use visual data tools to create connections to a database and display data in forms and reports. The project should provide opportunities to write ADO code to access and update the data, should use class modules where appropriate and include in-process and out-of-process COM components.

Links

Learners should have good skills and knowledge in Visual Basic programming techniques so that the principles presented here are delivered in context. Learners without significant Visual Basic programming experience are advised to complete *Unit 39: Visual Programming Fundamentals*. This unit builds on the concepts and skills learned in Unit 39 to take learners to the level required for Microsoft certification in Visual Basic. The unit can be used as preparatory material for the Microsoft Certified Professional examination 70–176 Visual Basic Desktop Applications, although it is expected that only a small proportion of learners will reach this standard. The unit has links with other programming units, for example, *Unit 17: MS Office Solution Development*, *Unit 35: Distributed Design and Development*, *Unit 36: OOP Programming* and *Unit 37: VB Enterprise Development*.

Resources

A copy of Visual Basic 6 Professional Edition needs to be available to learners. The MSDN Visual Basic help library and search features should be installed. Access to suitable data sources is required. Recommended data sources are SQL Server 6.5 or 7 and Microsoft Access 97, 2000 or XP. If this is a remote data source, network capabilities will be required. In this case, it will not be necessary for the host application to be installed on all learner machines. Learner computers should be set up with NT4 Server and the NT Options Pack. If learners are to create Visual Basic Internet Information Server projects they will require either IIS or Personal Web Server installed on their computers.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes.

Sufficient library resources should be available to enable learners to achieve this unit. Texts that are particularly relevant are:

- Chappell, D — *Understanding ActiveX and OLE* — (Microsoft Press, 1995)
ISBN: 1572312165
- Connell, J — *Beginning Visual Basic 6 Database Programming* — (Wrox Press, 1998)
ISBN: 1861001061
- Fox, D — *Pure Visual Basic* — (Que, 1999) ISBN: 067231598X
- Franklin, C — *Visual Basic 6 Internet Programming* — (John Wiley, 1999)
ISBN: 0471314986

Many more books can be found at www.visualbasicbooks.com/

Websites

Websites that support the development of this unit include those of computing associations and employers. The following may be useful:

- <http://msdn.microsoft.com/vbasic/> — Product information, Microsoft knowledge base
- www.programmersheaven.com/zone1/index.htm — Links to many other Visual Basic sites
- www.visualbasicbooks.com/activeXtutorial.html — ActiveX online tutorial
- www.astentech.com/tutorials/ActiveX.html — ActiveX online tutorial
- www.microsoft.com/com/news/drgui.asp — Dr GUI's Gentle Guide to COM
- Visual Basic questions sites
- Web pages provide access to a further range of internet information sources. Learners must use this resource with care, justifying the use of information gathered.

Unit 39: Visual Programming Fundamentals

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

This unit concentrates on the fundamentals of Visual Programming: the principles of event-driven programming, designing the user interface and writing the program code to add the application functionality. The unit provides a grounding for more advanced work in visual programming including ActiveX, object orientation and component-based development (COM) as covered in *Unit 38: Visual Programming Development*.

This unit presents opportunities to demonstrate key skills in information technology, improving own learning and performance and problem solving.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Understand **event-driven programming concepts**
- 2 Use the **visual programming Integrated Development Environment (IDE)** to create applications
- 3 Understand and demonstrate principles of **user interface design**
- 4 Understand and write **event-driven code**.

Content

1 Event-driven programming concepts

Software development: user involvement in design, rapid application development (RAD), modularity, reusability, encapsulation, interactivity. Event-driven systems. Stages of application development in a visual programming environment

Characteristics of event-driven systems: user-centric design, objects, events, event procedures

2 Visual programming Integrated Development Environment (IDE)

IDE components: menus, toolbars, toolbox, windows (Form, Code Editor, Properties, Project Explorer, Form Layout, Immediate). Navigation methods. Code completion features. Project templates (pre-defined templates, user-defined). Environment options, docking

Running and testing programs: starting and stopping execution, break mode. Types of errors. Debugging techniques: break points, step through, Watch expressions, Locals window, Call stack, use of Immediate window, Debug options

File types: identification of common files, file locations

Distributing an application: creating exe files, Package and Deployment wizard, setup files

3 User interface design

Objects: forms, controls, properties, methods, events. Design time properties. Order of events. Loading, unloading, showing and hiding forms. Modal and modeless forms. Creating an About form. Disabling and enabling controls

Menus: menu editor, shortcut keys. Creating and activating popup menus

ActiveX controls: adding ActiveX controls, Windows common controls (image list, toolbar, status bar, DateTimePicker), common dialog control, masked edit control, ADO data control

Principles of user interface design: user control, modal interactions, simplicity, consistency, personalisation, feedback, user assistance

4 Event-driven code

Variables and constants: declaration and use of variables and user-defined constants. Static variables. Scope of variables. Data types (String, Integer, Long, Single, Double, Currency, Boolean, Variant). Conversion between data types. Use of pre-defined constants.

