QUALIFICATION HANDBOOK

City & Guilds Level 4 Diploma for ICT Professionals – Systems and Principles (7630-04)

Version 6.0 March 2022

City & Guilds
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Qualification at a glance

Subject area	**ICT Systems and Principles for IT Professionals**
City & Guilds number	7630
Age group approved	16+
Entry requirements	None
Assessment	Assignments, Portfolio, Centre Devised Assignments, Vendor examinations
Grading	Pass/Fail
Fast track	Not available for this qualification
Support materials	Centre handbook Assessment pack Centre Devised Assignments Guidance Exemplar assignments Centre devised recording forms
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	**City & Guilds number**	**Ofqual number**
City & Guilds Level 4 Diploma for ICT Professionals - Systems and Principles	7630-04	600/6124/8

Version and date	**Change detail**	**Section**
V1.1 Sept 2014	Unit 317 Creating an event-driven computer program using Visual Basic - Y/503/7090 Detail in the LO and ACs corrected	Units
V 2.0 Feb 2015	Added units 437 and 438	Units
V3.0 Nov 2015	Added units 600-603, 608-616 630-642, 644.	
V4.0 March 2017	Centre devised guidance worded amended	Assessment
V5.0 August 2017	Centre devised guidance worded amended	Assessment
V6.0 March 2022	Optional units in RoCs updated following a structural amendment of this qualification.	All

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Contents

1 Introduction

This section tells you what you need to do to deliver the qualification:

Area	Description
Who is the qualification for?	For learners who work or want to work in senior or supervisory positions in areas such as: • Systems or data analysis • Systems or software development • Network design or management • ICT or telecommunications integration • Information or systems management in either the ICT and Telecommunications sector or industries that require ICT and Telecommunications professionals. It provides a progression route for learners qualified to level 3 wishing to acquire a range of high-level IT skills relevant to their chosen career paths and aspirations.
What does the qualification cover?	It allows learners to learn, develop and practise the higher-level skills required for employment and/or career progression as ICT and Telecommunications professionals. The qualification will enable learners to gain generic and specific management and technical skills appropriate to their field or aspirations. The qualification also gives opportunities for research, analysis and original thought, helping learners to develop these higher-level skills which are useful for entry into Higher Education.
Is the qualification part of a framework or initiative?	It serves as technical certificate, in the IT, Software and Telecommunications Higher Apprenticeship framework.
What opportunities for progression are there?	It allows learners to progress into employment or to the following qualifications: • ILM Level 4 or Level 5 Qualifications in Management • City & Guilds Professional Recognition Awards • Foundation degree or other Higher Education qualifications.

Structure

To achieve the **City & Guilds Level 4 Diploma for ICT Professionals - Systems and Principles**, learners must achieve **120** credits in total.

120 credits overall from
(316, 319, 322-335, 338-339, 345-355, 358, 360, 400-404, 408-409, 412-421, 423-432, 437-438, 500-508, 600-603, 608-616, 630-642, 857-860, 862-863, 865-885, 887-891) (OB)

Learners must achieve **52** credits from mandatory (MA) group (400-403)

a **minimum** of **38** credits from (404, 408-409, 412-421, 423-432, 437-438, 500-508, 601, 638-641, 877-885, 887-891) (OA)

and a **maximum** of **12** credits from (324, 327-328, 330, 332, 339, 349, 354-355, 358, 360) (OC)

Level 4 Diploma for ICT Professionals - Systems and Principles

Unit accreditation number	City & Guilds unit number	Unit title	Credit value	Group
Mandatory				
T/504/1129	400	Project management	15	MA
A/504/1455	401	Effective communication in business	15	MA
K/504/1483	402	Systems development	12	MA
K/504/1449	403	Personal and professional development	10	MA
Optional				
R/601/3171	316	Creating a procedural computer program	12	OB
F/601/3179	319	Creating an object-oriented computer program	12	OB
D/502/1117	322	Creative problem solving	5	OB
R/602/1173	323	Customer support provision for the ICT professional	12	OB
T/502/4556	324	Database software	6	OC
M/501/4012	325	Design and plan for an external overhead network cabling infrastructure	11	OB
F/501/4015	326	Design and plan for an external underground network cabling infrastructure	11	OB

A/502/4574	327	Design software	5	OC
H/502/4567	328	Desktop publishing software	5	OC
H/501/4007	329	Develop software using SQL	9	OB
F/502/4611	330	Drawing and planning software	4	OC
A/501/4000	331	ICT Repair centre procedure	8	OB
R/502/4614	332	Imaging software	5	OC
T/602/2557	333	Implementing an ICT systems security policy	10	OB
L/501/3997	334	Install, configure and upgrade ICT software	7	OB
Y/502/1116	335	IT consulting skills	8	OB
R/501/4004	338	Maintain ICT equipment and systems 3	12	OB
H/502/4617	339	Multimedia software	6	OC
R/601/3509	345	Principles of ICT system and data security	9	OB
L/501/4003	346	Principles of planning telecommunications services	10	OB
D/501/4006	347	Requirements analysis and systems specifications	16	OB
L/601/3251	348	Software design fundamentals	10	OB
J/502/4626	349	Spreadsheet software	6	OC
T/601/3504	350	Systems architecture	10	OB
D/601/3254	351	Telecommunications principles	10	OB
R/501/3998	352	Testing ICT systems	11	OB
R/502/1115	353	The technologies of the Internet	6	OB
T/502/4301	354	Using email	3	OC
F/502/4298	355	Using the Internet	5	OC
Y/502/4632	358	Website software	5	OC
Y/502/4629	360	Word processing software	6	OC
Y/601/1244	404	Business skills for e-commerce	15	OA
M/602/2251	408	Data communications and networks	15	OA
R/601/0447	409	Database design concepts	15	OA
Y/601/1101	412	E-Business operations	15	OA
Y/601/0451	413	Emerging technologies	15	OA
H/601/0453	414	Event-driven programming solutions	15	OA

A/601/0457	415	Human computer interaction	15	OA
Y/601/6881	416	Manage budgets in a creative and cultural organisation	8	OA
J/601/0462	417	Management in information technology	15	OA
D/601/0466	418	Mathematics for software development	15	OA
K/601/0468	419	Network operating systems	15	OA
M/601/0472	420	Networking technologies	15	OA
K/601/1295	421	Object oriented Programming	15	OA
D/601/1293	423	Procedural programming	15	OA
D/601/1276	424	Research skills	15	OA
Y/601/1423	425	Routing concepts	15	OA
L/601/1984	426	Software applications testing	15	OA
A/503/9642	427	Solving problems by making effective decisions in the workplace	3	OA
K/601/1281	428	Systems analysis and design	15	OA
A/601/3505	429	Systems architecture	10	OA
F/503/9660	430	Understanding financial management	3	OA
J/601/1286	431	Website design	15	OA
R/601/1288	432	Website management	15	OA
T/506/8167	437	Business intelligence	15	OA
F/506/8169	438	Test-driven Development	17	OA
M/601/1525	500	Distributed software applications	15	OA
A/601/1513	501	Internet server management	15	OA
A/601/1933	502	IT virtualisation	15	OA
L/601/1547	503	Local area networking technologies	15	OA
A/601/1964	504	Networking infrastructure	15	OA
H/601/1537	505	Programming in .NET	15	OA
F/601/1528	506	Programming in Java	15	OA
F/601/1562	507	Wide area networking technologies	15	OA
H/600/4376	508	Windows internals	15	OA
H/507/0173	600	Introduction to networks	17	OA
K/507/0174	601	Routing and switching essentials	27	OA
M/507/0175	602	Scaling networks	15	OB

T/507/0176	603	Connecting networks	18	OB
R/507/0184	608	Fundamentals of Linux based operating systems	7	OB
Y/507/0185	609	Implementing and maintaining cloud technologies and infrastructure	10	OB
R/507/0198	610	Configure and manage Linux based operating systems	12	OB
F/507/0200	611	Implement and manage a network	10	OB
D/507/0219	612	Securing ICT systems and networks	9	OB
Y/507/0221	613	Install and configure a server	9	OB
K/507/0224	614	Implement and manage a mobile computing environment	8	OB
J/507/0229	615	Developing security for mobile apps on IOS	14	OB
T/507/0226	616	Developing security for mobile apps on android	13	OB
A/507/0292	630	Administering server databases	12	OB
A/507/0289	631	Administering a Windows based server	11	OB
R/507/0332	632	Configuring advanced Windows server services	12	OB
D/507/0334	633	Configuring Windows based systems	12	OB
H/507/0335	634	Installing and configuring Windows based servers	11	OB
A/507/0275	635	Programming in HTML5 with JavaScript and CSS3	11	OB
T/507/0338	636	Implementing a Windows based data warehouse	10	OB
A/507/0342	637	Managing a Windows based system	11	OB
T/507/0341	638	Designing and implementing a Windows desktop infrastructure	13	OA
M/507/0340	639	Implementing Windows desktop application environments	12	OA
J/507/0344	640	Supporting Microsoft Exchange server solutions	12	OA
M/507/0337	641	Designing and implementing a Windows server infrastructure	13	OA

F/601/3179	642	Creating an event-driven computer program	12	OB
K/505/5786	857	Principles of information governance and assurance	15	OB
T/505/5788	858	Testing the security of information systems	12	OB
T/505/5791	859	Carrying out information security risk assessment	9	OB
F/505/5793	860	Investigating information security incidents	9	OB
F/505/5812	862	Carrying out information security incident management activities	9	OB
R/505/5801	863	Carrying out information security forensic examinations	6	OB
A/505/5808	865	Carrying out information security audits	6	OB
A/500/7340	866	System operation	12	OB
D/500/7332	867	System management	12	OB
K/500/7379	868	User profile administration	9	OB
H/501/4010	869	Network management and security	14	OB
F/601/3246	870	Advanced data representation and manipulation for IT	17	OB
R/505/5815	871	Principles of information security testing	12	OB
K/505/5819	872	Principles of secure system development	6	OB
R/601/3249	873	Investigating and defining customer requirements for ICT systems	12	OB
L/601/3203	874	Data modelling	9	OB
T/501/4013	875	Design and plan for an internal network cabling infrastructure	10	OB
J/501/4002	876	Design and maintain ICT networks software components	11	OB
	877	Carrying out electronic forensic examinations	12	OA
A/505/5811	878	Carrying out information security audits	12	OA
M/505/5806	879	Carrying out information security forensic examinations	9	OA
J/505/5813	880	Carrying out information security incident management activities	12	OA

A/505/5792	881	Carrying out information security risk assessment	12	OA
L/505/5814	882	Carrying out information security risk management	12	OA
J/601/3300	883	Designing and developing event-driven computer programs	15	OA
T/601/3308	884	Designing and developing object-oriented computer programs	15	OA
T/601/3311	885	Designing and developing procedural computer programs	15	OA
R/602/1772	887	Investigating and defining customer requirements for ICT Systems	15	OA
D/505/5798	888	Investigating information security incidents	15	OA
M/504/5504	889	IT and telecoms system management	15	OA
R/504/5513	890	IT and telecoms system operation	15	OA
A/505/5789	891	Testing the security of information systems	15	OA

Total Qualification Time

Total Qualification Time (TQT) is the total amount of time, in hours, expected to be spent by a learner to achieve a qualification. It includes both guided learning hours (which are listed separately) and hours spent in preparation, study and assessment.

Title and level	GLH	TQT
City & Guilds Level 4 Diploma for ICT Professionals – Systems and Principles	522	1200

2 Centre requirements

Approval

To offer these qualifications, new centres will need to gain both centre and qualification approval. Please refer to the document *Quality Assurance Standards: Centre Approval Process* for further information.

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualifications before designing a course programme.

There is no fast-track approval for this qualification; existing centres who wish to offer this qualification must use the **standard** Qualification Approval Process.

Resource requirements

Centre staffing

It is important that centre staff involved in the delivery or internal verification of this qualification have the appropriate knowledge and skills to ensure its effective delivery.

Staff delivering this qualification must be able to demonstrate that they meet the following occupational expertise requirements. They should:

- be technically competent and knowledgeable in the areas for which they are delivering training. This must be at least to the same level as the training being delivered.
- hold the Level 3 Diploma for ICT Professionals, or an equivalent qualification
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training with a relevant teaching qualification.

Centre staff may undertake more than one role, eg tutor and assessor or internal verifier, but must never internally verify their own assessments.

Assessors and Internal Quality Assurers (IQAs)

While the Assessor/Verifier (A/V) units are valued as qualifications for centre staff, they are not currently a requirement for the qualification.

However, it is strongly recommended that Assessors and IQAs hold these qualifications or equivalent if they are going to be involved in writing and approving centre set and marked assignments.

Expert Witnesses

If additional experts involved in the delivery of this qualification do not have the necessary teaching qualifications or experience, it will be necessary for any assessment they undertake to be re-assessed by a qualified member of staff and form part of the centre's internal quality process.

Continuing professional development (CPD)

Centres are expected to support their staff in ensuring that their knowledge remains current of the occupational area and of best practice in delivery, mentoring, training, assessment and verification, and that it takes account of any national or legislative developments.

Learner entry requirements

Learners should not be entered for a qualification of the same type, content and level as that of a qualification they already hold.

There are no formal entry requirements for learners undertaking this qualification. However, centres must ensure that learners have the potential and opportunity to successfully gain the qualification.

Age restrictions

This qualification is not approved for use by learners under the age of 16, and City & Guilds cannot accept any registrations for learners in this age group.

3 Delivering the qualification

Initial assessment and induction

An initial assessment of each learner should be made before the start of their programme to identify:

- if the learner has any specific training needs,
- support and guidance they may need when working towards their qualification.
- any units they have already completed, or credit they have accumulated which is relevant to the qualification.
- the appropriate type and level of qualification.

We recommend that centres provide an induction programme so that the learner fully understands the requirements of the qualification[s], their responsibilities as a learner and the responsibilities of the centre. This information can be recorded on a learning contract.

Recommended delivery strategies

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualification before designing a course programme.

Centres may design course programmes of study in any way which:

- best meets the needs and capabilities of their learners
- satisfies the requirements of the qualification.

In terms of the delivering the qualification, the emphasis is expected to be on the relationship between the content of the unit and the demands made on the individual by their existing or future job and career aspirations.

When designing and delivering the course programme, centres might wish to incorporate other teaching and learning that is not assessed as part of the qualification. This might include the following:

- literacy, language and/or numeracy
- personal learning and thinking
- personal and social development
- employability.

Where applicable, this could involve enabling the learner to access relevant qualifications covering these skills.

Support materials

The following resources are available for this qualification:

Description	How to access
Level 3 Unit Handbook	www.cityandguilds.com
Level 4 & 5 Unit Handbook	www.cityandguilds.com
Exemplar assignments (mandatory units)	www.cityandguilds.com
Assessment pack	www.cityandguilds.com
Developing centre-based assessments (guidance for centre-based assessment writers – GM2)	www.cityandguilds.com
Centre devised recording forms	www.cityandguilds.com
Tutor/assessor support materials	Smartscreen registration
Learner support materials	Smartscreen registration

4 Assessment

Assessment of the qualification

The units within this qualification are assessed in the following ways:

- City & Guilds set assignments
- Portfolio of evidence
- Centre devised assignment s
- Vendor assessment.

Assessment guidance and assignments for the Level 3 units can be found on the City & Guilds website.

Centre set and marked assessments

City & Guilds has provided separate guidance for writers of centre-based assessments which should be read in conjunction with this document, entitled, '***GM1 - Developing centre devised assessments*** *– guidance for centre-based assessment writers'*.

A set of generic recording forms is also provided as follows:

- Assessment tasks (AD1)
- Assessment grading criteria (AD2)
- Assessment sign-off form (AD3)
- Evidence recording form (GF1)
- Assessment unit front and mark sheet (GF2)
- Assessment task front sheet (GF3)
- Assessment unit mark sheet (GF4)
- Assessment feedback and action plan form (GF5)
- Qualification assessment tracking form (GF6)
- Group assessment tracking form (GF7).

A full explanation of the use of these forms can be found in the centre devised assessment writing guidance. All of this material is available to download from the City & Guilds website here A full explanation of the use of these forms can be found in the centre devised assessment writing guidance. All of this material is available to download from the City & Guilds website at **http://www.cityandguilds.com/delivering-our-qualifications/centre-development/quality-assurance/quality-assurance-documents**

Level 4 Diploma for ICT Professionals - Systems and Principles

Unit Number	Unit Title	Assessment method	Where to obtain assessment materials
316	Creating a procedural computer program (Level 3) (12)	Assignment	www.cityandguilds.com
319	Creating an object-oriented computer program (Level 3) (12)	Assignment	www.cityandguilds.com
322	Creative problem solving (Level 3) (5)	Assignment	www.cityandguilds.com
323	Customer support provision for the ICT professional (Level 3) (12)	Assignment	www.cityandguilds.com
324	Database software (Level 3) (6)	Portfolio	www.cityandguilds.com
325	Design and plan for an external overhead network cabling infrastructure (Level 3) (11)	Assignment	www.cityandguilds.com
326	Design and plan for an external underground network cabling infrastructure (Level 3) (11)	Assignment	www.cityandguilds.com
327	Design software (Level 3) (5)	Portfolio	www.cityandguilds.com
328	Desktop publishing software (Entry 3) (5)	Portfolio	www.cityandguilds.com
329	Develop software using SQL (Level 3) (9)	Assignment	www.cityandguilds.com
330	Drawing and planning software (Level 3) (4)	Portfolio	www.cityandguilds.com
331	ICT Repair centre procedure (Level 3) (8)	Assignment	www.cityandguilds.com
332	Imaging software (Level 3) (5)	Portfolio	www.cityandguilds.com
333	Implementing an ICT systems security policy (Level 3) (10)	Assignment	www.cityandguilds.com
334	Install, configure and upgrade ICT software (Level 3) (7)	Assignment	www.cityandguilds.com

335	IT consulting skills (Level 3) (8)	Assignment	www.cityandguilds.com
338	Maintain ICT equipment and systems 3 (Level 3) (12)	Assignment	www.cityandguilds.com
339	Multimedia software (Level 3) (6)	Portfolio	www.cityandguilds.com
345	Principles of ICT system and data security (Level 3) (9)	Assignment	www.cityandguilds.com
346	Principles of planning telecommunications services (Level 3) (10)	Assignment	www.cityandguilds.com
347	Requirements analysis and systems specifications (Level 3) (16)	Assignment	www.cityandguilds.com
348	Software design fundamentals (Level 3) (10)	Assignment	www.cityandguilds.com
349	Spreadsheet software (Level 3) (6)	Portfolio	www.cityandguilds.com
350	Systems architecture (Level 3) (10)	Assignment	www.cityandguilds.com
351	Telecommunications principles (Level 3) (10)	Assignment	www.cityandguilds.com
352	Testing ICT systems (Level 3) (11)	Assignment	www.cityandguilds.com
353	The technologies of the Internet (Level 3) (6)	Assignment	www.cityandguilds.com
354	Using email (Level 3) (3)	Portfolio	www.cityandguilds.com
355	Using the Internet (Level 3) (5)	Portfolio	www.cityandguilds.com
358	Website software (Level 3) (5)	Portfolio	www.cityandguilds.com
360	Word processing software (Level 3) (6)	Portfolio	www.cityandguilds.com
400	Project management (Level 4) (15)	Centre Devised	www.cityandguilds.com

401	Effective communication in business (Level 4) (15)	Centre Devised	www.cityandguilds.com
402	Systems development (Level 4) (12)	Centre Devised	www.cityandguilds.com
403	Personal and professional development (Level 4) (10)	Centre Devised	www.cityandguilds.com
404	Business skills for e-commerce (Level 4) (15)	Centre Devised	www.cityandguilds.com
408	Data communications and networks (Level 4) (15)	Centre Devised	www.cityandguilds.com
409	Database design concepts (Level 4) (15)	Centre Devised	www.cityandguilds.com
412	E-Business operations (Level 4) (15)	Centre Devised	www.cityandguilds.com
413	Emerging technologies (Level 4) (15)	Centre Devised	www.cityandguilds.com
414	Event-driven programming solutions (Level 4) (15)	Centre Devised	www.cityandguilds.com
415	Human computer interaction (Level 4) (15)	Centre Devised	www.cityandguilds.com
416	Manage budgets in a creative and cultural organisation (Level 4) (8)	Centre Devised	www.cityandguilds.com
417	Management in Information Technology (Level 4) (15)	Centre Devised	www.cityandguilds.com
418	Mathematics for software development (Level 4) (15)	Centre Devised	www.cityandguilds.com
419	Network operating systems (Level 4) (15)	Centre Devised	www.cityandguilds.com
420	Networking technologies (Level 4) (15)	Centre Devised	www.cityandguilds.com
421	Object-oriented programming (Level 4) (15)	Centre Devised	www.cityandguilds.com
423	Procedural programming (Level 4) (15)	Centre Devised	www.cityandguilds.com

424	Research skills (Level 4) (15)	Centre Devised	www.cityandguilds.com
425	Routing concepts (Level 4) (15)	Centre Devised	www.cityandguilds.com
426	Software applications Testing (Level 4) (15)	Centre Devised	www.cityandguilds.com
427	Solving problems by making effective decisions in the workplace (Level 4) (3)	Centre Devised	www.cityandguilds.com
428	Systems analysis and design (Level 4) (15)	Centre Devised	www.cityandguilds.com
429	Systems architecture (Level 4) (10)	Centre Devised	www.cityandguilds.com
430	Understanding financial management (Level 4) (3)	Centre Devised	www.cityandguilds.com
431	Website design (Level 4) (15)	Centre Devised	www.cityandguilds.com
432	Website management (Level 4) (15)	Centre Devised	www.cityandguilds.com
437	Business intelligence (Level 4) (15)	Portfolio	www.cityandguilds.com
438	Test-driven Development (Level 4) (17)	Portfolio	www.cityandguilds.com
500	Distributed software applications (Level 5) (15)	Centre Devised	www.cityandguilds.com
501	Internet server management (Level 5) (15)	Centre Devised	www.cityandguilds.com
502	IT virtualisation (Level 5) (15)	Centre Devised	www.cityandguilds.com
503	Local area networking technologies (Level 5) (15)	Centre Devised	www.cityandguilds.com
504	Networking infrastructure (Level 5) (15)	Centre Devised	www.cityandguilds.com
505	Programming in .NET (Level 5) (15)	Centre Devised	www.cityandguilds.com

506	Programming in Java (Level 5) (15)	Centre Devised	www.cityandguilds.com
507	Wide area networking technologies (Level 5) (15)	Centre Devised	www.cityandguilds.com
508	Windows internals (Level 5) (15)	Centre Devised	www.cityandguilds.com
600	Introduction to networks (Level 3) (17)	Portfolio	www.cityandguilds.com
601	Routing and switching essentials (Level 4) (27)	Portfolio	www.cityandguilds.com
602	Scaling networks (Level 3) (15)	Portfolio	www.cityandguilds.com
603	Connecting networks (Level 3) (18)	Portfolio	www.cityandguilds.com
608	Fundamentals of Linux based operating systems (Level 3) (7)	Portfolio	www.cityandguilds.com
609	Implementing and maintaining cloud technologies and infrastructure (Level 3) (10)	Portfolio	www.cityandguilds.com
610	Configure and manage Linux based operating systems (Level 3) (12)	Portfolio	www.cityandguilds.com
611	Implement and manage a network (Level 3) (10)	Portfolio	www.cityandguilds.com
612	Securing ICT systems and networks (Level 3) (9)	Portfolio	www.cityandguilds.com
613	Install and configure a server (Level 3) (9)	Portfolio	www.cityandguilds.com
614	Implement and manage a mobile computing environment (Level 3) (8	Portfolio	www.cityandguilds.com
615	Developing security for mobile apps on IOS	Portfolio	www.cityandguilds.com
616	Developing security for mobile apps on android (Level 3) (13)	Portfolio	www.cityandguilds.com
630	Administering server databases (Level 3)(12)	Portfolio	www.cityandguilds.com
631	Administering a Windows based server (Level 3) (11)	Portfolio	www.cityandguilds.com
632	Configuring advanced Windows server services (Level 3) (12)	Portfolio	www.cityandguilds.com
633	Configuring Windows based systems (Level 3)(12	Portfolio	www.cityandguilds.com
634	Installing and configuring Windows based servers (Level 3)(11)	Portfolio	www.cityandguilds.com
635	Programming in HTML5 with JavaScript and CSS3 (Level 3) (11)	Portfolio	www.cityandguilds.com

636	Implementing a Windows based data warehouse (Level 3) (10)	Portfolio	www.cityandguilds.com
637	Managing a Windows based system (Level 3) (11)	Portfolio	www.cityandguilds.com
638	Designing and implementing a Windows Desktop infrastructure (Level 4) 13)	Portfolio	www.cityandguilds.com
639	Implementing Windows desktop application environments (Level 4) (12)	Portfolio	www.cityandguilds.com
640	Supporting Microsoft Exchange server solutions (Level 4) (12)	Portfolio	www.cityandguilds.com
641	Designing and implementing a Windows server infrastructure (Level 4) (13)	Portfolio	www.cityandguilds.com
642	Creating an event-driven computer program (Level 3) (12)	Portfolio	www.cityandguilds.com
857	Principles of Information Governance and Assurance (Level 3) (15)	Centre devised	www.cityandguilds.com
858	Testing the security of Information Systems (Level 3) (12)	Portfolio	www.cityandguilds.com
859	Carrying out information security risk assessment (Level 3) (9)	Portfolio	www.cityandguilds.com
860	Investigating information security incidents (9)	Portfolio	www.cityandguilds.com
862	Carrying out Information Security Incident Management activities (Level 3) (9)	Portfolio	www.cityandguilds.com
863	Carrying out information security forensic examinations (Level 3) (6)	Portfolio	www.cityandguilds.com
865	Carrying out information security audits (Level 3) (6)	Portfolio	www.cityandguilds.com
866	System operation (Level 3) (12)	Portfolio	www.cityandguilds.com
867	System management (Level 3) 12)	Portfolio	www.cityandguilds.com
868	User profile administration (Level 3) (9)	Portfolio	www.cityandguilds.com
869	Network management and security (Level 3) (14)	Assignment	www.cityandguilds.com
870	Advanced data representation and manipulation for IT (Level 3) (7)	Assignment	www.cityandguilds.com
871	Principles of Information Security testing (Level 3) (12)	Centre devised	www.cityandguilds.com
872	Principles of secure system development (Level 3) (6)	Centre devised	www.cityandguilds.com
873	Investigating and defining customer requirements for ICT systems (Level 3) (12)	Assignment	www.cityandguilds.com

874	Data modelling (Level 3) (9)	Portfolio	www.cityandguilds.com
875	Design and plan for an internal network cabling infrastructure (Level 3) (10)	Assignment	www.cityandguilds.com
876	Design and maintain ICT networks software components (Level 3) (11)	Assignment	www.cityandguilds.com
877	Carrying out electronic forensic examinations (Level 4) (12)	Portfolio	www.cityandguilds.com
878	Carrying out information security audits (Level 4) (12)	Portfolio	www.cityandguilds.com
879	Carrying out information security forensic examinations (Level 4) (9)	Portfolio	www.cityandguilds.com
880	Carrying out information security incident management activities (Level 4) (12)	Portfolio	www.cityandguilds.com
881	Carrying out information security risk assessment (Level 4) (12)	Portfolio	www.cityandguilds.com
882	Carrying out information security risk management (Level 4) (12)	Portfolio	www.cityandguilds.com
883	Designing and developing event-driven computer programs (Level 4) (15 credits)	Portfolio	www.cityandguilds.com
884	Designing and developing object-oriented computer programs (Level 4) (15 credits)	Portfolio	www.cityandguilds.com
885	Designing and developing procedural computer programs (Level 4) (15 credits)	Portfolio	www.cityandguilds.com
887	Investigating and defining customer requirements for ICT systems (Level 4) (15 credits)	Portfolio	www.cityandguilds.com
888	Investigating information security incidents (Level 4) (12 credits)	Portfolio	www.cityandguilds.com
889	IT and telecoms system management (Level 4) (15 credits)	Portfolio	www.cityandguilds.com
890	IT and telecoms system operation (Level 4) (15 credits)	Portfolio	www.cityandguilds.com
891	Testing the security of information systems (Level 4) (15 credits)	Portfolio	www.cityandguilds.com

5 Units

Structure of units

The units in these qualifications are written in a standard format and comprise the following:

- City & Guilds reference number
- title
- level
- credit value
- unit aim
- statement of guided learning hours
- information on assessment
- learning outcomes in detail expressed as practical skills and/or underpinning knowledge
- range: the words in bold are listed as headings at the end of the unit. This content must be covered in the delivery of the unit. Where eg is used, this is indicative content that could be covered or replaced by other, similar material. It is not a requirement that all of the content is assessed. In some cases, additional guidance is provided in relation to the breadth and depth of coverage of range
- notes for guidance (where applicable): this section includes guidance notes for assessors and tutors to support delivery of the unit.

Units for this qualification are available in separate unit handbooks, which are available to download from **www.cityandguilds.com**

Unit 316 Creating a procedural computer program

UAN:	**R/601/3171**
Level:	Level 3
Credit value:	12
GLH:	90
Aim:	This unit covers more advanced concepts of procedural computer languages and their use to implement, refine and test computer programs.

Learning outcome
The learner will: 1. Implement a software design using procedural programming
Assessment criteria
The learner can: 1.1 Identify the program modules and data and file structures required to implement a given design 1.2 Select, declare and initialise variable and data structure types and sizes to implement design requirements 1.3 Select and implement control structures to meet the design algorithms 1.4 Select and declare file structures to meet design file storage requirements 1.5 Select and use standard input/output commands to implement design requirements 1.6 Make effective use of operators and predefined functions 1.7 Correctly use parameter passing mechanisms

Learning outcome
The learner will: 2. Refine a procedural program to improve quality
Assessment criteria
The learner can: 2.1 Use an agreed standard for naming, comments and code layout 2.2 Define user functions to replace repeating code sequences 2.3 Implement data validation for inputs

2.4	Identify and implement opportunities for error handling and reporting

Learning outcome
The learner will: 3. Test the operation of a procedural program
Assessment criteria
The learner can: 3.1 Make effective use of available debugging tools 3.2 Prepare a test strategy 3.3 Select suitable test data and determine expected test results 3.4 Record actual test results to enable comparison with expected results 3.5 Analyse actual test results against expected results to identify discrepancies 3.6 Investigate test discrepancies to identify and rectify their causes

Learning outcome
The learner will: 4. Document a computer program
Assessment criteria
The learner can: 4.1 Create documentation to assist the users of a computer program 4.2 Create documentation for the support and maintenance of a computer program

Unit 319 Creating an object-oriented computer program

UAN:	**F/601/3179**
Level:	Level 3
Credit value:	12
GLH:	90
Aim:	This unit covers more advanced concepts of event-driven computer languages and their use to implement, refine and test computer programs.

Learning outcome
The learner will: 1. Implement a software design using object-oriented programming
Assessment criteria
The learner can: 1.1 Identify the objects and data and file structures required to implement a given design 1.2 Select, declare and initialise variable and data structure types and sizes to implement design requirements 1.3 Define relationships between objects to implement design requirements 1.4 Implement message passing between objects to implement design requirements 1.5 Implement object behaviours using control structures to meet the design algorithms 1.6 Select and declare file structures to meet design file storage requirements 1.7 Select and use standard input/output commands to implement design requirements 1.8 Make effective use of operators and predefined functions 1.9 Make effective use of an Integrated Development Environment (IDE) including code and screen templates

Learning outcome
The learner will: 2. Refine an object-oriented program to improve quality
Assessment criteria
The learner can: 2.1 Use an agreed standard for naming, comments and code layout 2.2 Make effective use of encapsulation, polymorphism and inheritance 2.3 Implement data validation for inputs 2.4 Identify and implement opportunities for error handling and reporting

Learning outcome
The learner will: 3. Test the operation of an object-oriented driven program
Assessment criteria
The learner can: 3.1 Make effective use of the debugging facilities available in the IDE 3.2 Prepare a test strategy 3.3 Select suitable test data and determine expected test results 3.4 Record actual test results to enable comparison with expected results 3.5 Analyse actual test results against expected results to identify discrepancies 3.6 Investigate test discrepancies to identify and rectify their causes

Learning outcome
The learner will: 4. Document an object-oriented driven program
Assessment criteria
The learner can: 4.1 Create on-screen help to assist the users of a computer program 4.2 Create documentation for the support and maintenance of a computer program

Unit 322 Creative problem solving

UAN:	**D/502/1117**
Level:	Level 3
Credit value:	5
GLH:	30
Aim:	The aim of this unit is to enable learners to understand the process of analysing a problem and providing a solution. Learners will develop the skills to write a problem statement, generate, select and evaluate possible solutions and plan for successful implementation

Learning outcome
The learner will: 1. Be able to identify and analyse a problem
Assessment criteria
The learner can: 1.1 Select and use a technique to obtain information on a problem 1.2 Provide solution criteria 1.3 Create a problem statement 1.4 Create an impact statement using time, cost, personnel issues 1.5 Select and use analysis techniques to look at causes and potential solutions to problems 1.6 Compare the main features and risks of each possible solution 1.7 Use tools like BOSCARD to make clear what is required

Learning outcome
The learner will: 2. Be able to plan, monitor and evaluate an implementation/a problem solution
Assessment criteria
The learner can: 2.1 Identify the steps to solve the problem using their preferred solution

2.2	Use diagrammatic representations or charts to plan the solution implementation
2.3	Present the solution to a line manager or experienced person
2.4	Collect data around the problem
2.5	Analyse data collected using established methodologies
2.6	Monitor and evaluate progress as the implementation progresses
2.7	Plan tasks in a chronological and logical order
2.8	Justify the solution to the decision maker
2.9	Log results in a systematic and consistent manner

Learning outcome
The learner will: 3. Review their approach to problem solving and the proposed problem solution
Assessment criteria
The learner can: 3.1 Check if the problem has been solved by gathering and comparing data to benchmarked data 3.2 Assess whether the solution met the original criteria for the problem to be deemed solved 3.3 Create a logical and easily understood document / presentation showing the results and the degree of success in solving the problem 3.4 Create a summary of lessons learned to apply to the next problem 3.5 Create a summary of lessons learned for the solution, concerning the approach used in the problem-solving process 3.6 Run a review session

Unit 323 Customer support provision for the ICT professional

UAN:	**R/602/1173**
Level:	Level 3
Credit value:	12
GLH:	60
Aim:	This unit will enable the learner to provide technical customer support and understand the processes involved in improving the way in which customers use networked ICT systems.

Learning outcome
The learner will: 1. Provide technical support to customers
Assessment criteria
The learner can: 1.1 Determine customer requirements for ICT systems and services support 1.2 Respond to individual customer requests for technical support using different communication techniques 1.3 Use manual/written or electronic methods to record details of the customer request and the outcome 1.4 Obtain technical support information from other sources 1.5 Record and escalate unresolved technical support requests following agreed processes

Learning outcome
The learner will: 2. Gather and evaluate feedback from customers on improving technical support provision
Assessment criteria
The learner can: 2.1 Design and use suitable tools for gathering effective feedback from customers to improve technical support provision 2.2 Obtain and analyse feedback from customers 2.3 Document analysis findings and propose recommendations

Learning outcome
The learner will: 3. Implement recommended action plan
Assessment criteria
The learner can: 3.1 Analyse support records or logs identifying patterns of customer support request 3.2 Prepare an action plan to implement the recommendations

Learning outcome
The learner will: 4. Provide remote technical customer support
Assessment criteria
The learner can: 4.1 Determine the customers' requirements for technical support in a remote situation 4.2 Use available diagnostic tools to remotely investigate and inspect a system or system components as part of a fault-finding process 4.3 Guide a remote user through a fault-finding process 4.4 Record the fault-finding process and the results of tests or checks reported by the customer 4.5 Advise on the corrective action to be taken to restore a system to working order and to confirm problem resolution

Learning outcome
The learner will: 5. Provide coaching in technical skills for customers
Assessment criteria
The learner can: 5.1 Identify types of customers and their knowledge 5.2 Identify technical skills required by the customer and prepare a coaching plan 5.3 Provide coaching to the customer in technical skills 5.4 Obtain feedback regarding the effectiveness of the coaching 5.5 Evaluate coaching delivered and make recommendations

Unit 324 Database software

UAN:	**T/502/4556**
Level:	Level 3
Credit value:	6
GLH:	45
Aim:	In this unit the Learner will gain the ability to use a software application designed to organise and store structured information and generate reports. On completion of this unit a learner should be able to select and use advanced database software tools and techniques efficiently.

Learning outcome
The learner will: 1. Plan, create and modify relational database tables to meet requirements
Assessment criteria
The learner can: 1.1 Explain how a relational database design enables data to be organised and queried 1.2 Plan and create multiple tables for data entry with appropriate fields and properties 1.3 Set up and modify relationships between database tables 1.4 Explain why and how to maintain data integrity 1.5 Respond appropriately to problems with database tables 1.6 Use database tools and techniques to ensure data integrity is maintained

Learning outcome
The learner will: 2. Enter, edit and organise structured information in a database
Assessment criteria
The learner can: 2.1 Design and create forms to access, enter, edit and organise data in a database 2.2 Select and use appropriate tools and techniques to format data entry forms 2.3 Check data entry meets needs, using IT tools and making corrections as necessary

2.4 Respond appropriately to data entry errors

Learning outcome
The learner will: 3. Use database software tools to create, edit and run data queries and produce reports
Assessment criteria
The learner can: 3.1 Explain how to select, generate and output information from queries according to requirements 3.2 Create and run database queries to display, amend or calculate selected data 3.3 Plan and produce database reports from a multiple-table relational database 3.4 Select and use appropriate tools and techniques to format database reports 3.5 Check reports meet needs, using IT tools and making corrections as necessary

Guidance
Use advanced database software tools and techniques to: enter complex information into databases; retrieve information by creating queries using multiple selection criteria; and produce reports by setting up menus or short cuts. They will also be able to design, create and interrogate multiple-table relational databases. Database tools, functions and techniques will be described as 'advanced' because: the software tools and functions involved will be complex and at times require new learning, which will involve having the idea that there may be a tool or function to do something (eg improve efficiency or create an effect), exploring technical support, self-teaching and applying; and the input, manipulation and output techniques involved will be complex, which will involve research, identification and application. Examples of context: Typical 'more complex' reports from multiple-table relational databases may be about – customers' buying methods, order frequency and payment patterns.

Unit 325 Design and plan for an external overhead network cabling infrastructure

UAN:	**M/501/4012**
Level:	Level 3
Credit value:	11
GLH:	65
Aim:	This unit will provide the learner with the basic principles needed to plan an external overhead cable route. Learners will be able to develop an understanding of how an external overhead communications infrastructure is specified, planned and provided.

Learning outcome
The learner will: 1. Know how to survey a site for the provision of an external overhead telecoms infrastructure.
Assessment criteria
The learner can: 1.1 Identify a range of data, equipment and tools necessary for an external overhead infrastructure site survey 1.2 Identify the hazards and environmental constraints that may be identified during a site survey. 1.3 Give examples of health and safety issues that could apply during a site survey and explain how they may be resolved. 1.4 Describe what actions could be taken when variations are identified between the survey findings and site records and plans. 1.5 Explain why it is important to record accurately the findings of the survey.