Declaration and use of fixed and dynamic arrays

Control flow structures: If...Then...Else, Select Case, Do...Loop, For...Next, For...Each

Communication with users: MsgBox, InputBox functions. Keyboard events (KeyPress, KeyUp, KeyDown), KeyPreview property. Validation (field level, form level), Validate event, ValidationError event

Error handling: error traps, error handlers, Err object, Resume options, error handling styles, inline error handling

Procedures and functions: functions (string functions, format function, date functions etc). General procedures and functions, passing arguments to procedures and functions. Standard modules

Data access: relational database concepts, ADO data control, binding controls, SQL Select statement. Navigating recordsets. Updating and manipulating recordsets (AddItem, Update, Delete, Find). DataForm wizard

Drag and drop: mouse events, drag modes, drag and drop events, drag icon, OLE drag and drop

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Understand event-driven programming concepts	<ul style="list-style-type: none"> • describe the stages in visual application development • analyse how event driven programming is different from procedural programming • identify and respond to user events
2 Use the Visual Programming Integrated Development Environment (IDE) to create applications	<ul style="list-style-type: none"> • identify, navigate and manage the component windows in the Visual Programming IDE • start, pause and stop program execution • use debugging tools • set options to change the development environment • identify file types and their purpose • use the package and deployment wizard to create a installation program • use the SetUp program to install an application
3 Demonstrate principles of user interface design	<ul style="list-style-type: none"> • use the standard control tools to create the user interface • set properties of forms and controls at design time • create and use control arrays • create multi-form projects, load, unload, hide, show forms, modally and modelessly • use ActiveX controls to enhance a user interface • create menus and implement menu functionality • demonstrate use of principles of user interface design

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
4 Understand and write event-driven code	<ul style="list-style-type: none"> • access and set properties of controls from code • declare and use variables, arrays, user-defined constants • use pre-defined constants • get and validate data from users • use data types correctly • use conversion functions to convert between data types • use control flow statements of selection and iteration • create and use procedures and functions • create a standard module • use comments to document code • write an error handler • use the ADO data control to access and manipulate data in a database table

Guidance

Delivery

The focus of this unit is the achievement of a solid grounding in the use of a visual programming language. It requires a clear understanding of event-driven programming, the use of appropriate design methods, and a range of experience in creating programs. To this end, assessment should include the ability to design functional and effective user interfaces and the ability to write well documented programs that implement the functionality in a coherent and structured manner.

Learners should also show an awareness of the contribution of event-driven programming in creating user-friendly Windows applications and the principles of the Windows system.

Assessment

The main evidence for this unit is likely to be in the form of simple application programs written in the visual programming language and demonstrating the achievement of the learning outcomes. At least one of the applications in the unit should be of sufficient complexity to simulate a real-world application.

Learners should demonstrate the use of user interface design principles and effective documentation and testing.

Links

The unit requires problem-solving skills and a basic knowledge of programming such as that gained from studying *Unit 3: Programming Concepts*. Learners should have working skills and knowledge in basic programming techniques so that the principles presented here are delivered in context. The unit forms a grounding for more advanced units in visual programming, for example, *Unit 35: Distributed Design and Development*, *Unit 36: OOP Programming*, *Unit 37: VB Enterprise Development* and *Unit 38: Visual Programming Development*. Skills gained in this unit can be applied in *Unit 17: MS Office Solution Development*.

Resources

A copy of a visual programming application, for example, Visual Basic, Visual C++, Delphi, needs to be available to learners. The recommended development environment is Visual Basic Professional Edition Version 6. Much of this unit can be delivered using other development environments although more advanced Visual Basic units will require features not available in all development environments. The MSDN help library and search features should be installed.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Andrews, M — *Learn Visual C++ Now* — (MSPress, 1995) ISBN: 1556158459
- Buchanan, W — *Mastering Pascal and Delphi Programming* — (Palgrave-MacMillan, 1998) ISBN: 0333730070
- Cantù, M — *Mastering Delphi 5* — (Sybex, 1999) ISBN: 0782125654
- Halvorson, M — *Microsoft Visual Basic 6.0 Professional Step by Step* (with CD-Rom) — (Microsoft Press, 1998) ISBN: 073560729X
- Horton, I — *Beginning Visual C++* — (Wrox Press, 1998) ISBN: 1861001967
- Jones, P — *Visual Basic: A Complete Course* — (Continuum, 2001) ISBN: 0826454054
- Lischner, R — *Delphi in a Nutshell* — (O'Reilly 2000) ISBN: 1565926595
- Perry, G — *Teach Yourself Visual Basic 6 in 24 Hours* (with CD-Rom) — (Pearson, 1999) ISBN: 0672315335
- Wright, P — *Beginning Visual Basic 6* — (Wrox Press, Inc,1998) ISBN: 1861001053

Websites

Websites that support the development of this unit include those of computing associations and employers. The following may be useful:

- *Learn Visual Basic Now*, Self-paced, instructional CD-Rom that includes multimedia video lessons, and hands-on lab exercises
- <http://msdn.microsoft.com/vbasic/> — Product information, Microsoft Visual Basic knowledge base
- <http://msdn.microsoft.com/visualc/> — Product information, Microsoft knowledge base.
- www.vb-bookmark.com/VisualCPP.html — Visual C++ resource centre
- http://iam.classics.unc.edu/loci/16/16_res.html — Delphi resources
- www.simplythebest.net/info/delphinf.html — Delphi resources
- www.hamarashehar.com/powerbuilder — Introduction to event driven programming
- www.programmersheaven.com/zone1/index.htm — Links to many other Visual Programming sites
- www.almanac.esmartweb.com/program/vbasic/index.html — Tutorials, quizzes and books
- Web pages provide access to a further range of internet information sources. Learners must use this resource with care, justifying the use of information gathered.