Learning outcome
The learner will: 2. Survey a site for the provision of an external overhead telecoms infrastructure.
Assessment criteria
The learner can: 2.1 Identify the areas and systems and equipment required to be surveyed from the planning request 2.2 Identify the full range of data required from the survey. 2.3 Obtain plans and records of the areas to be surveyed and interpret them. 2.4 Collect and record the data required from the survey. 2.5 Record details that may affect the planning options.

Learning outcome
The learner will: 3. Know how to produce preliminary designs for the provision of an external overhead communications cabling infrastructure and select an optimum solution.
Assessment criteria
The learner can: 3.1 Explain why it is important to consider forecasts for both existing and proposed services when considering viable options the implications of existing and already planned systems and equipment, support systems and accommodation when evaluating options. 3.2 Explain why it is important to keep abreast of new and emerging technologies evaluate information objectively and without bias to identify viable options. cost options over the lifetime of the equipment or an accepted period. evaluate, compare and rank different options according to their relative merits. 3.3 Describe how to confirm the accuracy, currency and reliability of forecast information 3.4 Describe the basic principles of risk, cost benefit and sensitivity analysis when considering options. 3.5 Identify the capabilities of the communications system being planned and what details are critical to decision makers with regards to the proposed solution.

Learning outcome
The learner will: 4. Produce preliminary designs for the provision of an external overhead Communications cabling infrastructure and select an optimum solution.
Assessment criteria
The learner can: 4.1 Gather sufficient information to be able to identify future demands for: existing communications services proposed new communications services. 4.2 Plan the collection of the information in a timescale suitable for achieving the forecast future demand. 4.3 Evaluate the information objectively, and use it to identify a range of options 4.4 Calculate the budget for the options 4.5 Select and document the optimum solution in sufficient detail to meet the requirements of the customer 4.6 Obtain authority to proceed

Learning outcome
The learner will: 5. Know how to produce a design for the provision of an external overhead communications cabling infrastructure.
Assessment criteria
The learner can: 5.1 Describe and give examples of the different types of telecoms systems 5.2 Identify and explain the constraints and limitations of an external overhead communications infrastructure operational and environment requirements of a permanent overhead communications infrastructure 5.3 Explain why it is important to confirm the currency and reliability of information 5.4 Describe how to translate specified communications requirements into realistic and practical designs 5.5 Explain where to find information: on new and emerging technologies; relevant to component supply 5.6 Know the legislation and regulations that governing the provision of an external overhead communications cabling infrastructure.

Learning outcome
The learner will: 6. Produce a design for the provision of an external overhead communications cabling infrastructure
Assessment criteria
The learner can: 6.1 Carry out and document a detailed survey on the selected optimum route. 6.2 Produce designs for an external overhead cabling infrastructure based on the optimum route. 6.3 Use design tools that are suitable for the purpose. 6.4 Identify components for the communications systems 6.5 Specify the quantities of components taking into account: existing and already planned plant and services, present and predictable future requirements, design requirements. 6.6 Specify a route.

Unit 326 Design and plan for an external underground network cabling infrastructure

UAN:	**F/501/4015**
Level:	Level 3
Credit value:	11
GLH:	65
Aim:	This unit will provide the learner with the basic principles needed to plan an external underground cable route. Learners will be able to develop an understanding of how external underground communications infrastructures are specified, planned and provided.

Learning outcome
The learner will: 1. Know how to do a preliminary site survey for the provision of an external underground communications infrastructure.
Assessment criteria
The learner can: 1.1 Identify a range of data, equipment and tools required to carry out an external underground infrastructure site survey. 1.2 Describe the hazards and environmental constraints that may be identified during a site survey for a proposed route. 1.3 Know the health and safety issues that could apply during a site survey and explain how they may be resolved. 1.4 Explain why it is important to record accurately the findings of the survey 1.5 Take action when variations are identified between the survey findings and site records and plans

Learning outcome
The learner will: 2. Survey a site for the provision of an external underground communications cabling infrastructure
Assessment criteria
The learner can: 2.1 Identify the areas and systems and equipment required to be surveyed from the planning request 2.2 Identify the full range of data required from the survey 2.3 Obtain plans and records of the areas to be surveyed and interpret them 2.4 Collect and record the data required from the survey 2.5 Record details that may affect the planning options

Learning outcome
The learner will: 3. Know how to produce preliminary designs for the provision of an external underground communications cabling infrastructure and select an optimum solution
Assessment criteria
The learner can: 3.1 Explain why it is important to: consider forecasts for both existing and proposed services when considering viable options the implications of existing and already planned systems and equipment, support systems and accommodation when considering options keep abreast of new and emerging technologies evaluate information objectively and without bias to identify viable options. cost options over the lifetime of the equipment over an accepted period evaluate, compare and rank different options according to their relative merits 3.2 Confirm the accuracy, currency and reliability of forecast information 3.3 Describe the basic principles of risk, cost benefit and sensitivity analysis when considering options 3.4 Identify what details are critical to decision makers with regards to the proposed solution and the capabilities of the communications infrastructure being planned

Learning outcome
The learner will: 4. Produce preliminary designs for the provision of an external underground Communications cabling infrastructure and select an optimum solution.
Assessment criteria
The learner can: 4.1 Gather sufficient information to identify future demands for existing and/or proposed new communications services 4.2 Plan the collection of the information in a timescale suitable for achieving the forecast future demand 4.3 Evaluate the information objectively and use it to identify a range of options 4.4 Calculate the budget for the options 4.5 Select and document the optimum solution in sufficient detail to meet the requirements of the customer 4.6 Obtain authority to proceed

Learning outcome
The learner will: 5. Produce a design for the provision of an external underground communications cabling infrastructure.
Assessment criteria
The learner can: 5.1 Identify and explain the constraints and limitations, including operational and environmental requirements, of a permanent underground communications infrastructure 5.2 Explain why it is important to confirm the currency and reliability of information 5.3 Translate specified communications requirements into realistic and practical designs 5.4 Explain where to find component supp information on new and emerging technologies 5.5 Identify legislation and regulations that governing the provision of an external underground communications cabling infrastructure

Learning outcome
The learner will: 6. Plan and produce a design for the provision of an external underground communications cabling infrastructure.
Assessment criteria
The learner can: 6.1 Carry out and document a detailed survey on the selected optimum route 6.2 Produce designs for an external underground cabling infrastructure based on the selected optimum route 6.3 Use design tools that are suitable for the purpose 6.4 Identify and document components for the communications systems 6.5 Specify the quantities of components taking into account: existing and already planned plant and services, present and predictable future requirements, design requirements

Unit 327 Design software

UAN:	**A/502/4574**
Level:	Level 3
Credit value:	5
GLH:	40
Aim:	This is the ability to use a software application designed to create, modify and layout artwork for display in print or on a screen (eg vector graphics for design and drawing; raster graphics for photo manipulation or illustration). On completion of this unit a learner should be able to select and use a wide range of advanced design software tools and techniques to complex and non-routine designs.

Learning outcome
The learner will: 1. Obtain, insert and combine information for designs.
Assessment criteria
The learner can: 1.1 Explain what designs are needed 1.2 Explain how the context affects the way designs should be prepared 1.3 Provide guidance on what and how any copyright or other constraints may apply to the use of own and others' designs 1.4 Obtain, insert and prepare designs 1.5 Explain how file format affects design quality, format and size and how to choose appropriate formats for saving designs 1.6 Use appropriate techniques to organise and combine information of different types or from different sources 1.7 Store and retrieve files effectively, in line with guidelines and conventions where available

Learning outcome
The learner will: 2. Use design software tools to create, manipulate and edit designs
Assessment criteria
The learner can: 2.1 Explain what technical factors affecting designs needs to be taken into account and how to do so 2.2 Select and use suitable tools and techniques efficiently to create designs 2.3 Use guidelines and dimensioning tools appropriately to enhance precision 2.4 Select and use appropriate tools and techniques to manipulate and edit designs 2.5 Check designs meet needs, using IT tools and making corrections as necessary 2.6 Identify and respond appropriately to quality problems to ensure that outcomes are fit for purpose and meet needs

Range
Design software tools and techniques will be defined as 'advanced' because: the software tools and functions used will be complex and at times require new learning, which will involve having the idea that there may be a tool or function to do something (eg improve efficiency or create an effect), exploring technical support, self-teaching and applying; the inputting, manipulating and outputting techniques will be multi-step and complex, and will involve research, identification and application; and the user will take full responsibility for inputting, structuring, editing and presenting the information. Examples of context: logo for a company or touching up and removing unwanted elements from a photograph.

Unit 328 Desktop publishing software

UAN:	**H/502/4567**
Level:	Entry 3
Credit value:	5
GLH:	40
Aim:	This is the ability to use desktop publishing software designed to combine and manipulate text, image and graphic elements in layouts appropriate for subsequent publication to screen or print. On completion of this unit a learner should be able to select and use a wide range of advanced desktop publishing software tools and techniques effectively to produce publications that are at times non-routine or unfamiliar.

Learning outcome
The learner will: 1. Select and use appropriate designs and page layouts for publications.
Assessment criteria
The learner can: 1.1 Explain what types of information are needed 1.2 Explain when and how to change page design and layout to increase effectiveness of a publication 1.3 Select, change, define, create and use appropriate page design and layout for publications in line with local guidelines, where relevant 1.4 Select and use appropriate media for the publication

Learning outcome
The learner will: 2. Input and combine text and other information within publications.
Assessment criteria
The learner can: 2.1 Find and input information into a publication so that it is ready for editing and formatting 2.2 Organise and combine information for publications in line with any copyright constraints, including importing information produced using other software 2.3 Provide guidance on how copyright constraints affect use of own and others' information 2.4 Explain which file format to use for saving designs and images 2.5 Store and retrieve publication files effectively, in line with local guidelines and conventions where available

Learning outcome
The learner will: 3. Use desktop publishing software techniques to edit and format publications.
Assessment criteria
The learner can: 3.1 Determine and discuss what styles, colours, font schemes, editing and formatting to use for the publication 3.2 Create styles, colours and font schemes to meet needs 3.3 Select and use appropriate techniques to edit publications and format text 3.4 Manipulate images and graphic elements accurately 3.5 Control text flow within single and multiple columns and pages 3.6 Check publications meet needs, using IT tools and making corrections as necessary 3.7 Identify and respond appropriately to quality problems with publications to ensure that outcomes are fit for purpose and meet needs

Range
Publication tools and techniques will be described as 'advanced' because: the software tools and functions used will be complex and at times require new learning, which will involve having the idea that there may be a tool or function to do something (eg improve efficiency or create an effect), exploring technical support, self-teaching and applying; the inputting, manipulating and outputting techniques will be complex, and will involve research, identification and application; and the user will take full responsibility for inputting, structuring, editing and presenting the information. Examples of context: Typical documents may include – an interactive or multi-media publication for the web; multi-page magazine.

Unit 329 Develop software using SQL

UAN:	**H/501/4007**
Level:	Level 3
Credit value:	9
GLH:	40
Aim:	The aim of this unit is to enable learners to develop the skills required to create queries, provide reports, manipulate data and document test results in a Relational Database Management System (RDMS).

Learning outcome
The learner will: 1. Know how to Query and display data from a single table.
Assessment criteria
The learner can: 1.1 Create a query 1.2 Limit the rows retrieved by a query 1.3 Sort the rows retrieved by a query in ascending or descending order and by single and/or multiple columns by use of the ORDER BY clause

Learning outcome
The learner will: 2. Query and display data from multiple tables.
Assessment criteria
The learner can: 2.1 Interpret an Entity Relationship Diagram (ERD) 2.2 Resolve ambiguous column names in a query by use of qualifiers 2.3 Retrieve data from multiple tables 2.4 Create a query using joins to retrieve records 2.5 Create a query using the GROUP BY clause to group data in one column and multiple columns 2.6 Create a query using built-in functions 2.7 Use nested built-in functions in a query 2.8 Limit the columns or rows retrieved by a query by use of the HAVING clause

2.9 Create a query containing a sub query

Learning outcome
The learner will: 3. Manipulate data in tables.
Assessment criteria
The learner can: 3.1 Use the INSERT statement to a. insert new rows to a table including -null values -special values -specific date values b. copy rows from another table 3.2 Use the UPDATE statement to update rows in a table and update rows based on another table 3.3 Use the DELETE statement to delete rows from a table and rows based on another table 3.4 Create and write scripts

Learning outcome
The learner will: 4. Create and manage tables, views and indexes.
Assessment criteria
The learner can: 4.1 Create a table and view 4.2 Alter a view definition 4.3 Drop a view and a table 4.4 Rename and truncate a table 4.5 Insert, update, retrieve and delete data using a view 4.6 Create and maintain constraints 4.7 Create and maintain an index

Learning outcome
The learner will: 5. Control user access.
Assessment criteria
The learner can: 5.1 Identify the commands used to control user access

Unit 330 Drawing and planning software

UAN:	**F/502/4611**
Level:	Level 3
Credit value:	4
GLH:	30
Aim:	This is the ability to use software designed for producing drawings or plans, such as flowcharts, mindmaps and technical drawings. On completion of this unit a learner should be able to select and use advanced tools and techniques to produce complex and non-routine drawings and plans.

Learning outcome
The learner will: 1. Input, organise and combine information for drawings or plans.
Assessment criteria
The learner can: 1.1 Identify what types of shapes and other elements will be needed 1.2 Evaluate templates and explain why and how they need to be changed to meet needs 1.3 Select, adapt, create and use the appropriate shapes to meet needs, including shapes imported from other sources 1.4 Select, adapt, define and create appropriate templates and styles to meet needs 1.5 Provide guidance on what copyright constraints apply to the use of own and others' shapes or other elements 1.6 Combine information for drawings or plans including exporting outcomes to other software 1.7 Store and retrieve drawing files effectively, in line with local guidelines and conventions where available

Learning outcome
The learner will: 2. Use tools and techniques to edit, manipulate, format and present drawings or plans.
Assessment criteria
The learner can: 2.1 Explain what drafting guides to use so that the shapes and other elements are appropriately prepared 2.2 Select and use appropriate software tools to manipulate and edit shapes and other elements with precision 2.3 Select and use appropriate software tools to format shapes and other elements, including applying styles and colour schemes 2.4 Check drawings or plans meet needs, using IT tools and making corrections as necessary 2.5 Identify and respond to quality problems with drawings or plans to make sure they are fit for purpose and meet needs 2.6 Explain what context the drawings and plans will be used in and how this will affect how they are presented 2.7 Select and use appropriate presentation methods and accepted page layouts

Range
drawing and planning software tools and techniques will be described as 'advanced' because: the software tools and functions used will be complex and at times require new learning, which will involve having the idea that there may be a tool or function to do something (eg improve efficiency or create an effect), exploring technical support, self-teaching and applying; the inputting, manipulating and outputting techniques will be complex, and will involve research, identification and application; and the user will take full responsibility for inputting, structuring, editing and presenting the information.

Unit 331 ICT Repair centre procedure

UAN:	**A/501/4000**
Level:	Level 3
Credit value:	8
GLH:	30
Aim:	This unit will enable the learner to assess and specify technical resource requirements of a range of typical repair centres.

Learning outcome
The learner will: 1. Describe legislative requirements for repair centre operations
Assessment criteria
The learner can: 1.1 Evaluate the current requirements of health and safety and environmental legislation as applicable to repair centre operations 1.2 Describe the regulatory requirements for data protection, confidentiality and software licensing

Learning outcome
The learner will: 2. Detail specific technical resource requirements for repair centre operations
Assessment criteria
The learner can: 2.1 Describe the specific technical and safety requirements 2.2 Locate and extract information on specific technical and safety requirements for repair centre operations 2.3 Identify resource requirements for a repair centre 2.4 Evaluate information gained and decide on its applicability to specific repair centre operations

Learning outcome
The learner will: 3. Develop a repair centre specification
Assessment criteria
The learner can: 3.1 Identify issues affecting the provision of technical resources 3.2 Identify sources to obtain information for equipment to be repaired including manufacturers' test and repair specifications for equipment, health and safety and environmental legislation 3.3 Produce a report outlining the risk factors, options to minimise them and recommendations as to the most appropriate options 3.4 Produce repair centre work instructions for using test equipment. 3.5 Describe the main steps to the development of specifications for repair centre operations 3.6 Outline methods for carrying out workplace risk assessments for planned new operations and recording findings

Learning outcome
The learner will: 4. Provide technical support to others
Assessment criteria
The learner can: 4.1 Produce local repair work instructions giving consideration to the major factors 4.2 Produce local work instructions for post repair testing

Unit 331 ICT Repair centre procedure

Supporting information

Guidance

N.B. It is not necessary for the assessment of this unit to be undertaken in a workshop. However, the centre is advised to make available a specific location (room/building) on which the learner can base the planning process.

Unit 332 Imaging software

UAN:	**R/502/4614**
Level:	Level 3
Credit value:	5
GLH:	40
Aim:	This is the ability to use a software application designed to create, modify and layout images for display in print or on a screen (eg vector graphics for design and drawing; raster graphics for photo manipulation or illustration). On completion of this unit a learner should be able to select and use a wide range of advanced imaging software tools and techniques to complex and non-routine designs.

Learning outcome
The learner will: 1. Obtain, insert and combine information for images
Assessment criteria
The learner can: 1.1 Explain what images are needed 1.2 Explain how the context affects the way images should be prepared 1.3 Provide guidance on what and how any copyright or other constraints may apply to the use of own and others' images 1.4 Obtain, insert and prepare images 1.5 Explain how file format affects image quality, format and size and how to choose appropriate formats for savings images 1.6 Use appropriate techniques to organise and combine information of different types or from different sources 1.7 Store and retrieve files effectively, in line with guidelines and conventions where available

Learning outcome
The learner will: 2. Use imaging software tools to create, manipulate and edit images
Assessment criteria
The learner can: 2.1 Explain what technical factors affecting images need to be taken into account and how to do so 2.2 Select and use suitable tools and techniques efficiently to create images 2.3 Use guide lines and dimensioning tools appropriately to enhance precision 2.4 Select and use appropriate tools and techniques to manipulate and edit images 2.5 Check images meet needs, using IT tools and making corrections as necessary 2.6 Identify and respond appropriately to quality problems to ensure that images are fit for purpose and meet needs

Guidance
Imaging software tools and techniques will be defined as 'advanced' because: the software tools and functions used will be complex and at times require new learning, which will involve having the idea that there may be a tool or function to do something (eg improve efficiency or create an effect), exploring technical support, self-teaching and applying; the inputting, manipulating and outputting techniques will be multi-step and complex, and will involve research, identification and application; and the user will take full responsibility for inputting, structuring, editing and presenting the information. Examples of context: logo for a company or touching up and removing unwanted elements from a photograph.

Unit 333 Implementing an ICT systems security policy

UAN:	**T/602/2557**
Level:	Level 3
Credit value:	10
GLH:	60
Aim:	This unit will provide the learner with the basic knowledge and principles to implement a security policy on data networks and computer systems. Learners will be able to understand the practical steps a network/system administrator can take to mitigate the threats to the network and the consequent effects of any attacks. Additionally learners will be able to understand the business implications of network and system downtime as a result of attacks on computer systems.