Unit 40: Software Testing

Learning hours: 60

NQF level 4: BTEC Higher National — H1

Description of unit

In this unit the learner will work with a medium-sized application, developing a full and detailed testing procedure, documenting the results. They will then be able to evaluate the effectiveness of the application and the testing procedures employed.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Demonstrate an understanding of **testing stages and requirements**
- 2 Create a customised **test strategy, plan and techniques** for a given specification
- 3 Undertake the test plan, producing associated **outcomes**
- 4 Provide a detailed **evaluation** of the test plan and its associated outcomes.

Content

1 Testing stages and requirements

Stages: user needs (analysis of requirements, expected outcomes); dry run of design (given data, expected outcomes); implementation (black box or functional testing, white (or glass) box testing; sub-system, integration (whole system, interface); top down, bottom up); maintenance (following changes or reviews, after length of time, stress/overload); user evaluation (analysis of requirements, actual outcomes, acceptance, alpha, beta)

Requirements: resources, documentation (eg system and program specifications, user requirements, plans and logs)

2 Test strategy, plan and techniques

Test strategy: timing, justification, functionality, maintainability

Test plan: example data (normal, erroneous, extreme), expected outcomes (valid, invalid, information gained), priority

Techniques: black box or functional testing (eg control flow, data flow), white (or glass) box testing (eg boundary value, branch condition); validation, verification

3 Outcomes

Outcomes: actual results (valid information or action, invalid information or action; system-generated messages, program-generated messages)

Modifications: changes to specification, changes to analysis, design, amendments to code written, alterations to test strategy and plan

4 Evaluation

Evaluation: functionality, accuracy, effectiveness; alterations to tests carried out, possible improvements; program specification and design, self-reflection, management aspects

Maintainability: usefulness to self, usefulness to others

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Demonstrate an understanding of testing stages and requirements	<ul style="list-style-type: none"> • identify the testing stages involved in relation to the given specification • justify the rationale behind the choice of testing stages • describe the requirements involved at each testing stage in relation to the given specification
2 Create a customised test strategy, plan and techniques for a given specification	<ul style="list-style-type: none"> • establish a test strategy for the given specification and resultant application • develop a full and detailed test plan relating to the associated test strategy • discuss the techniques employed in performing the listed tests
3 Undertake the test plan, producing associated outcomes	<ul style="list-style-type: none"> • perform the tests identified in the test plan • provide a detailed log of all test results • identify modifications made to the given specification, the associated application and the test strategy and plan
4 Provide a detailed evaluation of the test plan and its associated outcomes	<ul style="list-style-type: none"> • discuss the reasons for all modifications made at each stage of the testing procedure • evaluate the effectiveness of the test strategy and the associated test plan • evaluate the maintainability of the test procedure

Guidance

Delivery

This unit could be delivered in conjunction with any of the programming units as listed above, as well as combining those with *Unit 10: Software Development Project* or *Unit 13: Database Analysis and Design*. Centres should provide learners with case studies in order to demonstrate the various stages and techniques of software testing. Centres are reminded that the learners should be aware of the need to provide documentation in a format suitable for use by other members of a software testing team.

Assessment

The evidence for this unit should comprise the detailed testing processes carried out for a given specification. The given specification is related to an existing medium-sized program comprising at least five modules or a suite of smaller programs which may have been developed as part of the evidence for other units. The learner should produce a full, detailed and justified test log appropriate to the given specification, an evaluation of the processes undertaken and reflection of the management aspects of testing.

Links

This unit can be used in conjunction with any of the programming units, for example: *Unit 3: Programming Concepts*, *Unit 30: Java Programming*, *Unit 36: OOP Programming* and *Unit 42: Visual Programming* within the Software Development stream of the HN. It will allow learners the opportunity to demonstrate detailed testing of applications developed.

Resources

Learners need a given specification related to a medium-sized program comprising at least four modules or a suite of smaller programs. Suitable software is required for the planning and management of the test procedure, the application development related to the given specification and the presentation of the outcomes.

Support materials

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Galin, D — *Software Quality Assurance From Theory to Implementation* — (Addison-Wesley, 2003) ISBN: 0201709457

Unit 41: Data Structures and Algorithms

Learning hours: 60

NQF level 4: BTEC Higher National — H2

Description of unit

This unit provides the learner with a range of experiences in using the algorithms and data structures that underpin much of today's computing. The various techniques presented should be seen in the context of solving problems using computers.

The unit aims to develop the formal concepts of data structures, algorithms and their relationships to each other and to the concepts of object-oriented programming. This should allow learners to develop solutions using data structures for a range of commercial needs.

Summary of learning outcomes

To achieve this unit a learner must:

- 1 Apply concepts of **abstraction in designing object-oriented data structures**
- 2 Specify and implement **abstract data types** (ADTs)
- 3 Evaluate and implement **data structures**
- 4 Justify the selection of an appropriate **data structure/algorithm**.