Learning outcome
The learner will: 1. Be able to analyse and identify ICT system security issues
Assessment criteria
The learner can: 1.1 Interpret building, network and system plans and diagrams 1.2 Identify vulnerable areas within an ICT system and the different types of security risks in these areas 1.3 Suggest the financial impact to the organisation due to ICT system downtime as a result of security issues 1.4 Collate and record the data from the analysis and assessment. 1.5 Make suggestions for a security policy based upon the conclusions reached

Learning outcome
The learner will: 2. Be able to Implement security on email and instant messaging systems
Assessment criteria
The learner can: 2.1 Analyse a given network/ICT system in relation to email and messaging privacy and security requirements 2.2 Research current types of potential risk 2.3 Research major cost implications of implementing security solutions 2.4 Select and justify the choice of email and messaging security solution with respect to functionality, business requirements and budget availability 2.5 Identify the issues and considerations surrounding email and messaging privacy with respect to current laws concerning privacy and data protection 2.6 Implement basic security protection on an ICT system 2.7 Make recommendations for an organisation wide policy with relation to email and messaging systems and document it.

Learning outcome
The learner will: 3. Be able to Implement and maintain internet and network security
Assessment criteria
The learner can: 3.1 Interpret diagrams and summaries of installed networking equipment in an organisation 3.2 Identify potential security threats and risks in network topologies and diagrams 3.3 Identify security risks associated with different networking media technologies 3.4 Identify, install and configure hardware and software solutions to protect the network and client devices from attack 3.5 Take appropriate action to remove unwanted networking protocols on the ICT network 3.6 Select appropriate solutions and technologies to back up important data as part of disaster recovery strategies

Learning outcome
The learner will: 4. Be able to maintain data integrity and system security
Assessment criteria
The learner can: 4.1 Make appropriate recommendations for hardware and software to implement secure access to an organisation's networks 4.2 Make recommendations to implement an organisation wide password policy 4.3 Configure basic networking protocols in a secure manner on a range of different connections to an internet service provider (ISP) or other remote network

Unit 334 Install, configure and upgrade ICT software

UAN:	**L/501/3997**
Level:	Level 3
Credit value:	7
GLH:	30
Aim:	This unit will enable the learner to install, configure and upgrade networked and stand-alone operating systems, and/or applications software.

Learning outcome
The learner will: 1. Prepare for the installation of software
Assessment criteria
The learner can: 1.1 Assemble information and prepare plans for software installation including listing the items which need to be backed-up and the reasons for each 1.2 Determine the specification and configuration of one or more systems using different methods 1.3 Check that resources required for installation are available and that they are suitable including confirming that the system meets the requirements of the new software backing up system and scanning for viruses and spyware recording the existing system specification 1.4 Describe the type of action which should be included in a software installation plan 1.5 Describe sources of installation media or files 1.6 Explain the importance of protecting existing software and data 1.7 Outline regulations relating to software licensing and installation 1.8 Describe the items commonly found in a manufacturer's minimum system requirement 1.9 Describe incompatibilities that can exist between software and systems (hardware and operating system)

Learning outcome
The learner will: 2. Install and configure a range of system and application software
Assessment criteria
The learner can: 2.1 Install system and application software from a range of media to specified destinations using different installation options 2.2 Install different types of system and application software 2.3 Upgrade existing system and application software 2.4 Maintain registration documentation and/or installation records 2.5 Perform an automated deployment of a software application.

Learning outcome
The learner will: 3. Be able to check the system operates as planned during and after installation of system and application software
Assessment criteria
The learner can: 3.1 Monitor the installation of software identifying any problems and errors and taking action to resolve them 3.2 Check that the installed system and application software operates as expected on completion of installation 3.3 Check the entire system operates as expected after system and application software installation 3.4 Record problems/errors encountered and actions taken.

Learning outcome
The learner will: 4. Resolve unwanted changes to the system caused by installation and configuration of system and application software
Assessment criteria
The learner can: 4.1 Identify actions to correct unwanted changes to system operation and performance 4.2 Make changes, as identified, to the software installation and configuration 4.3 Check that the changes have improved system operation and performance 4.4 Record any unwanted changes, recommendations, actions taken and results.

Unit 335 IT consulting skills

UAN:	**Y/502/1116**
Level:	Level 3
Credit value:	8
GLH:	60
Aim:	The aim of this unit is to enable learners to identify the key characteristics, techniques and methods associated with successful consulting skills. To practice those skills whilst engaging with internal or external clients in all stages of the consulting cycle to bring about change in an organisation.

Learning outcome
The learner will: 1. Understand the role that the consultant plays in helping to bring about technology driven organisational change
Assessment criteria
The learner can: 1.1 Identify the process by which change projects are initiated, managed and delivered in an organisation 1.2 Identify how key business functions in an organisation determine IT needs 1.3 Select ways in which key business functions interact with IT providers to deliver the required services. 1.4 Identify the types of behaviours influencing, rapport building, facilitating requirements definition 1.5 Select and use the most appropriate communication style in a given situation 1.6 Select appropriate techniques to meet the differing needs of various user groups

Learning outcome
The learner will: 2. Structure a client assignment and specify the key management deliverables involved
Assessment criteria
The learner can: 2.1 Use a consulting cycle to structure a client assignment to deliver an IT system 2.2 Produce and agree a statement of work for the assignment – business outcomes, products to be delivered 2.3 Construct an outline plan of work for the assignment 2.4 Negotiate, agree and document quality acceptance criteria for the conduct of the assignment 2.5 Identify key stakeholders and actions to engage them

Learning outcome
The learner will: 3. Capture, document and present back the functional requirements of business users
Assessment criteria
The learner can: 3.1 Construct a set of outcome focused objectives for a given IT system 3.2 Draw a process flow diagram for a business problem 3.3 Present a process flow diagram to an audience 3.4 Capture key performance metrics that must be achieved by the new business process 3.5 Define a set of user acceptance criteria for the products and services to be delivered

Learning outcome
The learner will: 4. Agree and document the manner in which the success of an assignment will be judged
Assessment criteria
The learner can: 4.1 Construct a set of acceptance criteria for an assignment 4.2 Select quality procedures appropriate for the type of work to be conducted 4.3 Identify the costs and the benefits associated with a given scenario 4.4 Construct a business case for the new IT system 4.5 Build a benefits realisation plan for the deployment of a new IT system

Learning outcome
The learner will: 5. Use standard techniques to plan and control the work involved in producing the products associated with a consulting assignment
Assessment criteria
The learner can: 5.1 Construct a product breakdown structure for an assignment 5.2 Decompose a product breakdown structure to produce a list of tasks that must be performed 5.3 Identify the critical dependencies between tasks 5.4 Formulate a schedule of work from a list of tasks and an understanding of the dependencies between those tasks 5.5 Prioritise work to achieve agreed delivery schedules

Learning outcome
The learner will: 6. Manage the client during an assignment and develop an appreciation of the challenges faced when dealing with difficult clients
Assessment criteria
The learner can: 6.1 Communicate concisely the proposed method of achieving the required business solution 6.2 Negotiate with the client the phasing of deliverables to enable the early achievement of business benefit 6.3 Agree the nature, frequency and content of progress reporting to build client confidence and reduce potential risk and exposure 6.4 Agree the tolerances within which the consultant can operate without need for escalation to higher decision making 6.5 Apply appropriate questioning techniques at different stages of the assignment to elicit information whilst building rapport 6.6 Match communication style to the purpose at hand when communicating

Unit 338 Maintain ICT equipment and systems 3

UAN:	**R/501/4004**
Level:	3
Credit value:	12
GLH:	60
Aim:	This unit develops learners' knowledge of utilising hardware and software to maintain systems. Upon completion of this unit, learners will have developed an understanding of processes involved in maintaining systems.

Learning outcome
The learner will: 1. Identify types of system maintenance
Assessment criteria
The learner can: 1.1 Prepare a system maintenance plan for peer to peer and client server 1.2 Identify types of system maintenance 1.3 Describe the properties of different types of maintenance 1.4 Describe the key activities in each type of maintenance and their benefits 1.5 Describe types of remote maintenance 1.6 Describe the importance of negotiating system priorities and availability with customers.

Learning outcome
The learner will: 2. Collect information on technical problems with ICT systems
Assessment criteria
The learner can: 2.1 Obtain information to resolve technical problems with ICT systems 2.2 Select and justify the test to be undertaken for a given problem, ensuring the tests are applied correctly 2.3 Create and maintain operational records 2.4 Describe the information needed to resolve technical problems with ICT systems

2.5	Identify the most common types of technical problems that could occur in ICT systems
2.6	Identify the most common routine maintenance procedures

Learning outcome
The learner will: 3. Evaluate technical problems and implement solutions
Assessment criteria
The learner can: 3.1 Apply preventative maintenance using the recommended procedures, materials and parts 3.2 Maintain different types of hardware 3.3 Maintain function of hardware by applying software fixes 3.4 Check the equipment to confirm that the preventative maintenance procedures have been carried out successfully 3.5 Produce a report of problems encountered while carrying out preventative maintenance 3.6 Maintain preventative maintenance records.

Unit 339 Multimedia software

UAN:	**H/502/4617**
Level:	Level 3
Credit value:	6
GLH:	45
Aim:	On completion of this unit the learner will have the ability to use multimedia software designed to combine, manipulate and animate a variety of objects and data types in layouts appropriate for subsequent production to screen. In general, multimedia includes a combination of text, audio, still images, animation, video, and interactive content. They will be able to select and use a wide range of advanced multimedia tools and techniques effectively to produce publications that are at times non-routine or unfamiliar.

Learning outcome
The learner will: 1. Plan the content and organisation of multimedia products to meet needs
Assessment criteria
The learner can: 1.1 Select and use appropriate techniques to plan and communicate the content, design and layout of multimedia outcomes 1.2 Plan the use of interactive features, transitions and effects to meet needs 1.3 Explain the type of multimedia outcome needed and the specification that it must meet 1.4 Develop the design layout for multimedia outcomes 1.5 Explain how the different elements of the content will relate and what elements of the content will be interactive 1.6 Summarise how copyright and other constraints affect use of own and others' information

Learning outcome
The learner will: 2. Obtain, input and combine content to build multimedia outcomes
Assessment criteria
The learner can: 2.1 Select and use an appropriate combination of input device, software and input techniques to obtain and input the relevant content 2.2 Combine information of different types or from different sources for multimedia outcomes 2.3 Select and use appropriate software to write and compress multimedia files 2.4 Store and retrieve multimedia files effectively, in line with local guidelines and conventions where available 2.5 Explain when and why to use different file formats and file compression for saving multimedia files

Learning outcome
The learner will: 3. Use tools and techniques to build and edit multimedia content
Assessment criteria
The learner can: 3.1 Select and use appropriate techniques to edit and format multimedia outcomes 3.2 Manipulate images and graphic elements accurately 3.3 Check multimedia outcomes meet needs, using IT tools and making corrections as necessary 3.4 Identify and respond appropriately to quality problems to ensure that outcomes are fit for purpose and meet needs

Guidance
Publication tools and techniques will be described as 'advanced' because: the software tools and functions used will be complex and at times require new learning, which will involve having the idea that there may be a tool or function to do something (eg improve efficiency or create an effect), exploring technical support, self-teaching and applying; the inputting, manipulating and outputting techniques will be complex, and will involve research, identification and application; and the user will take full responsibility for inputting, structuring, editing and presenting the information.

Learning outcome
The learner will: 4. Play and present multimedia outcomes
Assessment criteria
The learner can: 4.1 Explain what combination of display device and software to use that will overcome any constraints there may be in displaying different multimedia file formats 4.2 Select and use appropriate software to optimise the display of multimedia outcomes and maximise impact 4.3 Select and adjust the display settings to exploit the features of the display device and optimise the quality of the presentation

Unit 345 Principles of ICT system and data security

UAN:	**R/601/3509**
Level:	Level 3
Credit value:	9
GLH:	75
Aim:	This unit develops an understanding of the types of threat to ICT systems and data and methods of protecting against them. It also covers an understanding of the applications of cryptography to ICT systems and data.

Learning outcome
The learner will: 1. Understand the common types of threat to ICT systems and data
Assessment criteria
The learner can: 1.1 Describe common types of physical threats to ICT systems and data (hardware damage, loss and theft) 1.2 Describe common types of electronic threats to ICT systems and data (e.g. denial of service, data theft or damage, unauthorised use) 1.3 Explain the security vulnerabilities associated with remote access technologies (including wireless)

Learning outcome
The learner will: 2. Understand how to protect ICT systems
Assessment criteria
The learner can: 2.1 Describe methods of providing physical access control and security for ICT systems (locks, biometric controls, CCTV, shielding, fire detection and control) 2.2 Describe methods of providing electronic access control and security for ICT systems (firewalls, virtual networks, secure connection/transfer protocols, secure wireless connection) 2.3 Differentiate the following Access Control methods: Mandatory Discretionary Role Based 2.4 Describe the operation of common types of malicious code: Virus Trojan Logic Bomb Worm Spyware 2.5 Describe the characteristics of strong passwords and methods of attacking password-protected systems

Learning outcome
The learner will: 3. Understand the applications of cryptography to ICT systems and data
Assessment criteria
The learner can: 3.1 Describe cryptographic algorithms: Hashing Symmetric Asymmetric 3.2 Describe how cryptography can be applied to ICT system and data security in terms of: Confidentiality Integrity Authentication Non-repudiation Access Control 3.3 Explain the operation of Public Key Infrastructure (PKI) 3.4 Explain the concepts of the Key Management and Certificate lifecycles

Unit 346 Principles of planning telecommunications services

UAN:	**L/501/4003**
Level:	Level 3
Credit value:	10
GLH:	65
Aim:	This unit will provide the learner with the basic principles needed to plan a telecommunications service. Learners will be able to develop an understanding of how telecommunications services are specified, planned and provided.

Learning outcome
The learner will: 1. Prepare for and carry out a site survey for the provision of telecoms services
Assessment criteria
The learner can: 1.1 Identify the areas and systems and equipment required to be surveyed from the planning request including equipment accommodation areas, existing and planned systems and equipment, cable routings, power and environmental services, building structure 1.2 Identify the full range of data required from the survey 1.3 Obtain plans and records of the areas to be surveyed and interpret them 1.4 Collect and record the data required from the survey 1.5 Record details that may affect the planning options.

Learning outcome
The learner will: 2. Identify a range of options for the provision of telecoms services and select the optimum solution
Assessment criteria
The learner can: 2.1 Gather sufficient information to be able to identify future demands for existing telecoms services and proposed new telecoms services 2.2 Plan the collection of the information in a timescale suitable for achieving the forecast future demand 2.3 Evaluate the information objectively, and use it to identify a range of options that • are sufficiently detailed to enable an objective comparison to be made • comply with relevant legislation, regulations and organisational obligations • consider the availability of existing systems, support services and accommodation •take account of longer-term requirements 2.4 Calculate the broad costs of the options including cost of equipment and materials, installation costs, running and maintenance costs 2.5 Select and document the optimum solution in sufficient detail to meet the requirements of the customer 2.6 Obtain authority to proceed 2.7 Process the selected option to meet agreed timescale for the delivery of the requirements.

Learning outcome
The learner will: 3. Produce designs for the provision of telecoms services
Assessment criteria
The learner can: 3.1 Produce designs for telecoms systems 3.2 Produce designs that • are based on information that is sufficient, valid, current and reliable • take account of present and future requirements • contain sufficient detail for components to be identified and quantified • optimise resources • are practicable, and will deliver the specified telecoms services 3.3 Use design tools that are suitable for the purpose 3.4 Identify components for the telecoms systems that • are approved • take account of relevant environmental constraints • optimise costs • take account of availability and required timescales 3.5 Specify the quantities of component taking into account • existing and already planned plant and services • present and predictable future requirements • design requirements 3.6 Specify locations that • optimise resources, and take account of present and predictable future requirements • comply with health and safety and other relevant legislation, and regulations • minimise interference, degradation or disruption to other services and activities • satisfy operational and environmental requirements and constraints • take account of other relevant existing and planned plant and services 3.7 Identify, evaluate and record actual and potential hazards or hazardous substances which may be encountered at the proposed locations 3.8 Document the selected option in sufficient details and obtain relevant authority to proceed.

Learning outcome
The learner will: 4. Produce detailed plans for telecoms services
Assessment criteria
The learner can: 4.1 Produce plans that specify works activities that • comply with relevant legislation, regulations, and safe working practices • optimise the use of resources • deliver the telecoms services • maintain existing services while work is carried out • control risks that have been identified • identify procedures and instructions to be followed 4.2 Produce plans that • accurately identify equipment locations • identify the systems, equipment and materials to be provided • identify the risks that may be encountered during work activities • provide sufficient information to be able to carry out the work • identify the manpower required to carry out the work • ensure the resources are available to meet the required timescales 4.3 Prepare costings that • are based on accurate current information • are within budget • allow for contingencies • are recorded clearly and accurately in an approved format 4.4 Calculate the costs of resources including • systems, equipment and materials • accommodation and support services • manpower • sub-contract work • the hire of specialist equipment.

Learning outcome
The learner will: 5. Co-ordinate the provision of telecoms services
Assessment criteria
The learner can: 5.1 Identify the work activities to be scheduled and agree the resources available to undertake the work 5.2 Obtain details of the work activities to enable the development of a realistic works programme 5.3 Schedule the works packages taking into account: • their required timescale • the availability of resources • the inter-dependency of work activities 5.4 Review the works programme at regular intervals to ensure all target dates are being met and revise where necessary 5.5 Allocate work so that it will: •enable the effective and efficient use of resources •take account of team and individual competencies 5.6 Maintain a level of resources at the work sites consistent with meeting the required timescales 5.7 Collect information on work progress at regular intervals for analysis to confirm the targets are being met 5.8 Report details of work completed promptly and accurately to the appropriate people

Unit 347 Requirements analysis and systems specifications

UAN:	**D/501/4006**
Level:	Level 3
Credit value:	16
GLH:	65
Aim:	The aim of this unit is to provide learners with an advanced understanding of some of the important elements involved in systems design, especially the idea of following a Systems Development Life Cycle (SDLC). It also allows them to follow a prescribed methodology such as Yourdon or SSADM, it also allows them to competently and professionally work with a scenario to identify the best possible IT solution to meet their needs. Learners will develop a more in depth understanding of advanced systems investigation, Analysis and design; this will also enable them to work in a supervisory role performing advanced tasks with high degree of competence, using problem solving skills and giving direction to others.

Learning outcome
The learner will: 1. Plan for the identification of customer requirements
Assessment criteria
The learner can: 1.1 Interpret project briefs to identify the scope and objectives of investigations and analyses 1.2 Select investigative methods to extract the information to identify customer requirements 1.3 Produce a plan for carrying out investigations and analyses using most appropriate tools

Learning outcome
The learner will: 2. Establish customer requirements
Assessment criteria
The learner can: 2.1 Carry out investigations to meet agreed plans 2.2 Use investigative methods to obtain information on system inputs, outputs, processes, user interfaces and frequency 2.3 Interpret and draw document analysis grids 2.4 Identify constraints 2.5 Obtain approval/sign off

Learning outcome
The learner will: 3. Produce logical and physical design specifications
Assessment criteria
The learner can: 3.1 Carry out analyses to meet agreed plans 3.2 Identify logical functional and data requirements 3.3 Create a data dictionary 3.4 Select and produce suitable diagrammatical representations for modelling 3.5 Create and extract information from decision tables/trees 3.6 Specify capacity requirements 3.7 Check for defects in the requirements definition 3.8 Produce hardware and software specifications 3.9 Produce specifications for input and output data and security requirements 3.10 Obtain approval/sign off

Learning outcome
The learner will: 4. Identify implementation and maintenance procedures
Assessment criteria
The learner can: 4.1 Describe the main stages of system implementation: 4.2 Describe the purpose and methods of testing new systems 4.3 Describe training methods and techniques 4.4 Describe methods used to convert manual files and the main problems associated with file conversion 4.5 Describe the typical documentation provided on completion of implementation: 4.6 Explain the purpose of version control procedures when developing, amending and maintaining software and documentation

4.7	State that maintenance is the process of responding to a user request for change plus correction of errors.

Unit 348 Software design fundamentals

UAN:	**L/601/3251**
Level:	Level 3
Credit value:	10
GLH:	80
Aim:	This unit covers the principles of software design and the application of the techniques used in software design to represent software solutions.