Content

1 Abstraction in designing object-oriented data structures

Complexity: in software development, interfaces and encapsulation

Definition of abstract data types: collection, structure

Values, states, and objects: types and classes, encapsulation, inheritance

2 Abstract data types

ADTs: look at examples of ADTs (stacks, queues)

Implementation: look at how different data structures can implement the same ADT (arrays and single linked lists)

3 Data structures

Context: common complex data structures and typical applications

Arrays: tables (hashed, lookup), matrices, dynamic memory, linked lists (single, double), tree (binary search trees, expression trees, quad), graphs

Algorithms for data structures: appropriate algorithms include 'insert', 'delete', 'search' and 'sort' (with many forms being naturally recursive)

Code implementation: documented computer code that covers the range of data structures

4 Data structure/algorithm

Applications: relevant application areas, research and review of current uses of data structures within applications

Evaluation: criteria for the use of data structure/algorithms for chosen applications ('Big Oh' calculations), estimation of disc/memory requirements, evaluation of data structures/algorithms against these criteria, selection of the most suitable data structure

Testing: algorithm, measure of efficiency

Outcomes and assessment criteria

Outcomes	Assessment criteria for pass To achieve each outcome a learner must demonstrate the ability to:
1 Apply concepts of abstraction in designing object-oriented data structures	<ul style="list-style-type: none"> • determine appropriate properties and methods for data structures • produce specifications for object-oriented data structures • extend specifications of data structures to a sub-class of data structure
2 Specify and implement abstract data types (ADTs)	<ul style="list-style-type: none"> • produce a specification of an ADT • implement ADTs • describe alternative methods of implementing the ADT
3 Evaluate and implement data structures	<ul style="list-style-type: none"> • describe how basic operations are implemented on data structures (such as inserting into a tree) • describe a typical application where such a data structure may be found • write code to implement a selection of data structures
4 Justify the selection of an appropriate data structure/algorithm	<ul style="list-style-type: none"> • review current uses of data structures within application areas • perform estimates of the resource and time requirements for a data structure/algorithm • justify the selection of the most appropriate data structure/algorithm for a given application

Guidance

Delivery

Centres are expected to cover the following data structures:

Arrays: tables (hashed, lookup), matrices, dynamic memory, linked lists (single, double). Trees: (binary search trees, expression trees) and graphs.

Appropriate languages supporting object orientation should be chosen for the computer implementation, eg Java.

For outcome 3 learners will be expected to show, by comparing performance, how they selected the most appropriate data structure for an application. Application areas may be chosen from the following: graphical eg storing a map in memory or in a file; CAD system; text processing/editing; external storage and its maintenance; searching a graph such as a transport network; simulation using priority queues; finding a critical path.

Assessment

Where possible, the practical side of this topic should be emphasised, with learners actively implementing data structures to solve problems. Reports and presentations should complement the machine-based practical outcomes. Learners should demonstrate how they selected the best data structure for an application area.

Links

Learners should possess significant experience in programming before attempting this unit. Some mathematical ability will be assumed in the estimation of time and resources used by a particular algorithm. This unit links with: *Unit 30: Java Programming*, *Unit 32: Maths for Software Development*, *Unit 36: OOP Programming*, *Unit 37: VB Enterprise Development*, *Unit 38: Visual Programming Development* and *Unit 39: Visual Programming Fundamentals*.

Support materials

The unit only requires access to a programming language capable of supporting the various types of data structures being presented.

Textbooks

Tutors should be aware that textbooks are frequently updated and that they should use the latest editions where available. This is a practical unit and textbook materials should be used for reference purposes. There is a range of general textbooks relating to this unit, including the following:

- Standish, T A — *Data Structures, Algorithms and Software Principles* — (Addison-Wesley 1993) ISBN: 0201528800
- Weiss, M A — *Data Structures and Algorithm Analysis in Java* — (Addison-Wesley, 1998) ISBN: 0201357542

Annex A

Qualification codes

Each qualification title, or suite of qualification titles with endorsements, is allocated two codes, as are the individual units within a qualification.

QCA codes

The QCA National Qualifications Framework (NQF) code is known as a Qualification Accreditation Number (QAN). Each unit within a qualification will also have a QCA NQF unit code.

The QCA qualification and unit codes will appear on the learner's final certification documentation.

The QANs for qualifications in this publication are:

100/3257/5	Edexcel Level 4 BTEC Higher National Certificate in Computing (General)
100/3260/5	Edexcel Level 4 BTEC Higher National Diploma in Computing (General)
100/3258/7	Edexcel Level 4 BTEC Higher National Certificate in Computing (ICT Systems Support)
100/3261/7	Edexcel Level 4 BTEC Higher National Diploma in Computing (ICT Systems Support)
100/3259/9	Edexcel Level 4 BTEC Higher National Certificate in Computing (Software Development)
100/3262/9	Edexcel Level 4 BTEC Higher National Diploma in Computing (Software Development)

Edexcel codes

The Edexcel codes enable approval, registration, assessment and certification, they will appear on documentation such as the Student Report Form (SRF) and the programme definition. The Edexcel codes are not provided in this publication. The Edexcel codes will link automatically to the QCA codes for certification purposes.