Learning outcome	
The learner will:	
1. Understand the principles of software design	
Assessment criteria	
The learner can:	
1.1	Describe the role of software design and computer programming in the IT Systems Development Life Cycle (SDLC)
1.2	Describe the application and limits of programming paradigms procedural, object oriented and event-driven and the available supporting tools and environments (e.g. CASE tools, IDEs)
1.3	Explain sequence, selection and iteration as used in computer programming
1.4	Explain abstraction of data and code and the use of predefined data and code in computer programming
1.5	Explain the importance of the readability and understandability of code and how these can be improved by naming, comments and layout.
1.6	Describe how the following factors contribute to the quality of code: efficiency, reliability, robustness, usability, portability and maintainability

Learning outcome
The learner will: 2. Apply the techniques of software design
Assessment criteria
The learner can: 2.1 Develop algorithms to represent problems 2.2 Identify and define data and file storage requirements including predefined data items 2.3 Identify and define program structures including predefined code items 2.4 Identify and represent required inputs and outputs. 2.5 Use tools (e.g. pseudocode) to express software designs

Unit 349 Spreadsheet software

UAN:	**J/502/4626**
Level:	Level 3
Credit value:	6
GLH:	45
Aim:	This is the ability to use a software application designed to record data in rows and columns, perform calculations with numerical data and present information using charts and graphs. On completion of this unit a learner should be able to select and use a wide range of advanced spreadsheet software tools and techniques to produce, present and check complex and non-routine spreadsheets.

Learning outcome
The learner will: 1. Use a spreadsheet to enter, edit and organise numerical and other data
Assessment criteria
The learner can: 1.1 Identify what numerical and other information is needed in the spreadsheet and how it should be structured 1.2 Enter and edit numerical and other data accurately 1.3 Combine and link data from different sources 1.4 Store and retrieve spreadsheet files effectively, in line with local guidelines and conventions where available

Learning outcome
The learner will: 2. Select and use appropriate formulas and data analysis tools and techniques to meet requirements
Assessment criteria
The learner can: 2.1 Explain what methods can be used to summarise, analyse and interpret spreadsheet data and when to use them 2.2 Select and use a wide range of appropriate functions and formulas to meet calculation requirements 2.3 Select and use a range of tools and techniques to analyse and interpret data to meet requirements 2.4 Select and use forecasting tools and techniques

Range
Spreadsheet software tools and techniques will be defined as 'advanced' because: the range of data entry, manipulation and outputting techniques will be complex and non-routine; the tools, formulas and functions needed to analyse and interpret the required information require complex and non-routine knowledge and understanding (for example, data restrictions, data validation using formula, pivot tables, data maps); and the user will take full responsibility for setting up and developing the functionality of the spreadsheet. Examples of context: Typical examples may include - cost benefit analysis, analysis of results from a questionnaire or survey, developing summary reports from a large data set, creating a personalised customer quotation from a standard price list.

Learning outcome
The learner will: 3. Use tools and techniques to present, and format and publish spreadsheet information
Assessment criteria
The learner can: 3.1 Explain how to present and format spreadsheet information effectively to meet needs 3.2 Select and use appropriate tools and techniques to format spreadsheet cells, rows, columns and worksheets effectively 3.3 Select and use appropriate tools and techniques to generate, develop and format charts and graphs 3.4 Select and use appropriate page layout to present, print and publish spreadsheet information 3.5 Explain how to find and sort out any errors in formulas 3.6 Check spreadsheet information meets needs, using IT tools and making corrections as necessary 3.7 Use auditing tools to identify and respond appropriately to any problems with spreadsheets

Unit 350 Systems architecture

UAN:	**T/601/3504**
Level:	Level 3
Credit value:	10
GLH:	80
Aim:	This unit covers how information is represented and processed in a computer, communication processes in networks and distributed systems and distributed applications and transaction processing. It also involves knowledge and use of an operating environment.

Learning outcome
The learner will: 1. Understand the representation of information within a computer and the way it is processed
Assessment criteria
The learner can: 1.1 Describe how number systems and data representation are used to store information in a computer 1.2 Describe the role of input, output and storage devices 1.3 Describe the characteristics of C.P.U. components and the operation of the Fetch Execute Cycle 1.4 Describe the operation of a peripheral device using correct technical terminology

Learning outcome
The learner will: 2. Make effective use of the operating environment of current computer systems
Assessment criteria
The learner can: 2.1 Use and configure operating system interfaces and functions 2.2 Explain the role of process management and concurrent processes in computer operating systems 2.3 Describe how operating system features can contribute to data and system security

Learning outcome
The learner will: 3. Know the communication process in distributed operating systems and computer networks
Assessment criteria
The learner can: 3.1 Outline the function and operation of distributed operating systems 3.2 Outline the functions of data communications systems in enabling network and distributed systems

Learning outcome
The learner will: 4. Know distributed applications and transaction processing in mainframe systems
Assessment criteria
The learner can: 4.1 Outline the operation and functions of mainframe systems 4.2 Outline the evolution of and characteristics of distributed applications 4.3 Outline data and process distribution

Unit 351 Telecommunications principles

UAN:	**D/601/3254**
Level:	Level 3
Credit value:	10
GLH:	80
Aim:	The aim of this unit is to cover the principles of telecommunications including AC circuits, line impairments and transmissions.

Learning outcome
The learner will: 1. Understand the principals of alternating current (AC) circuits
Assessment criteria
The learner can: 1.1 Explain reactance in circuits impedance in terms of resistive and reactive components 1.2 Describe the characteristics of series and parallel resonant circuits 1.3 Calculate the resonant frequency of a circuit

Learning outcome
The learner will: 2. Understand the effects of line impairments on a transmitted signal
Assessment criteria
The learner can: 2.1 Explain; decibel (dB) as a unit of loss dBm as a unit of power 2.2 Define signal-to-noise ratio as applied to transmission lines 2.3 Calculate using dBs and dBms the total loss of a system from individual losses total loss of a system from input and output signal levels output signal level from total loss and input signal level signal-to-noise ratio

Learning outcome
The learner will: 3. Apply the characteristics of transmission lines
Assessment criteria
The learner can: 3.1 Explain the effect of the primary line constants R, G, L & C on the characteristic impedance of transmission lines 3.2 Define the concept of angular frequency as applied to transmission lines 3.3 Calculate, using the primary line constants, the characteristic impedance of: finite and infinite line lengths a parallel pair of wires co-axial cable 3.4 Produce an equivalent circuit model of a transmission line in terms of resistance, capacitance and inductance 3.5 Calculate the bandwidth of a transmission line in terms of frequency between half power points

Learning outcome
The learner will: 4. Understand the transmission of digital signals over transmission media
Assessment criteria
The learner can: 4.1 Demonstrate the following representations of binary information and explain the advantages of each type non-return to zero (NRZ) digital encoding from given values return to zero (RTZ) digital encoding from given values bi-phase digital encoding (Manchester) from given values bi-phase digital encoding (Differential Manchester) from given values 4.2 Explain the concepts of bit rate and bit error rate (BER) 4.3 Explain digital signal impairments in terms of delay jitter binary errors 4.4 Demonstrate the effects of delay, limited bandwidth and jitter on the extraction of binary information from a digital signal

Learning outcome
The learner will: 5. Understand the process of modulating an analogue carrier frequency using digital signals
Assessment criteria
The learner can: 5.1 Explain the following methods of digital modulation using analogue frequency carriers: amplitude shift keying (ASK & OOK) frequency shift keying (FSK) phase shift keying (PSK) bi-polar shift keying (BPSK) quadra-phase shift keying (QPSK) quadrature amplitude shift keying (QAM) 5.2 Describe the purpose of, and produce constellation diagrams 5.3 Calculate the practical channel capacity using: Shannon-Hartley formula ?log2(S/N+1) Shannon formula 2?log2(n) 5.4 Explain the need for filters and their effect on digitally modulated signals 5.5 Calculate the Baud rate of a given link states using given values

Learning outcome
The learner will: 6. Be able to apply the process of multiplexing digital and analogue signals over transmission media
Assessment criteria
The learner can: 6.1 Explain the following type of multiplexing: frequency division synchronous time division asynchronous time division digital time division code division Wavelength (coarse and dense) division

Unit 352 Testing ICT systems

UAN:	**R/501/3998**
Level:	Level 3
Credit value:	11
GLH:	60
Aim:	This unit will enable the learner to plan, select and implement IT system tests. By the end of the unit, learners will be able to devise standard testing procedures for stand-alone and networked systems using existing test hardware and software; they will also be able to select and apply test procedures for particular situations, compare the results with benchmarks and make recommendations for further action.

Learning outcome
The learner will: 1. Plan and produce standard testing procedures
Assessment criteria
The learner can: 1.1 Use manufacturer's test and product information (supplied by trainer and/or downloaded from the Internet) to devise test plans for systems and equipment 1.2 Determine acceptable tolerances for test results to indicate serviceable and faulty components in systems 1.3 Produce a standard test plan to include, expected results and conclusions, fault diagnosis guidance. 1.4 Describe the benefits of effective standard testing procedures, eg effects on labour costs, materials costs, system down time, reliability 1.5 Describe the main features of a testing plan 1.6 Explain the importance of discussing the testing plan with the customer

Learning outcome
The learner will: 2. Select tests and determine expected results
Assessment criteria
The learner can: 2.1 Identify and record details of system hardware and software configuration settings eg 2.2 Clarify the nature of any known problems by discussion with the user 2.3 Identify a test plan (supplied by trainer) that will enable a diagnosis to be made. 2.4 Describe methods and procedures for identifying system hardware, software and configuration settings 2.5 Identify common sources of information for system hardware and software 2.6 State the main characteristics of typical system hardware and software

Learning outcome
The learner will: 3. Identify and manage consequences of testing
Assessment criteria
The learner can: 3.1 Identify tests which may affect system data, software and configuration by consulting 3.2 Backup and restore system software 3.3 Record and reinstate system configuration and hardware settings 3.4 Record and reinstate user settings and customisations 3.5 Identify tests with possible adverse consequences 3.6 Describe the effects of tests with possible adverse consequences 3.7 Describe typical actions to be taken to avoid adverse consequences of tests

Learning outcome
The learner will: 4. Apply tests and analyse results
Assessment criteria
The learner can: 4.1 Use diagnostic and testing software including vendor supplied, third party and operating system utilities 4.2 Use functions of anti-virus and anti-spyware utilities 4.3 Use test equipment, hardware and accessories 4.4 Implement tests 4.5 Compare actual test results with expected results 4.6 Draw conclusions from test results and disseminate information 4.7 Describe the purpose and function of commonly available testing hardware and software 4.8 Describe when and where to use different types of diagnostic hardware and software 4.9 Describe how to draw conclusions from actual and expected test results, based on a comprehensive knowledge of system characteristics and performance.

Unit 352 Testing ICT systems

Supporting information

Evidence requirements

N.B. The centre will be required to provide the learner with documentation specific to the system being used for training, in order that the learner can make realistic decisions to include in the software installation plans (see outcomes 1.and 2.3).

Unit 353 The technologies of the Internet

UAN:	**R/502/1115**
Level:	Level 3
Credit value:	6
GLH:	60
Aim:	The aim of this unit is to enable learners to understand the principles and the technologies that allow the Internet to function and how different types of communications take place. The learner will also learn about securing communications and will develop the skills required to understand how to create, support and maintain the environment that enables the Internet in Windows systems.

Learning outcome
The learner will: 1. Be able to explain the concepts behind the Internet, its history and purpose
Assessment criteria
The learner can: 1.1 Use an RFC search engine 1.2 Interpret internet related Requests for Comments 1.3 Search the world wide web (www) using different types of search engine 1.4 Search the Internet using specialist search engines for locating: news archives, FTP servers, media files, usenet 1.5 Optimise an internet search

Learning outcome
The learner will: 2. Know the technologies that allow communication across the Internet
Assessment criteria
The learner can: 2.1 Use Tranmission Control Protocol/Internet Protocol (TCP/IP) diagnostic utilities 2.2 Run a command prompt 2.3 Use the IPCONFIG diagnostic tool 2.4 Use the /all switch of IPCONFIG to find out additional network information 2.5 Use the network utility PING 2.6 Look at a routing table and understand the results 2.7 Analyse the results of using the TRACERT utility with IP results to route to another address 2.8 Use TRACERT to test a route to one of the global name servers 2.9 Compare the results of TRACERT tests and understand the significance of the information 2.10 Install a graphical application for displaying route information 2.11 Use the command prompt 2.12 Analyse the setup of a DNS client 2.13 Set a DNS connection to a domain name server 2.14 Analyse the results of using the TRACERT utility with domain name results to route to another address 2.15 Use the NSLOOKUP utility to obtain information from IP addresses and domain names 2.16 Use the NSLOOKUP utility to do a reverse lookup 2.17 Evaluate some web-based services providing 'whois' lookups 2.18 Evaluate a web-based facility for investigating download times 2.19 Formulate solutions for connectivity strategies in different scenarios taking into account

Learning outcome
The learner will: 3. Be able to explain the technologies behind the World Wide Web and how to make information available
Assessment criteria
The learner can: 3.1 Use a text editor to create an HTML page 3.2 Save a file in the root folder structure of a web server 3.3 Use a web browser to access a HTML page with a HTTP connection 3.4 Start a non-graphical browser 3.5 Simulate the interactions between a browser and server using a non graphical browser 3.6 Create a connection to the web server using the correct port 3.7 Request a non graphical browser page from the web server using Telnet 3.8 Analyse the header response from the web server 3.9 Analyse the response data from the web server 3.10 Request a different type of resource from the web server 3.11 Compare the settings of different browsers 3.12 Analyse the results of changing browser settings 3.13 Show the effects of adding plug-ins to a browser 3.14 Evaluate the issues relating to non-desktop browsing environments 3.15 Use an HTML editor

Learning outcome
The learner will: 4. Understand the additional services available on the Internet, their function and use
Assessment criteria
The learner can: 4.1 Identify and locate a relevant news server 4.2 Install and use a newsreader application 4.3 Configure the newsreader application to attach to a news server 4.4 Specify the requirements for the creation of a news server account 4.5 Modify account information and attach to a public news server 4.6 Extract newsgroup messages 4.7 Use a newsgroup reading facility with a web front end 4.8 Locate public file repositories 4.9 Use the browser to download a file with FTP 4.10 Explore different options for finding FTP servers 4.11 Install and use a graphical FTP application 4.12 Select different predefined FTP servers and analyse their files 4.13 Use Telnet to connect to a mail server using 4.14 Simple Mail Transfer Protocol (SMTP) 4.15 Create an email message by manually typing the required SMTP commands and send the message 4.16 Use Telnet to connect to a mail server using Post Office Protocol (POP) 4.17 Issue the commands necessary to retrieve an email message from a specified account 4.18 Identify different web-based email applications 4.19 Analyse the results of an auto responder by sending an email to an automated system

Learning outcome
The learner will: 5. Understand the security implications of making information available on the Internet
Assessment criteria
The learner can: 5.1 Install and configure a software Firewall application 5.2 Analyse the responses to application requests 5.3 Make decisions concerning the acceptability of application requests 5.4 Appraise the applications' response to different types of internet communications 5.5 Issue ICMP requests and demonstrate how to block relevant packets 5.6 Create a trust relationship

5.7 Produce a diagram showing the structure of a secure communication

Unit 354 Using email

UAN:	**T/502/4301**
Level:	Level 3
Credit value:	3
GLH:	20
Aim:	This is the ability to make the best use of e-mail software to safely and securely send, receive and store messages. On completion of this unit a learner should be able to help others to make more efficient use of email software tools to send, receive and store messages for complex and non-routine activities.

Learning outcome
The learner will: 1. Use e-mail software tools and techniques to compose and send messages
Assessment criteria
The learner can: 1.1 Select and use software tools to compose and format e-mail messages, including attachments 1.2 Explain methods to improve message transmission 1.3 Send e-mail messages to individuals and groups 1.4 Explain why and how to stay safe and respect others when using e-mail 1.5 Use an address book to manage contact information

Range
E-mail tools and techniques will be defined as 'advanced' because: the techniques required will be multi-step and complex, and the selection process may involve research, identification and application; and the IT tools required will be complex and at times involve having the idea that there may be a tool or function to do something (eg improve efficiency or create an effect), exploring technical support, self-teaching and applying. Examples of context: Set up rules for automatic filtering and responses to incoming messages; create templates for automating email replies.

Learning outcome
The learner will: 2. Manage use of e-mail software effectively
Assessment criteria
The learner can: 2.1 Develop and communicate guidelines and procedures for using e-mail effectively 2.2 Read and respond appropriately to e-mail messages and attachments 2.3 Use email software tools and techniques to automate responses 2.4 Explain why, how and when to archive messages 2.5 Organise, store and archive e-mail messages effectively 2.6 Customise e-mail software to make it easier to use 2.7 Explain how to minimise e-mail problems 2.8 Respond appropriately to email problems

Unit 355 Using the Internet

UAN:	**F/502/4298**
Level:	Level 3
Credit value:	5
GLH:	40
Aim:	This is the ability to set up and use appropriate connection methods to access the Internet; make the best use of browser software tools and techniques to search for, retrieve and exchange information using a browser or public search engine, and work safely and securely online. On completion of this unit a learner should be able to advise on and set up an Internet connection to meet a variety of user needs. They can also make efficient use of advanced Internet software tools and techniques to search for and exchange information for complex and non-routine activities.

Learning outcome
The learner will: 1. Select and set up an appropriate connection to access the Internet
Assessment criteria
The learner can: 1.1 Identify different types of connection methods that can be used to access the Internet 1.2 Explain the benefits and drawbacks of different connection methods 1.3 Analyse the issues affecting different groups of users 1.4 Select and set up an Internet connection using an appropriate combination of hardware and software 1.5 Recommend a connection method for Internet access to meet identified needs 1.6 Diagnose and solve Internet connection problems

Range
Internet tools and techniques will be defined as 'advanced' because: the software tools and functions required will be described as complex because at times they involve having the idea that there may be a tool or function to do something (eg improve efficiency or create an effect), exploring technical support, self-teaching and applying; and the range of techniques required for searching and exchanging information will be complex, and the selection process may involve research, identification and application. Examples of context: Setting up an Internet connection for use by others; developing and promoting organisational guidelines and procedures for Internet safety; setting up and moderating the content of a discussion forum.

Learning outcome
The learner will: 2. Set up and use browser software to navigate webpages
Assessment criteria
The learner can: 2.1 Select and use browser tools to navigate webpages effectively 2.2 Explain when to change browser settings to aid navigation 2.3 Adjust and monitor browser settings to maintain and improve performance 2.4 Explain when and how to improve browser performance 2.5 Customise browser software to make it easier to use

Learning outcome
The learner will: 3. Use browser tools to search effectively and efficiently for information from the Internet
Assessment criteria
The learner can: 3.1 Select and use appropriate search techniques to locate information efficiently 3.2 Evaluate how well information meets requirements 3.3 Manage and use references to make it easier to find information another time 3.4 Download, organise and store different types of information from the Internet

Learning outcome
The learner will: 4. Use browser software to communicate information online
Assessment criteria
The learner can: 4.1 Identify and analyse opportunities to create, post or publish material to websites 4.2 Select and use appropriate tools and techniques to communicate information online 4.3 Share and submit information online using appropriate language and moderate content from others

Learning outcome
The learner will: 5. Develop and apply appropriate safety and security practices and procedures when working online
Assessment criteria
The learner can: 5.1 Explain the threats to system performance when working online 5.2 Work responsibly and take appropriate safety and security precautions when working online 5.3 Explain the threats to information security and integrity when working online 5.4 Keep information secure and manage user access to online sources securely 5.5 Explain the threats to user safety when working online 5.6 Explain how to minimise internet security risks 5.7 Develop and promote laws, guidelines and procedures for safe and secure use of the Internet

Unit 358 Website software

UAN:	**Y/502/4632**
Level:	Level 3
Credit value:	5
GLH:	40
Aim:	This is the ability to use a software application designed for planning, designing and building websites. On completion of this unit a learner should be able to use basic website software tools and techniques appropriately to produce straightforward or routine single web pages from pre-set templates.

Learning outcome
The learner will: 1. Create structures and styles and use them to produce websites
Assessment criteria
The learner can: 1.1 Determine what website content and layout will be needed for each page and for the site 1.2 Plan and create web page templates to layout content 1.3 Select and use website features and structures to enhance website navigation and functionality 1.4 Create, select and use styles to enhance website consistency and readability 1.5 Provide guidance on laws, guidelines and constraints that affect the content and use of websites 1.6 Explain what access issues may need to be taken into account 1.7 Explain when and why to use different file types for saving content 1.8 Store and retrieve files effectively, in line with local guidelines and conventions where available

Learning outcome
The learner will: 2. Select and use website software tools and features to develop multiple page websites with multimedia and interactive features
Assessment criteria
The learner can: 2.1 Prepare content for web pages so that it is ready for editing and formatting 2.2 Organise and combine information needed for web pages in line with any copyright constraints, including across different software 2.3 Select and use appropriate editing and formatting techniques to aid meaning 2.4 Select and use appropriate programming and development techniques to add features and enhance websites 2.5 Select and use file formats that make information easier to download 2.6 Check web pages meet needs, using IT tools and making corrections as necessary

Range
Website software tools and techniques will be defined as 'basic' because: the software tools and functions involved will be predefined or commonly used; the range of inputting, manipulation and outputting techniques are straightforward or routine; and the template used for the content will be predetermined or familiar. Examples of context: Personal webpage or blog created in social networking, learning or auction site; information pages created within web or content management system.

Learning outcome
The learner will: 3. Publish and test multiple page websites with multimedia and interactive features
Assessment criteria
The learner can: 3.1 Select and use appropriate testing methods to check that all elements and features of complex websites are working as planned 3.2 Identify any quality problems with websites and explain how to respond to them 3.3 Select and use an appropriate programme to upload and publish the website and make sure that it will download efficiently

3.4 Respond appropriately to quality problems with websites to ensure outcomes are fit for purpose

Unit 360 Word processing software

UAN:	**Y/502/4629**
Level:	Level 3
Credit value:	6
GLH:	45
Aim:	This is the ability to use a software application designed for the creation, editing and production of largely text-based documents. On completion of this unit a learner should be able to select and use a range of advanced word processing software tools and techniques to produce complex and non-routine documents.

Learning outcome
The learner will: 1. Enter and combine text and other information accurately within word processing documents
Assessment criteria
The learner can: 1.1 Summarise what types of information are needed for the document and how they should be linked or integrated 1.2 Use appropriate techniques to enter text and other types of information accurately and efficiently 1.3 Create, use and modify appropriate templates for different types of documents 1.4 Explain how to combine and merge information from other software or multiple documents 1.5 Combine and merge information within a document from a range of sources 1.6 Store and retrieve document and associated files effectively, in line with local guidelines and conventions where available 1.7 Select and use tools and techniques to work with multiple documents or users 1.8 Customise interface to meet needs

Learning outcome
The learner will: 2. Create and modify appropriate layouts, structures and styles for word processing documents
Assessment criteria
The learner can: 2.1 Analyse and explain the requirements for structure and style 2.2 Create, use and modify columns, tables and forms to organise information 2.3 Define and modify styles for document elements 2.4 Select and use tools and techniques to organise and structure long documents

Learning outcome
The learner will: 3. Use word processing software tools and techniques to format and present documents effectively to meet requirements
Assessment criteria
The learner can: 3.1 Explain how the information should be formatted to aid meaning 3.2 Select and use appropriate techniques to format characters and paragraphs 3.3 Select and use appropriate page and section layouts to present and print multi-page and multi-section documents 3.4 Check documents meet needs, using IT tools and making corrections as necessary 3.5 Evaluate the quality of the documents produced to ensure they are fit for purpose 3.6 Respond appropriately to any quality problems with documents to ensure that outcomes meet needs and are fit for purpose

Range
Word processing tools and techniques will be described as 'advanced' because: the software tools and functions will be complex and at times require new learning, which will involve having the idea that there may be a tool or function to do something (eg improve efficiency or create an effect), exploring technical support, self-teaching and applying; the techniques required will be complex, and the process of selecting appropriate techniques may involve research, identification and application; and the user will take full responsibility for the inputting, manipulating and outputting of the information.

Examples of context: Typical documents will require problem solving and creative thinking and may include – complex reports and content for publications such as web pages, journals, newsletters or other printed materials.

Unit 400 Project management

UAN:	**T/504/1129**
Level:	Level 4
Credit value:	15
GLH:	50
Aim:	The purpose of this unit is to provide learners with an understanding of the principles of project management and how projects are set up. Learners will gain an understanding of how to mitigate for risks and develop their skills in using management tools to monitor and review projects.

Learning outcome
The learner will: 1. Understand why organisations use project management
Assessment criteria
The learner can: 1.1 Describe the **principles** of project management 1.2 Explain the **benefits** of project management to organisations and individuals

Range
Principles Business justification, learning from experience, defined roles and responsibilities, manage by stages, manage by exception, focus on products, objectives, constraints, lifecycle. **Benefits** Possible benefits will include: Increased efficiency, improved customer satisfaction, organisations may be more effective in delivering services, improvements in quality and output, development opportunities within the project team, increase in an organisation's competitive edge, opportunities to expand services, more flexibility, improved risk assessment.

Learning outcome
The learner will: 2. Understand how to set up projects
Assessment criteria
The learner can: 2.1 Explain the **considerations** when reviewing project proposals 2.2 Explain **how to set clear goals** for projects 2.3 Analyse project **resource requirements** 2.4 Explain **how roles and responsibilities are allocated** within project teams 2.5 Identify project **communication needs** 2.6 Assess **possible risks** to successful completion of projects 2.7 Explain how to **mitigate** for possible risks

Range
Considerations Financial viability of the project, time, legal, resource, budget, constraints, dependencies, confidentiality e.g. restrictions in relation to the Data Protection Act, who has access to data and project documentation. **How to set clear goals** Identify stakeholders, identify needs, use SMART principles, record goals in project plans **Resource requirements** Project requirements against goals, time constraints, budget, human resources, training needs, communication needs, IT requirements. **How roles and responsibilities are allocated** Use of experts from different areas of the organisation, use of key stakeholders, identify training needs, meeting schedules, timing of reports **Communication needs** Formal/informal communication, identifying who requires communication e.g. stakeholders, management, team members. **Possible risks** Safety issues, optimistic time and cost estimates, unexpected budget costs, unclear roles and responsibilities, stakeholder needs not sought, changing requirements after the start of the project, new requirements , poor communication, lack of commitment

Mitigation

Health and safety training, regular project review meetings, appropriate communication, training and monitoring.

Learning outcome
The learner will: 3. Be able to use management tools to maintain, control and monitor projects
Assessment criteria
The learner can: 3.1 Describe different **management tools** for monitoring and control of projects 3.2 Justify the use of management tools for **monitoring** and controlling projects 3.3 Use management tools to monitor projects

Range
Management tools Progress reports, budget monitoring reports, GANTT charts, Critical Path Analysis, use of relevant and current project software packages. **Monitoring** Updating task status, re-scheduling uncompleted tasks, updating project elements.

Learning outcome
The learner will: 4. Be able to review projects at all stages
Assessment criteria
The learner can: 4.1 Explain **reasons** for reviewing projects after completion 4.2 Review projects against original proposals

Range
Reasons Improve future projects, enables ability to learn from experience, identify key resources for future projects, ensures comparison against achievements to original objectives, highlights any issues e.g. health and safety, problems, training needs, shortages in terms of resources, increases in costs, allows for the ability to revise and update plans, enables completion of an end of project report.

Unit 401 Effective communication in business

UAN:	**A/504/1455**
Level:	Level 4
Credit value:	15
GLH:	40
Aim:	The purpose of this unit is to provide learners with an understanding of the importance of effective communication, written, verbal and non-verbal, in a business environment. Learners will understand why effective communication is critical for businesses and will be able to recommend different types of communication methods suitable for specific purposes.

Learning outcome
The learner will: 1. Understand the importance of effective communication in business
Assessment criteria
The learner can: 1.1 Explain the **relevance** of the **communication cycle** in effective communication 1.2 Explain the **benefits** of different types of communication 1.3 Explain how effective communication in business **motivates** employees and customers 1.4 Evaluate the **effectiveness of different types of communication**

Range
Relevance Communication is a two way process involving exchange of ideas **Communication cycle** Communication is not complete until the intended message is understood. **Benefits**

Ensures clarity, message is understood, allows depth of information to be conveyed, can be tailored to suit different audiences and situations.

Motivates

Can promote more efficient working, transparency and trust.

Effectiveness

Did communication meet its purpose

Different types of communication

Non-verbal communication including: reports, emails

Verbal communication including: presentations, video and teleconferencing, face to face meetings.

Learning outcome
The learner will: 2. Understand the importance of effective written communication in business
Assessment criteria
The learner can: 2.1 Explain the importance of clear written communication in business which meets the needs of **different audiences** 2.2 Evaluate **different sources of information** that may be used when preparing written communication 2.3 Evaluate different **styles and tones** of written communication

Range
Different audiences Internal and external stakeholders, difference between public documents and documents intended for internal use only, use of technical language (when to use/not to use). **Different sources of information** Reviewing the reliability of sources of information before use, checking the language used and suitability for the audience. **Styles and tones** Formal and informal Assertive, passive, passive aggressive, aggressive Impact of tone of voice to convey different messages

Learning outcome
The learner will: 3. Understand the importance of effective verbal communication in business
Assessment criteria
The learner can: 3.1 Evaluate ways of communicating verbally **clearly and convincingly** to different audiences 3.2 Describe the **benefits** of active listening 3.3 Explain how to overcome **barriers** to verbal communication

Range
Clearly and convincingly Use of tone of voice, passion, enthusiasm, subject knowledge and preparation. **Benefits** Ensures clarity and that the message was understood in the way it was intended **Barriers** In relation to, location, specific needs of individuals. These could be overcome by the use of technology e.g. video conferencing, tele-conferencing, specific equipment for people with particular requirements.

Learning outcome
The learner will: 4. Understand how to communicate effectively in a non verbal way
Assessment criteria
The learner can: 4.1 Explain how to **recognise** and respond to **different body language** in business environments 4.2 Explain how **rapport** is developed with colleagues and customers through using effective non verbal communication

Range
Recognise Facial expressions, gestures, movement, eye contact, touch, personal space **Different body language** Facial expressions, gestures, movement, eye contact, touch, personal space

Rapport
Use of mirroring, active listening.

Learning outcome
The learner will: 5. Understand the purpose and value of getting feedback when developing communication skills
Assessment criteria
The learner can: 5.1 Evaluate **different ways** of getting feedback on whether communications have achieved their purpose 5.2 Explain the **purpose** of using feedback to develop communication skills

Range
Different ways One to one feedback, use of surveys, focus groups, samples **Purpose** Can aid self-development, may assist the development of communication strategies.

Learning outcome
The learner will: 6. Be able to recommend communication methods for specific purposes
Assessment criteria
The learner can: 6.1 Identify the **purpose** of the communication 6.2 Justify the use of different types of communication for specific purposes 6.3 Recommend communication strategies for specific purposes

Range
Purpose What is the intended outcome of the communication, who is the audience, should the communication be technical/non-technical

Unit 402 Systems development

UAN:	**K/504/1483**
Level:	Level 4
Credit value:	12
GLH:	62
Aim:	The purpose of this unit is to provide learners within an understanding of the systems development life cycle. Using a project approach, learners will explore the stages in detail, gathering and analysing customer requirements, designing an IT solution, and planning its testing and implementation. Learners will identify the various stakeholder perspectives to ensure both that the solution meets requirements and that the wider implications are considered. Learners will develop practical skills in the use of the various tools and techniques associated with the various methodologies for systems development.

Learning outcome
The learner will: 1. Know how to plan systems development activities against agreed quality standards
Assessment criteria
The learner can: 1.1 Outline **stages** of the systems development **life cycle** 1.2 Explain the **deliverables** associated with systems development activities 1.3 Identify the **sponsors and stakeholders** involved in systems development and review 1.4 Explain the importance and role of systems integration to systems development process

Range
Stages Initiation, requirements definition; systems analysis; systems design; systems integration and testing; implementation; maintenance; disposal **Systems lifecycle** Systems Development Life Cycle models (SDLC): Waterfall; Spiral; Agile; Rapid prototyping; Rapid Application Design; Dynamic Systems Design Methodology (DSDM) **Deliverables** Output document from each stage of systems development life cycle For example: Initiation: Terms of reference; Feasibility study; Cost-benefit analysis; Business case; Documentation according to methodology adopted eg Conceptual model; Relational data model; Use cases; System documentation Documentation within organisational guidelines or standards: documentation content and layout, naming conventions, diagram requirements, quality standards and control, Organisational processes and requirements for project management **Sponsors and stakeholders** People or organisations; Organisation chart, beneficiaries, users; executive sponsor, designers, managers

Learning outcome
The learner will: 2. Be able to establish customer requirements
Assessment criteria
The learner can: 2.1 Identify the **requirements** or business specification of proposed systems 2.2 Obtain information on existing and required inputs, outputs and processes of ICT systems 2.3 Explain any **constraints** new systems may encounter 2.4 Recommend **solutions** for customer consideration 2.5 Explain the impact and implications of any changes to customer requirements

Range
Requirements Intended audience: Customer; business; stakeholder; supplier Establish scope and objectives; Structure; Meet deadlines, interface considerations Planning and scheduling activity; Analysis using PERT or GANTT charts Functional requirements for inputs, outputs and processes and process **Constraints** Relating to, for example, IT platform, language, cost, reliability, security, performance, accessibility Compatibility with legacy systems Regulatory or legal constraints; organisational policies or staffing factors **Solutions** Alternative approaches such as upgrade of existing system; new development; bespoke or off-the-shelf solution or combination. Advantages and disadvantages of different types of systems in different contexts

Learning outcome
The learner will: 3. Be able to establish procedures for system maintenance
Assessment criteria
The learner can: 3.1 Explain the need for **maintenance procedures** 3.2 Describe the types of maintenance ICT systems may require 3.3 Produce maintenance procedure plans for ICT systems 3.4 Produce relevant documentation for recording maintenance activity 3.5 Explain how maintenance can affect the quality of ICT systems

Range
Maintenance procedures Maintenance carried out, any parts replaced, upgrades carried out, issues found and results or action carried out and Impact on system quality.

Learning outcome
The learner will: 4. Understand system implementation procedures
Assessment criteria
The learner can: 4.1 Summarise the **main stages of system implementation** 4.2 Identify external **factors that affect implementation** and handover activities 4.3 Evaluate different **methods of system changeover** 4.4 Describe file conversion issues that may arise during systems implementation 4.5 Explain the purpose and methods for testing new systems 4.6 Describe user and support staff training requirements 4.7 Describe the typical **documentation** provided on completion of implementation 4.8 Explain the purpose of version control procedures

Range
Main stages of systems implementation Planning, equipment installation, preparation of test plans and test data, design and creation of pilot system, user and staff training, file or hardware conversion, system changeover **Factors that affect implementation** Planning, resources, supporting systems, handling levels of support requests, maintaining business operations, communications, business change; customer/supplier, change management, File conversion issues **Methods of system changeover** Parallel running, direct changeover, phased and pilot Version control procedures: when developing, amending and maintaining systems and documentation **Documentation** Detailed program specifications, operating procedures manual including system run charts, operation manuals for users, security measures, recovery procedures, test plans, test data, test logs Policies; guidelines and procedures for use, support, technical manuals.

Learning outcome
The learner will: 5. Be able to produce requirements specifications
Assessment criteria
The learner can: 5.1 Produce **logical design** specifications 5.2 Produce **physical design** specifications

Range
Logical design Deliverables associated with logical design relevant to methodology chosen, such as entity/object/relationship models, data flow diagrams; data dictionary; use cases; decision tables/trees; CASE tools Evaluating how logical designs reflect customer requirements: inconsistencies; faults; duplications; omissions; additions; constraints not applied. **Physical design** Input procedures, output procedures, file specifications, system specifications, system flowcharts, interface procedures, computer operations procedures Data structures, file structures, business rules, process diagrams, entity relationship diagram, data dictionary Input and output specifications: User interfaces, screen layouts, reports

Learning outcome
The learner will: 6. Be able to prepare for system implementation
Assessment criteria
The learner can: 6.1 Produce documentation for implementation 6.2 **Test systems** prior to rollout 6.3 **Review systems design**

Range
Review system design Meeting customer requirements: clear, complete, consistent, unambiguous, resolving conflicts **Test systems** Black box, white box and sandboxing

Unit 403 Personal and professional development

UAN:	**K/504/1449**
Level:	Level 4
Credit value:	10
GLH:	25
Aim:	The purpose of this unit is to provide learners with an understanding of the different methods and resources available to them to help them plan for their personal and professional development. They will learn how to identify factors that may affect targets or goals, prioritise actions and how feedback from others can be utilised to aid their development and career progression. They will be able to develop a plan which can either be used during progress of a course of study or as a tool for their future/current career path.

Learning outcome
The learner will: 1. Understand how to plan for personal and professional development
Assessment criteria
The learner can: 1.1 Describe the benefits of personal and professional development 1.2 Identify **development opportunities** for career and personal progression 1.3 Analyse development opportunities that may support career and personal progression

Range
Personal benefits Update skills, gain new skills, increase motivation, confidence **Professional benefits** Career progression, meeting organisation goals, how role fits into organisation

Development opportunities
Skills, knowledge, training, qualifications, job shadowing; internal and external.

Learning outcome
The learner will: 2. Understand how people learn
Assessment criteria
The learner can: 2.1 Explain the **principles** of how people learn 2.2 Describe different learning styles 2.3 Evaluate **learning resources** to support development 2.4 Analyse the use of different learning strategies

Range
Principles Learning theories, methodologies, pedagogies. **Learning resources** Internal learning resources, libraries, internet/websites.

Learning outcome
The learner will: 3. Be able to produce personal and professional development plans
Assessment criteria
The learner can: 3.1 Carry out **self-audit** of skills and experience 3.2 Identify **targets** for personal and professional development 3.3 Use **methods** to track personal development 3.4 Create a personal and professional development **plan**

Range
Self-audit Feedback from others, skills scans, matching job role/duties to job description. **Targets** SMART target setting. Candidate should investigate and select appropriate mechanisms to monitor own progress. **Methods** Task manager, blog, project management tools, diaries,

performance or personal development reviews/plans and objectives.

Plan includes what, who, how and when in clear format

Learning outcome
The learner will: 4. Be able to make recommendations for personal and professional development
Assessment criteria
The learner can: 4.1 Explain the **benefits** of reflective practice 4.1 Evaluate **progress** against development plan 4.2 Recommend opportunities for further development

Range
Benefits Update/review, target achievement/re-setting, current structure/team, new opportunities, barriers to progress, further support required. **Progress** Update/review, target achievement/re-setting, new development needs/opportunities, changed development needs/changed circumstances, barriers to progress, further support required.