QCA and Edexcel codes

All QCA and Edexcel qualification and unit codes will be published in a booklet, which will be made available on the Edexcel website. It will provide a comprehensive catalogue of all the qualifications and units available to centres. It will be useful for centres when making future decisions about centre choice units.

Annex B

Mapping against NVQ in Managing IT Skills — level 4

The following grid maps the knowledge covered in the NVQ in Managing IT Skills level 4 against the underpinning knowledge of the BTEC Higher National Diploma/Certificate in Computing.

HND/C titles NVQ unit titles	Unit 1: Computer Platforms	Unit 2: Systems Analysis	Unit 3: Programming Concepts	Unit 4: Concepts of Database Design	Unit 5: Networking Concepts	Unit 6: Personal Skills Development	Unit 7: Quality Systems	Unit 8: Information Systems Project	Unit 9: Networking Project	Unit 10: Software Development	Unit 11: Financial Systems	Unit 12: Networking Technology	Unit 13: Data Analysis and Design	Unit 14: Management in IT	Unit 15: End-user Support	Unit 16: Information Systems	Unit 17: MS Office Solution Development #	Unit 18: Multimedia Design and Authoring	Unit 19: Website Design	Unit 20: Internet Server Management #
206 Ensure your own actions reduce health risks to health and safety	E2																			
415 Define information technology operational requirements	E1				E2				E1											E1, 2
401 Develop and manage your own effectiveness and professionalism						E1, 2, 3, 4														
409 Evaluate potential information technology products and services									E1, 2											
414 Contribute to the development of information system strategy		E1																		

<div style="text-align: center;">HND/C titles</div> <div style="text-align: left;">NVQ unit titles</div>	Unit 1: Computer Platforms	Unit 2: Systems Analysis	Unit 3: Programming Concepts	Unit 4: Concepts of Database Design	Unit 5: Networking Concepts	Unit 6: Personal Skills Development	Unit 7: Quality Systems	Unit 8: Information Systems Project	Unit 9: Networking Project	Unit 10: Software Development	Unit 11: Financial Systems	Unit 12: Networking Technology	Unit 13: Data Analysis and Design	Unit 14: Management in IT	Unit 15: End-user Support	Unit 16: Information Systems	Unit 17: MS Office Solution Development #	Unit 18: Multimedia Design and Authoring	Unit 19: Website Design	Unit 20: Internet Server Management #	
416 Review and improve the performance of existing IT products and services							E1														
407 Control system installation and testing									E1, 2												E1, 3
410 Control the acquisition of information technology products and services																					
412 Manage the operation of information technology systems					E1, 3				E1												E1, 3
413 Manage the use of information technology systems							E1, 3														
417 Monitor procedures to control risks to health and safety																					

HND/C titles NVQ unit titles	Unit 21: Work Experience	Unit 22: Human Computer Interface	Unit 23: Project Management	Unit 24: e-Business Strategy	Unit 25: e-Business Development	Unit 26: e-Business Technology	Unit 27: e-Business Project	Unit 28: Professional Development	Unit 29: Knowledge Systems	Unit 30: Java Programming	Unit 31: Networking Infrastructure	Unit 32: Maths for Software Development	Unit 33: Formal Methods	Unit 34: Supporting NOS and OS	Unit 35: Distributed Design and Development	Unit 36: OOP Programming	Unit 37: VB Enterprises Development #	Unit 38: Visual Programming Development #	Unit 39: Visual Programming Fundamentals #	Unit 40: Software Testing
206 Ensure your own actions reduce health risks to health and safety		E1, 2																		
415 Define information technology operational requirements											E1, 2, 3			E1, 2, 3						
401 Develop and manage your own effectiveness and professionalism	E1, 2							E1, 2, 4												
409 Evaluate potential information technology products and services																				
414 Contribute to the development of information system strategy																				
416 Review and improve the performance of existing IT products and services																				
407 Control system installation and testing											E1			E1						
410 Control the acquisition of information technology products and services																				

<div style="text-align: center;">HND/C titles</div> <div style="text-align: center;">NVQ unit titles</div>	Unit 21: Work Experience	Unit 22: Human Computer Interface	Unit 23: Project Management	Unit 24: e-Business Strategy	Unit 25: e-Business Development	Unit 26: e-Business Technology	Unit 27: e-Business Project	Unit 28: Professional Development	Unit 29: Knowledge Systems	Unit 30: Java Programming	Unit 31: Networking Infrastructure	Unit 32: Maths for Software Development	Unit 33: Formal Methods	Unit 34: Supporting NOS and OS	Unit 35: Distributed Design and Development	Unit 36: OOP Programming	Unit 37: VB Enterprises Development #	Unit 38: Visual Programming Development #	Unit 39: Visual Programming Fundamentals #	Unit 40: Software Testing
412 Manage the operation of information technology systems																				
413 Manage the use of information technology systems											E1			E1						
417 Monitor procedures to control risks to health and safety																				

<div style="text-align: center;">HND/C titles</div> <div style="text-align: left;">NVQ unit titles</div>	Unit 41: Data Structures and Algorithms	Unit 42: Visual Programming																		
206 Ensure your own actions reduce health risks to health and safety																				
415 Define information technology operational requirements																				
401 Develop and manage your own effectiveness and professionalism																				
409 Evaluate potential information technology products and services																				
414 Contribute to the development of information system strategy																				
416 Review and improve the performance of existing IT products and services																				
407 Control system installation and testing																				
410 Control the acquisition of information technology products and services																				

<div style="text-align: center;">HND/C titles</div> <div style="text-align: left;">NVQ unit titles</div>	Unit 41: Data Structures and Algorithms	Unit 42: Visual Programming																		
412 Manage the operation of information technology systems																				
413 Manage the use of information technology systems																				
417 Monitor procedures to control risks to health and safety																				

Mapping against NVQ in Developing IT Systems — level 4

The following grid maps the knowledge covered in the NVQ in Developing IT Systems level 4 against the underpinning knowledge of the BTEC Higher National Diploma/Certificate in Computing.