Unit 404 Business skills for e-commerce

UAN:	**Y/601/1244**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with an awareness of the role of e-commerce in business and the potential impact and implications of adopting an e-commerce solution in different contexts. Learners will explore the market opportunity, design an e-commerce solution for a specific business application and evaluate the suitability of their design.

Learning outcome
The learner will: 1. Understand the structure and aims of business organisations
Assessment criteria
The learner can: 1.1 Assess an **organisation's core business functions**. 1.2 Evaluate an organisation's business aims and show how they relate to **stakeholders**

Range
Organisation Public, private, not for profit, charitable Start-up to multinational **Core business functions** Sales and marketing; production and logistics; procurement and supplies; research and development; customer relations and service; firm infrastructure (management, finance, administration); supply chain management; human resource management; IT/technology development; learning and development. Primary/operational and supporting processes. **Stakeholders** Identification of stakeholders: Internal/external; Direct/indirect

interest in business; Employers, owners, customers, competitors, shareholders. Satisfying stakeholder objectives

Learning outcome
The learner will: 2. Understand the impact of e-Commerce
Assessment criteria
The learner can: 2.1 Analyse the **impact**, including the **risks**, of introducing an **e-Commerce** system to an organisation 2.2 Discuss the **global impact** of e-Commerce on society

Range
Impact (positive or negative) On business: sales; revenue; profitability; customer base; costs; On customers: service; choice; communications; customer loyalty; brand awareness; corporate image; efficiency; market research Impact on marketing; cycle time; manufacturing, data and finance systems; accessibility; global markets; distribution channels; new legislation **Risks** Information risks (eg fraud and its prevention); Technology risks (eg system integration, software error, access, performance); Business risks (eg ability to fill orders; logistics); Data loss **e-Commerce system** Types of systems: B2B, B2C,C2C Such as Merchant: wholesale or retail of goods/services; Service provision; Subscription-based; Broker; Advertising; Auctions; Community; Infomedia **Global impact** Market reach; Speed to market; skills requirements and changing nature of work; new business opportunities; entrepreneurship. Dot com bubble. Emerging trends. New distribution channels, new supply/customer chains. Legislation and regulation

Learning outcome
The learner will: 3. Be able to design e-Commerce solutions
Assessment criteria
The learner can: 3.1 Investigate **market potential** for an e-Commerce opportunity 3.2 Evaluate current **e-Commerce systems** in use by organisations 3.3 Discuss the **financial implications** of an e-Commerce solution 3.4 Design an e-Commerce solution 3.5 Evaluate the **suitability** of an e-Commerce solution

Range
Market potential Market analysis; market size; competitor analysis; market share; identify stakeholders; business model; pricing and margins; financial projections; constraints; regulatory restrictions. Market characteristics, market segmentation. Value proposition. **e-Commerce systems** Advantages and disadvantages of different types of systems in different contexts **Financial implications** Costs (eg life cycle cost: design, development, testing, maintenance); Start-up and working capital Online payment systems Data and transaction security (eg identity and credit check; secure HTTP, SSL, Single sign on, digital certificates, encryption) Projected revenue and profitability **Suitability** Industry suitability; meet current/future business requirements; system effectiveness; stakeholder buy-in Functionality and navigation; system security; Content and its format – text, graphics, images, processes; DDA compliance Interactive features; shopping cart/store; registration; availability and load time; platform

Unit 408 Data communications and networks

UAN:	**M/602/2251**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is for learners to develop an understanding of the architecture, operation and major design issues relating to data networks.

Learning outcome
The learner will: 1. Understand data communication networks and the requirement for open systems
Assessment criteria
The learner can: 1.1 Explain the differing types of **data communication networks** and their applications 1.2 Explain the concept of the ISO open systems interconnect (OSI) reference model 1.3 Explain standard protocol suites and how they relate to the OSI reference model

Range
data communication networks public switched telephone network (PSTN), local area networks (LANs), metropolitan area networks (MANs), wide area networks (WANs), packet switched data network (PSDN), integrated services digital network (ISDN) Satellite networks **open systems interconnect (OSI) reference model** International Standards Organisation, OSI seven layer Model , the layered models and the function of the layers protocol suites IPX/SPX, TCP/IP, (inc. IPv4, IPv6) NetBUI, AppleTalk

Learning outcome
The learner will: 2. Understand the methods used for data communication
Assessment criteria
The learner can: 2.1 Explain the **data transmission methods** used for information interchange 2.2 Explain the principles of asynchronous and synchronous transmission 2.3 Discuss the strategies used for **controlling errors** in data networks

Range
Data transmission methods simplex, duplex, semi-duplex operation; Line codes: unipolar, bipolar, return to zero (RTZ), non-return to zero (NRZ), Manchester, HDB3 **Asynchronous and synchronous data transmission** stop-start systems, hardware and software control, strategies for synchronisation, interface standards (RS232), advantages and disadvantages of asynchronous and synchronous methods **controlling errors** (strategies) detection methods: parity, checksums, cyclic redundancy checks, cryptographic hash function; correction methods: ARQ, idle RQ, continuous RQ, forward error correction, stop and wait.

Learning outcome
The learner will: 3. Know the function and methods of control used for local area networks
Assessment criteria
The learner can: 3.1 Describe commonly used **LAN topologies** and transmission media 3.2 Describe the commonly used **media access control methods** for LANs 3.3 Describe the **IEEE 802 standards** for LAN classification 3.4 Describe the function of **LAN hardware**

Range
LAN topologies star; tree; bus; ring; mesh **Transmission media** copper-based e.g. twisted pair shielded and unshielded; coaxial (thin and thick); optical fibres; wireless **Media access control methods** polling, contention, token passing, token bus, carrier sensing / collision detection (CSMA/CA / CSMA/CD), ALOHA / Slotted ALOHA **IEEE 802 standards** 802.802.4, 802.5, 802.11, 802.12 **LAN hardware** NIC, repeaters; bridges; switches, routers; gateways, multiplexors, modem, (inc. wireless versions)

Learning outcome
The learner will: 4. Understand wide area networks and internet working
Assessment criteria
The learner can: 4.1 Explain the **features** of wide area networks (WANs) 4.2 Explain the switching and packet techniques used in WANs 4.3 Explain how **routing** is achieved 4.4 Discuss the methods used for data communication over the **PSTN**

Range
Features topologies; transmission media; public data networks (packet switched data network (PSDN), integrated services digital network (ISDN))
Switching and packet techniques switching (Circuit, Message and Packet); packet (Datagram, Virtual Circuit)
Routing static; dynamic, internet and X.25 addressing; Aloha; Slotted Aloha
PSTN access methods

modem modulation schemes eg amplitude shift keying (ASK), frequency shift keying (FSK), phase shift keying (PSK), quadrature phase shift keying (QPSK), CCITT standards

Unit 409 Database design concepts

UAN:	**R/601/0447**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with an understanding of databases and data management systems. Learners may already have grounding in the techniques of designing and creating databases and this unit will further develop their skills in analysing and evaluating database features and methodologies. Through the study of this unit, learners will also develop their skills to implement and fully document complex databases and provide supporting material for users in the work place.

Learning outcome
The learner will: 1. Understand databases and data management systems
Assessment criteria
The learner can: 1.1 Analyse the **key issues and application** of databases within organisational environments. 1.2 Critically evaluate the **features** and **advantages** of database management systems

Range
Key issues and application Intended usePhysical design Logical design Reducing data duplication Data independence Data item level Record level Bespoke applications Cost

Features
Data storage
Data entry formsCustomised reports
Data relationships
Controlled redundancy
Database programming environments
User focused data entry fields and forms
Data queries
Query languages

Advantages
Data independence
Reduced development time
Sharing data
Data integrity
Centralised management
Auditability
Switchboard
Bespoke

Learning outcome
The learner will: 2. Understand database design techniques
Assessment criteria
The learner can: 2.1 Analyse a **database developmental methodology** 2.2 Discuss **entity-relationship modelling** and **normalisation**

Range
Database developmental methodology Predictive methodology Adaptive methodology Relationship model Flat file model **Entity Relationship Modelling** Conceptual data model Logical data model Physical data model Semantic data model **Normalisation** Reduced redundancy Reduced dependency Linking fields and tables Data integrity Denormalisation

Performance Codd's rules

Learning outcome
The learner will: 3. Be able to design, create and document databases
Assessment criteria
The learner can: 3.1 Apply the **database developmental cycle** to a given data set. 3.2 Design a fully functional database (containing at least four inter-relational tables) including user interface 3.3 Evaluate the effectiveness of the database solution and suggest methods of improvement 3.4 Provide supporting user and technical documentation

Range
Database developmental cycle Systems development life cycle (SDLC) Life cycle methodologies

Unit 412 E-business operations

UAN:	**Y/601/1101**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to give learners an insight into both business-to-business procurement processes and business-to-consumer purchase transactions. Learners will explore the security of online payment systems and electronic data interchange and consider the benefits that IT systems can bring to supply chain management.

Learning outcome
The learner will: 1. Understand how business and consumer purchase transactions differ
Assessment criteria
The learner can: 1.1 Describe the **purchasing process** used in B2B and B2C 1.2 Explain how use of professional **buyers** affects the buying process 1.3 Analyse **variables in purchasing**

Range
Purchasing process e-sourcing, e-tendering, e-procurement, e-billing; e-commerce IT procurement: pre-qualification of vendors, soliciting bids (RFI, RFP, RFQ); Registration of interest/expression of interest (ROI,/EOI); Invitation to Tender/Request for Tender (IIT, RFT); elements of procurement contract Type of purchasing system: centralised; cross functional, distributed, self-service Dynamic markets, online auctions, reverse auction; price comparison **Buyers** Roles and responsibilities; authorities, contracts and agreements, Supplier management, document security, routing and approval methods **Variable in purchasing** Purchasing criteria, volumes, discounts, shipping options, lead time, payment terms. Personalisation

Learning outcome
The learner will: 2. Understand EDI and Electronic transactions
Assessment criteria
The learner can: 2.1 Explain how electronic transactions can reduce paperwork and delay 2.2 Examine how **EDI** has developed and laid the foundations for b2b e-business 2.3 Evaluate the use of different **Electronic Payment Systems**.

Range
EDI Standards, specifications, message implementation guidelines, transmission protocols, encryption. Compliance. Advantages over paper-based systems, cost impact **Electronic payment systems** Payment systems: smart/credit/debit cards, payment service providers, electronic banking, micropayments, mobile devices Virtual / credits-based currency systems Identity checks and authentication methods

Learning outcome
The learner will: 3. Be able to demonstrate the benefits of electronic transactions to supply chain management
Assessment criteria
The learner can: 3.1 Create a **diagram** for an E-Business Supply Chain 3.2 Write a report on the **advantages of E-Procurement** 3.3 Present an analysis on the flow of information in a typical **logistics operation** 3.4 demonstrate the benefits of electronic processes in integration of **Supply Chain management**

Range
Diagram Flow of information, product, funds. **Advantages of e-Procurement** Methods to cut costs, improve handling, enforce control, increase efficiency, reduce inventory **Logistics operation** Warehousing, inventory, stock/material handling, packaging,

distribution, transportation and tracking. Control systems.
Security, document automation

Supply chain management

Value added services;
Supply chain length, integration, stability, just in time
Benefits: efficiency, speed of service, accuracy and communication
e-procurement software systems

Learning outcome
The learner will: 4. Understand issues in e-business including quality recruitment and security
Assessment criteria
The learner can: 4.1 Explain how the issues of **trust and security** apply to supply chain management and other e-Business operations. 4.2 Evaluate how the Internet can be used for **communication with prospective/ current employees** 4.3 assess the issue of **quality** for an E-Business 4.4 review the development of the Internet technologies on B2B industry networks and B2C markets

Range
Trust and security Security of client data, of transactions. Privacy policies; protection of rights Electronic certificates Legal requirements and organisational guidelines Contingency planning **Communication with employees** Recruitment process: Company information, job listings, applications, learner screening and appointment Learning and development: compliance related, non-compliance relater; induction With existing employees: formal, informal, on-the-job Communications technologies: one to one, one to many conferencing; synchronous, a-synchronous **Quality** Customer service: order fulfilment; order tracking and status change handling; complaints, insurance, support, conformance to specification Website quality: reliability, responsiveness, accuracy Data quality Compliance with relevant regulations and contracts

Unit 413 Emerging technologies

UAN:	**Y/601/0451**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with an understanding of what emerging technologies are and how they can be implemented now and in the future based on further technological developments. Learners will develop their skills to analyse the effect on new and emerging technologies on society and research ethical implications and how these are influenced by ethical committees. Learners who achieve this unit may wish to progress into developing new technologies and applications for businesses.

Learning outcome
The learner will: 1. Understand emerging technologies
Assessment criteria
The learner can: 1.1 Examine the environments that utilise emerging technologies by **identifying the emerging technologies** and current developments in the field 1.2 Examine the environments that utilise emerging technologies by assessing the dependency of these environments on future enhancements

Range
Learners should be encouraged to consider emerging technologies within their subject area or job role and undertake the appropriate research. **Identifying the emerging technologies** Information technology Automation Robotics Communications (incl. Telecommunications) Multimedia System analysis Control systems Manufacturing Engineering

Learning outcome
The learner will: 2. Understand the impact of emerging technologies on society
Assessment criteria
The learner can: 2.1 Analyse emerging technologies and their **impact on society**

Range
Impact on Society Dependant on environment Developing countries and their societies Developed countries and their societies Cost Future trends Social cohesion Social fragmentation Redundancy Employment Advantages Drawbacks

Learning outcome
The learner will: 3. Be able to conduct research into emerging technologies
Assessment criteria
The learner can: 3.1 undertake **research** on an emerging technology 3.2 present findings from the research 3.3 evaluate the research process

Range
Research Research methodologies Justifying the methodology used Qualitative and quantitative data Validity of research Research sources Primary information Referencing Presenting research Research ethics Feedback/proposals

Learning outcome
The learner will: 4. Understand the ethical implications of emerging technologies
Assessment criteria
The learner can: 4.1 Evaluate the **ethical implications** of emerging technologies discussing the role of ethical committees

Range
Ethical implications Industrial Social Political Accountability Security Privacy Human rights Access to information Communication Diversity of Content Trust

Unit 414 Event-driven programming solutions

UAN:	**H/601/0453**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with an understanding of how event-driven programming technologies are used in programming and systems development. Learners will develop their skills to be able to design, create, implement and test programming solutions for given purposes

Learning outcome
The learner will: 1. Understand the principles of event-driven programming
Assessment criteria
The learner can: 1.1 Discuss the **principles, characteristics and features** of event-driven programming

Range
principles, characteristics and features Event-driven programming languages (e.g. Visual Basic, VB.NET, G2, ActionScript, etc) Top-down design Bottom-up design Flow control GUI Event-driven Reusable objects Web forms Mobile technologies OOED Object orientated

Learning outcome
The learner will: 2. Be able to design event-driven programming solutions
Assessment criteria
The learner can: 2.1 **Design an event-driven programming solution** to a given problem 2.2 Identify the screen components and data and file structures required to implement a given design

Range
Design an event-driven programming solution User specifications/requirements Design specifications to include: Inputs Outputs File handling Boolean Event .Net

Learning outcome
The learner will: 3. Be able to implement event-driven programming solutions
Assessment criteria
The learner can: 3.1 Implement an event-driven solution based on a prepared design 3.2 Implement event handling using control structures to meet the design algorithms 3.3 Identify and implement opportunities for error handling and reporting 3.4 Make effective use of an Integrated Development Environment (IDE) including code and screen templates

Learning outcome
The learner will: 4. Be able to test and document event-driven programming solutions
Assessment criteria
The learner can: 4.1 Critically review and test an event-driven programming solution 4.2 Analyse actual test results against expected results to identify discrepancies 4.3 Evaluate independent feedback on a developed event-driven programme solution and make recommendations for improvements 4.4 Create onscreen help to assist the users of a computer program 4.5 Create documentation for the support and maintenance of a computer program

Unit 415 Human computer interaction

UAN:	**A/601/0457**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners within an understanding of the principles of Human Computer Interaction and its impact on business and industry. Learners will have the opportunity to research current developments in HCI, in order to develop their understanding of the range of issues addressed in the field, prior to designing an effective user interface. Learners will also evaluate interfaces and understand how to measure their effectiveness.

Learning outcome
The learner will: 1. Understand recent human computer interaction related developments and their application
Assessment criteria
The learner can: 1.1 Evaluate recent **HCI related developments** and their applications 1.2 Discuss the **impact of HCI** in the workplace.

Range
HCI-related developments Core theories, models and methodologies End user development, embedded computation, virtual and augmented reality, 3D interfaces, remote control, specialist needs, thought input, intelligent interfaces, user-centred design Applications for range of platforms and devices: mobile devices; Graphical user interfaces and web interfaces; games devices; hostile environments; large display; domestic appliances; collaborative and social media; visual systems **Impact of HCI** Staff impact: cultural, psychological, sociological, behavioural factors Business impact: productivity, training need, time to competence, accuracy of changing computing environment:

social, economic, cultural impact DDA compliance

Learning outcome
The learner will: 2. Understand the issues related to a chosen human computer interface
Assessment criteria
The learner can: 2.1 Discuss the issues related to **user characteristics** for a chosen HCI

Range
User characteristics
Features; input and output methods and devices, form and content
Presentation: clarity, consistency, style, layout, colour
Navigation and control elements,
Interactivity, user focus, personalization, user experience
Specialist needs, adaptation of interfaces
Response times, task efficiency, system capability, user assistance/help
Cognitive aspects: memory, retention, attention, perception
Health and safety considerations: ergonomics, legal implications
Training requirements, documentation, Cost

Learning outcome
The learner will: 3. Be able to develop a human computer interface
Assessment criteria
The learner can: 3.1 **Design and create** a human computer interface for a specified application 3.2 Explain the **principles that have been applied** to the design 3.3 Critically **review** and test an interface 3.4 **Analyse actual test results** against expected results to identify discrepancies 3.5 **Evaluate independent feedback** and make recommendations for improvements 3.6 Create onscreen help to assist the users of an interface 3.7 Create **documentation** for the support and maintenance of an interface

Range
Design and create Requirements gathering, user analysis, information design, HCI options, visual design prototyping, (eg picture boards, storyboards, flowcharts, structured diagrams, narrative), graphic interface design Use of interactive and animated features, multimedia, using features of application (eg GPS on mobile device, touchscreen) as appropriate Use of graphic editors, graphic programming environment Performance or response requirements **Principles that have been applied** Fitts law, Keystroke level method Optimisation eg for ease of use, learnability, stress reduction, efficiency, controllability Tolerance, simplicity, visibility, affordance, consistency, structure, feedback International standards, organisational guidelines **Review** Effectiveness, efficiency, user satisfaction. Functionality **Analyse actual test results** Quantitative measures: load speed, input/output speed, resource requirement, development and maintenance cost. Controlled experiments. Qualitative methods: Comparison with requirements; comparison with other systems Usability testing **Evaluate independent feedback** Evaluation methods, user study, survey, software tools, expert review User satisfaction: eg ease of use, skills required, Results generated; managing constraints **Documentation** Specification, design, user guide, test log, site map

Unit 416 Manage budgets in a creative and cultural organisation

UAN:	**Y/601/6881**
Level:	Level 4
Credit value:	8
GLH:	40
Aim:	This unit will provide learners with the skills and knowledge to prepare budgets, monitor and report on activity against the budget whilst managing the agreed budget within frameworks of financial governance. Learners will prepare budgets, monitor and report on financial activity whilst applying relevant legal and accounting standards. Learners who achieve this unit may progress to a supervisory or accountancy position.