HND/C titles NVQ unit titles	Unit 1: Computer Platforms	Unit 2: Systems Analysis	Unit 3: Programming Concepts	Unit 4: Concepts of Database Design	Unit 5: Networking Concepts	Unit 6: Personal Skills Development	Unit 7: Quality Systems	Unit 8: Information Systems Project	Unit 9: Networking Project	Unit 10: Software Development	Unit 11: Financial Systems	Unit 12: Networking Technology	Unit 13: Data Analysis and Design	Unit 14: Management in IT	Unit 15: End-user Support	Unit 16: Information Systems	Unit 17: MS Office Solution Development #	Unit 18: Multimedia Design and Authoring	Unit 19: Website Design	Unit 20: Internet Server Management #
206 Ensure your own actions reduce risks to health and safety	E1																			
401 Develop and manage your own effectiveness and professionalism						E1, 2, 4		E1, 2, 4		E1, 2, 4										
409 Evaluate potential information technology products and services										E1, 2			E1			E1, 2				
414 Contribute to the development of information system strategy		E1			E1, 2															
402 Control the software creation process			E1, 3, 4							E1, 2, 3, 4, 5			E1, 3					E1, 3		
403 Control software testing and installation			E2							E1, 2										

<div style="text-align: center;">HND/C titles</div> <div style="text-align: center;">NVQ unit titles</div>	Unit 1: Computer Platforms	Unit 2: Systems Analysis	Unit 3: Programming Concepts	Unit 4: Concepts of Database Design	Unit 5: Networking Concepts	Unit 6: Personal Skills Development	Unit 7: Quality Systems	Unit 8: Information Systems Project	Unit 9: Networking Project	Unit 10: Software Development	Unit 11: Financial Systems	Unit 12: Networking Technology	Unit 13: Data Analysis and Design	Unit 14: Management in IT	Unit 15: End-user Support	Unit 16: Information Systems	Unit 17: MS Office Solution Development #	Unit 18: Multimedia Design and Authoring	Unit 19: Website Design	Unit 20: Internet Server Management #
404 Control the creation of software specifications										E1, 2, 3, 4										
405 Control the investigation of customer requirements										E1, 3					E1, 2, 3	E1, 2, 3		E1, 2, 3		
406 Control the analysis of customer information								E1, 3		E1						E1, 2, 3				
408 Control the provision of information technology support															E1					
411 Develop and maintain a software quality management system																				

<div style="text-align: center;"> HND/C titles </div> <div style="text-align: center;"> NVQ unit titles </div>	Unit 21: Work Experience	Unit 22: Human Computer Interface	Unit 23: Project Management	Unit 24: e-Business Strategy	Unit 25: e-Business Development	Unit 26: e-Business Technology	Unit 27: e-Business Project	Unit 28: Professional Development	Unit 29: Knowledge Systems	Unit 30: Java Programming	Unit 31: Networking Infrastructure	Unit 32: Maths for Software Development	Unit 33: Formal Methods	Unit 34: Supporting NOS and OS	Unit 35: Distributed Design and Development	Unit 36: OOP Programming	Unit 37: VB Enterprises Development #	Unit 38: Visual Programming Development #	Unit 39: Visual Programming Fundamentals #	Unit 40: Software Testing	
206 Ensure your own actions reduce risks to health and safety		E1, 2																			
401 Develop and manage your own effectiveness and professionalism	E1, 2							E1, 2, 3													
409 Evaluate potential information technology products and services						E1															
414 Contribute to the development of information system strategy					E1, 2																
402 Control the software creation process						E1	E1, 2, 3, 5								E1	E1					
403 Control software testing and installation									E1												E2
404 Control the creation of software specifications																			E4	E4	
405 Control the investigation of customer requirements		E1, 2, 3					E1, 2, 3														

NVQ unit titles	HND/C titles																				
	Unit 21: Work Experience	Unit 22: Human Computer Interface	Unit 23: Project Management	Unit 24: e-Business Strategy	Unit 25: e-Business Development	Unit 26: e-Business Technology	Unit 27: e-Business Project	Unit 28: Professional Development	Unit 29: Knowledge Systems	Unit 30: Java Programming	Unit 31: Networking Infrastructure	Unit 32: Maths for Software Development	Unit 33: Formal Methods	Unit 34: Supporting NOS and OS	Unit 35: Distributed Design and Development	Unit 36: OOP Programming	Unit 37: VB Enterprises Development #	Unit 38: Visual Programming Development #	Unit 39: Visual Programming Fundamentals #	Unit 40: Software Testing	
406 Control the analysis of customer information		E1, 2, 3					E1, 2								E1						
408 Control the provision of information technology support																					
411 Develop and maintain a software quality management system																					E1, 2

<div style="text-align: center;">HND/C titles</div> <div style="text-align: left;">NVQ unit titles</div>	Unit 41: Data Structures and Algorithms	Unit 42: Visual Programming																			
206 Ensure your own actions reduce risks to health and safety																					
401 Develop and manage your own effectiveness and professionalism																					
409 Evaluate potential information technology products and services																					
414 Contribute to the development of information system strategy																					
402 Control the software creation process																					
403 Control software testing and installation		E2																			
404 Control the creation of software specifications		E4																			
405 Control the investigation of customer requirements																					
406 Control the analysis of customer information																					

<div style="text-align: center;">HND/C titles</div> <div style="text-align: left;">NVQ unit titles</div>	Unit 41: Data Structures and Algorithms	Unit 42: Visual Programming																		
408 Control the provision of information technology support																				
411 Develop and maintain a software quality management system																				

Mapping of BTEC HN units to SFIA framework Categories

(Skill area 4 refers to 'Enable', area 5 refers to 'Ensure, Advise', area 6 refers to 'Initiate, Influence')

SFIA Mapping									
Category	Subcategory	Skill	1	2	3	4	5	6	7
Strategy and planning	Information management	Information resource management				31	16,34		
		Advise and guidance				6	16,21		
		Technical specialism				18,19,24,25,26,31	1,4,5,9,10,12,13,21,27,29,34		
	Business/IS strategy and planning	Business process improvement				11,31	8,13,16,21,34		
		IS strategy and planning				11,24,25,26	8,16,27,37,38		
		Business risk management							
	Technical strategy and planning	Systems architecture					1,5,9,12		
		Change control							
		Business continuity planning							
		Emerging technology monitoring				19,24,25,26	13,27		
Methods and tools					1,19,31	18,21,23,34			
Network planning						31	5,9,12		
Contract management					14				
Management and administration	Supply management	Procurement				14			
		Programme management					21		
	Project management	Project management					8,9,10,21,23,27,34		
		Project office							
		Quality management						7	
	Quality management	Quality assurance						7	
		Compliance						7	

SFIA Mapping											
Category	Subcategory	Skill	1	2	3	BTEC Unit	BTEC Unit	4	5	6	7
	Resource management	Asset management				11,14					
		Systems development management				2,22	4,13,16				
		IS co-ordination					16,23				
		ICT management					13				
		Service delivery management				26	27				
Sales and marketing	Sales and marketing	Account management									
		Marketing				25,26	27				
		Selling									
		Sales support				15					
Development and implementation	Systems development	Business analysis				2,3,11,24,25,26,30,31	8,16,23,27,34,36		7		
		Data analysis				11,18,24,25,26,30,39,41	13,17,27,29,35,36,37,38				
		Technical authority				2,3,18,19,24,25,26	1,27,29				
		Systems design				2,3,18,19,22,24,25,26,30	1,5,13,16,27,34,35-38		7		
		Database design				26	4,13,17,27,38				
		Programming/software development				11,18,19,22,30,39,41	4,8,10,13,17,29,35-38				
		Systems testing				2,3,19,22,24,25,26,30,39	1,8,9,10,12,13,17,27,29,35-38				
	Human factors	System ergonomics				18,22,39,40	1,17				
		Media creation				15,18,19	17				
	Installation and integration	Systems integration				15,31	34				
		Systems installation/decommissioning				15	5,9,10,12				
Service delivery	Education and training	Education and training management									
		Development and training				28	23				
		Training materials creation				15	1				
		Education and training delivery				15					

SFIA Mapping											
Category	Subcategory	Skill	1	2	3	BTEC Unit	4	BTEC Unit	5	6	7
	Infrastructure	Configuration management						5,9,10,12,34			
		Network control				31		5,9,10,12,34			
		Capacity management									
		Security administration				31		1,5,9,10,12,34			
	Operation	Application and systems support				15		4,13			
		ICT operations									
		Database administration						4,13			
		Service level control									
	User support	Network administration and support				15		1,5,9,10,12,34			
		User support				15,18		4,8,13,17,21,34			
Use	User	Business-IS alignment									
		Information handling						23			
		Use of ICT				6,40					

Annex C

Qualification Requirement for the BTEC Higher Nationals in Computing

This Qualification Requirement should be read in conjunction with overarching guidance from Edexcel.

Rationale

The BTEC Higher Nationals in computing have been developed to focus on:

- the education and training of computing technologists who are employed or wish to be employed in a wide variety of computing roles, such as: business systems developer, network administrator and software developer, or in a technical support role in industry, the public or education sectors
- providing learning opportunities for computing technologists in current employment to achieve a nationally recognised level 4 vocationally-specific qualification
- providing opportunities for full-time learners to gain a nationally-recognised vocationally-specific qualification to enter employment as a computing technologist or to progress to higher education vocational qualifications such as a full-time degree in computing or a related area
- developing the knowledge, understanding and skills of learners from a computing technologist's viewpoint
- the role of the computing technologist and their relationship within the section/department in which they work; how their role and that of their department/section fits within the overall structure of their organisation and within the technical and local community
- providing opportunities for learners to focus on the development of the higher-level skills within a technological context
- providing opportunities for learners to develop a range of skills and techniques and attributes essential for successful performance in working life.

Aims of the qualification

This qualification meets the needs of the above rationale by:

- equipping individuals with applied knowledge, understanding and skills for success in employment in the computing industry
- enabling progression to an undergraduate degree or further professional qualification in Computing or a related area
- providing specialist studies relevant to individual vocations and professions in which learners are working or intend to seek employment in the IT and computing sectors and their related industries
- developing the learner's ability through effective use and combination of the knowledge and skills gained in the different core and specialist parts of the programme

- developing a range of skills and techniques, personal qualities and attributes essential for successful performance in working life and thereby enable learners to make an immediate contribution to employment
- providing flexibility, knowledge, skills and motivation as a basis for future studies and career development: an educational foundation for a range of careers in the IT, computing and related industries.

Mandatory curriculum

Computer Systems: evaluate computer system performance, employ operating systems, upgrade a computer system, participate in planning a network installation.

Systems Analysis: understand the systems analysis life cycle, use systems analysis tools and techniques, perform a system investigation, investigate functional and data modelling.

Introduction to Programming: design and develop code using structured programming methods. Use modularisation appropriate to the chosen programming language. Produce appropriate documentation for a given program application. Create and apply appropriate test schedules.

Introduction to Database Design: understand database environments, use and manipulate appropriate database software, design a simple database, demonstrate the database.

Introduction to Networking: evaluate the benefit of networks, apply architectural concepts to the design/evaluation of networks. Install network software, and perform network management responsibilities.

Professional Development: demonstrate and deliver a range of transferable skills, show evidence of working and contributing to a group situation. Identify a given problem and provide feasible solutions, monitor and review own learning experience.

Using number: (contextualised for each pathway), **Financial Modelling:** analyse the functioning of an organisation's financial systems, evaluate the effectiveness of management control systems; **Mathematics for Software Development:** develop the mathematical skills necessary for software engineering, gain an understanding of linear algebra, apply the fundamentals of formal methods, use statistical techniques to analyse data.

Project: demonstrate an understanding of how to plan a project, provide evidence of the design of the framework for the project, document the phases of the project, deliver and evaluate the project.

Quality Assurance and Control: understand the principles and practices, costs and benefits of quality systems, TQM, performance indicators, applications of quality systems and how they are applied within a chemical industry environment.

Optional curriculum

General pathway: the optional units for this pathway focus on the skills and knowledge that would be expected from a learner following this particular route. This would include an understanding of management information systems, database design, multimedia and e-business strategy. The pathway attempts to allow the learner to understand how IT systems are designed and implemented and the physical and financial constraints.

ICT Systems Support pathway: this pathway will allow learners to investigate in depth the range of network software and hardware available and be able to install, test and implement a networked system. The Diploma allows the learner to explore the wider implications of networks including the connection with business and e-business systems.

Software Development pathway: develops and applies the knowledge and understanding of the methods available in software development; design methodology, programming techniques and theoretical models together with industry-standard implementation and testing methods.

Wider computing: (available in all pathways and especially at Diploma level) develops and applies the knowledge and understanding of the connections between specialist areas and their wider implications; this allows learners to explore networking, for example, within the context of e-business or to explore in greater depth networking.

Professional body recognition

Learners possessing an HNC/D in computing and a number of years (usually between 3–5 years) of post HNC/D experience in the IT or computing industry are able to apply for ‘Associate Membership of the British Computer Society’.

Links to National Standards

There is the opportunity for HNC/D programmes in computing to provide some of the underpinning knowledge, understanding and skills for the level 4 NVQs in Developing IT Systems and Managing IT Systems.

Higher-Level skills and abilities

Learners will be expected to develop the following skills during the programme of study:

- analysing, synthesising and summarising information critically
- the ability to read and use appropriate literature with a full and critical understanding
- the ability to think independently and solve problems
- the ability to take responsibility for their own learning and recognise their own learning style
- obtaining and integrating several lines of subject-specific evidence to formulate and test hypotheses
- applying subject knowledge and understanding to address familiar and unfamiliar problems recognising the moral and ethical issues surrounding computing and IT and experimentation and appreciating the need for ethical standards and professional codes of conduct designing, planning, conducting and reporting on investigations undertaking investigations of computer systems in a responsible, safe and ethical manner
- develop an appreciation of the interdisciplinary nature of computing and the capacity to give a clear and accurate account of a subject, marshal arguments in a mature way and engage in debate and dialogue both with specialists and non-specialists.

Prerequisites

- A BTEC National Certificate or Diploma for IT Practitioners, in Business Studies, e-Business, or a similar discipline.
- An AVCE/Applied GCE in an appropriate vocational area (eg in ICT or Business) or a similar discipline.
- A GCE A Level profile which demonstrates strong performance in a relevant subject or an adequate performance in more than one GCE subject. This profile is likely to be supported by GCSE grades at level A–C.
- Other related level 3 qualifications.
- An Access to Higher Education Certificate awarded by an approved further education institution.
- Related work experience.

More mature learners may present a more varied profile of achievement that is likely to include extensive work experience (paid and/or unpaid) and/or achievement of a range of professional qualifications in their work sector.

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