Learning outcome
The learner will: 1. Be able to prepare and agree a budget
Assessment criteria
The learner can: 1.1 Identify the **financial resources** required to meet the **objectives** of an organisation, area of work, service or project 1.2 Apply techniques to obtain accurate estimates of amounts, quantities and costs 1.3 Apply techniques to make or obtain reliable estimates of income 1.4 Develop a contingency estimate to cover unexpected expenses 1.5 Develop a budgeted income and expenditure account for the organisation, area of work, service or project 1.6 Apply techniques to negotiate and agree the budget with others as required

Range
Financial resources

Budgets
Constraints
Cost effectiveness
Justification of expenditure

Objectives
Proposals
Benefits to the organisation
Expected outcomes
Project Management
Deliverables
Timelines
Project budget

Learning outcome
The learner will: 2. Know how to monitor and report on financial activity
Assessment criteria
The learner can: 2.1 Know how to **monitor and report** on financial activity 2.2 Demonstrate how to **produce** accurate and timely **financial reports** in required formats 2.3 Demonstrate how to **report financial performance** to and agreed by the relevant people, including external funders if appropriate

Range
Monitor and report Financial management Local guidelines Legal requirements **Produce financial reports** Reporting periods Interim reportsFinal reports Report recipients Statutory returns/reports Bespoke report formats Vendor supplied formats Vendor supplied stationary Reporting standards **Report financial performance** Stakeholders Reporting periods Reporting guidelines

Learning outcome
The learner will: 3. Be able to manage the budget within relevant frameworks for financial governance
Assessment criteria
The learner can: 3.1 Describe how to **authorise expenditure** against budget, obtaining approval from others if necessary 3.2 Identify any **discrepancies** between budgeted and actual income and expenditure, taking corrective action and involving others as necessary 3.3 Implement work within appropriate **frameworks for financial governance**, applying relevant legal and accounting standards

Range
Authorise expenditure Levels of authority for payment Confirmation of invoice/order validity Expenditure within agreed budgets Recording of payments to suppliers Terms of payment **Discrepancies** Management accounts Day books Levels of authority Virement Agreed budgets **Frameworks for financial governance** Defined by organisation or sector Accounting standards

Unit 417 Management in Information Technology

UAN:	**J/601/0462**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with an introduction to the elements of management for the IT professional and a consideration of the software tools available to support the management role within an organisation. Learners will explore the issues around strategic planning within an organisation, the alignment of the IT function with business goals and evaluate the impact of recent developments in IT on business management and organisation.

Learning outcome
The learner will: 1. Understand principles of staff management
Assessment criteria
The learner can: 1.1 Evaluate an organisation's staff **recruitment policy** **1.2** Explain theories concerning **staff motivation** and the **management of change** 1.3 Evaluate staff administration **documentation**

Range
Recruitment policy Job descriptions: content, structure, consistency; Applicant sourcing, profiling, shortlisting, interviewing, selection, induction. Terms and conditions of employment, equality and diversity policy Evaluate: effectiveness, support, administration, adherence to legal and organisational requirements **Staff motivation** Motivational factors: reward, achievement, recognition,

progression, responsibility, involvement, retention of staff Low level needs, high level needs, CPD opportunities

De-motivational factors

Management of change

leadership, organisation structure, project management, communication, empowerment.

Documentation

Relating to HR business processes: recruitment, talent management, learning and development, appraisal and performance management; succession planning

Learning outcome
The learner will: 2. Be able to use software management tools
Assessment criteria
The learner can: 2.1 Use **system management tools** to assist a company in their **management planning process** 2.2 Effectively use **software management tools**

Range
System management tools IT system planning; system and user administration tools, monitoring and security tools, utilities Process mapping, project planning and scheduling tools, decision support tools **Management planning process** Establish goals, identify resources, set and prioritise tasks, evaluation strategy, contingency plans **Software management tools** Specialist management software such as project management, financial accounting, management accounting, HR systems; decision support systems, learning management systems (LMS), ERP systems, Bespoke management information systems (MIS) such as: database systems, diary and scheduling systems; warehousing systems; competency management systems; electronic performance support systems (EPSS), IT tools for communications, collaboration Business and productivity tools and applications

Learning outcome
The learner will: 3. Be able to participate in strategic planning
Assessment criteria
The learner can:

3.1	Use appropriate **research methods** to contribute to a company's strategic plan
3.2	Discuss the **issues associated with strategic planning**
3.3	Critically evaluate the **role of IT in strategic planning**

Range
Role of IT in strategic planning Changing role of CIO; opportunities to drive change and business results; Focus on business process, innovation and agility Key capabilities: change management, business orientation, communication, workforce development, architecture **Research methods** Approaches to strategic planning: scenario planning, SWOT, PEST, STEER analysis Situational analysis, balanced scorecard Feasibility study, business case **Issues associated with strategic planning** Social, economic, political, environmental, cultural issues Timescales, feasibility, leadership Alignment of IT architecture with business strategy; building credibility; change management Business/job restructuring issues relating to fast changing IT developments or outsourcing

Learning outcome
The learner will: 4. Understand current developments in information technology
Assessment criteria
The learner can: 4.1 Evaluate the importance of embracing new **developments in technology** 4.2 Analyse the **impact** of new technology on management

Range
Developments in technology IT for innovation, improving efficiency, productivity, impact, service, workflow, business growth, networking, communications. Cybersecurity Emerging technologies **Impact** Skills gaps, learning and development, organisational culture; deployment of staff, work locations; workforce demographics, collaboration Levels of management such as on senior managers, middle and

line managers Access to information Overcoming resistance to technology

Unit 418 Mathematics for software development

UAN:	**D/601/0466**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with an understanding of the mathematical concepts and principles that underpin software development. The unit covers conditional statements, geometry and vectors, matrix algebra, calculus, set theory and statistical techniques. Learners will design programming solutions in pseudocode to illustrate a range of mathematical and statistical techniques.

Learning outcome
The learner will: 1. Understand core mathematical skills for software engineers
Assessment criteria
The learner can: 1.1 Design a programming solution to a given **algebraic problem** 1.2 Design a programming solution to a given **geometric problem** 1.3 Implement code that presents a **range of vectors**

Range
Algebraic problem Basic rules and notations of algebra; use of brackets, factorisation, solving linear and simultaneous equations, quadratic equations Functions, induction and recursion **Geometric problem** Triangles: types, geometric properties, Pythagoras' theorem, Circles: geometric properties Trigonometry: angles, sine, cosine, tangent **Range of vectors** Equal and parallel vectors; addition and subtraction; scalar

multiplication; Linear transformations Rotation, reflection, translation, inversion

Learning outcome
The learner will: 2. Understand the application of algebraic concepts
Assessment criteria
The learner can: 2.1 Explain how **relations** link to technologies used in programming 2.2 Design a **programming solution** to solve a given **matrix manipulation.**

Range
Relations Domain, range, ordered tuples, Cartesian product Operations on relations: converse, join, composition, image Relations: universal, inverse, empty, equivalence, partitions Reflexivity, transitivity, symmetry Ordering, closure **Programming solution** Pseudocode Use of variables and operators, arrays, condition statements, routing, calling procedures, search trees **Matrix manipulation** Addition, subtraction, multiplication, Transposition, inverse, determinant

Learning outcome
The learner will: 3. Be able to apply the fundamentals of formal methods
Assessment criteria
The learner can: 3.1 Discuss the **application of set theory** in computing 3.2 Design a programming solution to a given **propositional calculus problem**

Range
Application of set theory Definitions, Venn diagrams, Euler diagrams, inclusion, subsets, notation Universal sets, empty sets, finite and infinite sets Boolean operations on sets: intersection, union, difference, complement predicates; laws of set theory; idempotent, associative, commutative, distributive, identity, involution, De Morgan's laws **Propositional calculus problem** Simple and compound propositions, conjunction, disjunction, negation, implication and bi-implication, truth tables, validity, principle of mathematical induction, logical argument and deductive proof Boolean laws of propositional calculus: idempotent, associative, commutative, distributive, identity, involution, complement, De Morgan's Laws

Learning outcome
The learner will: 4. Be able to apply statistical techniques to analyse data
Assessment criteria
The learner can: 4.1 Design a programming solution to solve a given **statistical analysis technique**

Range
Statistical analysis technique Frequency distribution, mean, median, variance, deviation, correlation Probability: factorial notation, permutations and combinations, laws of probability, conditional probability, Bayesian Networks, random variables

Unit 419 Network operating systems

UAN:	**K/601/0468**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with the understanding and skills needed to install, configure, troubleshoot and maintain a network operating system.

Learning outcome
The learner will: 1. Understand network operating systems principles
Assessment criteria
The learner can: 1.1 Evaluate **types** of NOS and **NOS services** 1.2 Discuss the **benefit of disaster recovery** and NOS security 1.3 Critically compare a selection of current NOS's in use

Range
Types Linux, Windows, Novell, Apple, Unix, **NOS Services** Applications Disk storage Printing Backup/Recovery Domain control Central upgrades/patches User accounts External connectivity Security Remote management DNS **Benefit of disaster recovery** Disaster recovery plans Less downtime Prevention of data loss Prevention of financial loss Increased client confidence Continued production Compliance with industry codes Credibility/Goodwill Standby systems **Benefit of NOS security** Reduced risk to services/data Reduced costs (downtime) Increased network performance/uptime Firewalls Secure domains System management Limits access

Learning outcome
The learner will: 2. Be able to plan the implementation of network operating systems
Assessment criteria
The learner can: 2.1 Plan the **implementation** of a NOS for a required service to meet a given specification 2.2 Evaluate the plan and analyse user **feedback**

Range
Implementation Service Level Agreement (SLA) Data migration Installation plan Test plan Test data Services Applications Disk storage Printing Backup/Recovery Central upgrades/patches User accounts External connectivity Physical installation Technical support Network security Network maintenance User training **Feedback** Test results Installation log Evaluation/analysis report

Learning outcome
The learner will: 3. Be able to implement network operating systems
Assessment criteria
The learner can: 3.1 Implement a NOS service based on a **prepared plan** 3.2 **Test** the NOS to meet user requirements 3.3 Document and analyse **test results** against expected results

Range
Prepared plan SLA Installation plan **Test** Sandboxing White box/black box testing **Test results** SLA review Test plan Test log Test results Actual results Expected results Client feedback Analysis documentation

Learning outcome
The learner will: 4. Be able to manage network operating systems
Assessment criteria
The learner can: 4.1 Establish and justify a **performance baseline** 4.2 Monitor **NOS performance** against the baseline 4.3 Justify **performance optimisation** and update to NOS

Range
Performance baseline Determining a baseline under normal working conditions Benchmark testing of data transfer Aligning network performance baselines with SLA **NOS performance** Installation log Changes/Update log Network performance log Fault log Maintenance log **Performance optimisation** System performance Fault log Maintenance log User Feedback

Unit 420 Networking technologies

UAN:	**M/601/0472**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with an understanding of the principles and components involved in computer networking. Learners will develop their skills to be able to design, implement and support new and existing computer network installations

Learning outcome
The learner will: 1. Understand networking principles
Assessment criteria
The learner can: 1.1 Discuss the benefits and constraints of different networking **systems types** and **topologies** 1.2 Evaluate the impact of current network technology, **communication** and **standards** 1.3 Discuss how **protocols** enable the effective utilisation of different networking systems

Range
Systems types peer to peer, client-server, cloud, cluster, centralised, virtualised **Topologies** star, bus, ring, mesh **Communication** bandwidth, throughput **Standards** OSI model, TCP/IP model, IEEE 802.x **Protocols** relationship to networking standards; purpose of protocols; routed protocols: IPv4, IPv6, FTP, HTTP, SMTP, POP3, SSL; management of protocols for addressing; routing protocols: RIP, RIPv2, OSPF, OSPFv3, BGP

Learning outcome
The learner will: 2. Understand networking components
Assessment criteria
The learner can: 2.1 Discuss the role of **software and hardware components** 2.2 Discuss **server types** and **selection** requirement 2.3 Discuss the inter-dependence of **workstation hardware** with network components

Range
Software components: client software, server software, client operating system, server operating system, network management systems **Hardware components**: workstation, laptop, fixed, handheld, console; servers; switches; routers; cabling; hubs; repeaters; bridges; wireless devices; mobile: 3G,4G, GPRS, firewall **Server type**: firewall, email, web, file, database, combination, virtualisation, terminal services server **Server selection:** cost, purpose, operating system requirement, environment, **Workstation hardware**: network card, cabling, system bus, graphics, memory, processor, I/O devices

Learning outcome
The learner will: 3. Be able to design networked systems
Assessment criteria
The learner can: 3.1 Design a networked system to meet a given **specification** 3.2 Evaluate the design and analyse user **feedback**

Range
Specification Location: Server room, devices, workstations, peripherals, Devices: access routers, distribution routers, core switches, layer 3 switches; installation of routing devices; allocation of networks; routing device configuration Purpose: usage and functions, Users: Stakeholders, quality expectations Services: DHCP, DNS, SMTP, FTP, monitoring

Specialised configuration: routing protocol, redistribution, interfaces, network address allocation, security features, VLAN,

Security: ACL's (Access Control Lists), MD5 authentication, routing device, quality of service needs

Connectivity: suitable bandwidth, communication infrastructure, throughput

Standards: 802.x

Bandwidth: expected average load; anticipated peak load; local internet availability

Communications: suited to devices, suited to users, supportive of business/ lifestyle aims and objectives

Constraints; cost, distances, infrastructure

Scalable: redundancy, able to support device growth & addition of communication

devices, able to cope with bandwidth use & trend changes, protocol utilisation,

addressing

Testing: local communication, end-to-end communication; security; bandwidth; routing table validity

Feedback: performance, user

Learning outcome
The learner will: 4. Be able to implement and support networked systems
Assessment criteria
The learner can: 4.1 **Implement** a networked system based on a prepared design 4.2 **Test** the network system to meet user requirements 4.3 Document and analyse test results against **expected results** 4.4 Recommend potential enhancements for the networked systems 4.5 Design a **maintenance schedule** to support the networked system

Range
Implement: install, configure **Test:** baseline, throughput, Range (wireless), configuration, connectivity, security, share, remote access **Expected results:** baseline, throughput, Range (wireless), configuration, connectivity, security, share, remote access **Maintenance schedule:** preventative maintenance, routine maintenance, anti-virus, firewall, back-up, UPS, disk, file, users. Schedule: daily, weekly, monthly, annually, out-of-hours , downtime,

Unit 421 Object-oriented programming

UAN:	**K/601/1295**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with an understanding of how object-orientated programming technologies are used in programming and systems development. Learners will also be able to design, create, implement and test programming solutions.

Learning outcome
The learner will: 1. Understand the principles of object-oriented programming
Assessment criteria
The learner can: 1.1 Discuss the **principles, characteristics and features** of objected oriented programming

Range
Principles, characteristics and features Differences between procedural, object-orientated and event-driven programming Object orientated programming languages (e.g. C++, C#, Fox Pro, Java, Cobol etc.) Top-down design Bottom-up design ASCII Object modelling GUI Reusable objects

Learning outcome
The learner will: 2. Be able to design object oriented programming solutions
Assessment criteria
The learner can: 2.1 Identify the **objects and data and file structures** required to implement a given design 2.2 Design an **object oriented programming solution** to a given problem

Range
Objects and data and file structures Classes Public Private Protected Functions Parameters Strings List containers Structures Enumerations Exceptions Variables Arrays Files Streams Unions **Object orientated programming solution** Design specifications Inputs Outputs File handling Iteration Conditional statements Logical operators Boolean Inheritance Constructors Destructors

Learning outcome
The learner will: 3. Be able to implement object oriented programming solutions
Assessment criteria
The learner can: 3.1 Implement an objected oriented solution based on a prepared design 3.2 Define **relationships between objects** to implement design requirements 3.3 Implement object behaviours using **control structures** to meet the design algorithms 3.4 Make effective use of an Integrated Development Environment (IDE), including code and screen templates

Range
Relationships between objects Conditional statements Logical operators Parameters Classes Functions **Control structures** Conditional statements Logical operators Return values

Learning outcome
The learner will: 4. Be able to test and document object oriented programming solutions
Assessment criteria
The learner can: 4.1 Critically review and test an object-orientated programming solution 4.2 Analyse actual test results against expected results to identify discrepancies 4.3 Evaluate independent feedback on a developed object-oriented programme solution and make recommendations for improvements 4.4 create onscreen help to assist the users of a computer program 4.5 create documentation for the support and maintenance of a computer program

Range
Review and test Test plan Test log Test data Functionality testing (user environments) Load testing **Test results against expected results** Test log Expected results Actual results Documenting errors **Independent feedback** End user feedback Verify values are passed as intended Navigation **Onscreen help** Error messages End user guidance Validation **Documentation** User manual Technical manual

Unit 423 Procedural programming

UAN:	**D/601/1293**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with an understanding of how procedural programming technologies are used in programming and systems development. Learners will also be able to design, create, implement and test programming solutions.

Learning outcome
The learner will: 1. Understand the principles of procedural programming
Assessment criteria
The learner can: 1.1 Discuss the **principles, characteristics and features** of procedural programming

Guidance
Principles, characteristics and features
Differences between procedural, object-orientated and event-driven programming
Procedural programming languages (e.g. Pascal, C, Fortran, Perl, etc.)
Top-down design
Bottom-up design
ASCII
Object modelling
GUI
Reusable objects

Learning outcome
The learner will: 2. Be able to design procedural programming solutions
Assessment criteria
The learner can: 2.1 Identify the program units and data and file structures required to implement a given design 2.2 Design a **procedural programming solution** for a given problem

Range
Procedural programming solution Design specifications Inputs Outputs File storage Memory

Learning outcome
The learner will: 3. Be able to implement procedural programming solutions
Assessment criteria
The learner can: 3.1 Select and implement **control structures** to meet the design algorithms 3.2 Correctly use **parameter passing mechanisms** 3.3 Implement a **procedural programming solution** based on a prepared design

Guidance
Control structures Design specification Conditional statements Logical operators **Parameter passing mechanisms** Initial values Return values Conditional statements Logical operators Parameters Functions Procedures

Procedural programming solution

Design specification

Version control

Layout

Input/Output

Learning outcome
The learner will: 4. Be able to test procedural programming solutions
Assessment criteria
The learner can: 4.1 Critically review and test a procedural programming solution 4.2 Analyse actual test results against expected results to identify discrepancies 4.3 Evaluate independent feedback on a developed procedural programme solution and make recommendations for improvements 4.4 Create onscreen help to assist the users of a computer program 4.5 Create documentation for the support and maintenance of a computer program

Unit 424 Research skills

UAN:	**D/601/1276**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with the research skills and knowledge needed, in order to explore a range of sources, to extract information and to produce a research proposal for a given topic.

Learning outcome
The learner will: 1. Understand different research methodologies
Assessment criteria
The learner can: 1.1 Assess **different research methodologies** 1.2 **Justify the use of a research methodology** to be used for the research proposal 1.3 Discuss the importance of both **qualitative and quantitative data** in research 1.4 Explain the **problems** that can arise when undertaking research

Range
Different research methodologies Books Internet Forums Questionnaires Team working Note taking Quantitative Direct observation Focus groups Interviews Case studies **Justify the use of a research methodology** Critical analysis Goals Primary sources of information Secondary sources of information Objectivity **Qualitative and quantitative data** Qualitative • In-depth interviews • Open-ended questions • Limited responses Quantitative • Pre-coded questionnaires • Direct questions • Volume of responses **Problems** Information overload Plagiarism Copyright Accuracy Validity Redundancy Personal safety online Information out of date Bias Limited forum of information

Learning outcome
The learner will: 2. Know how to conduct a literature review
Assessment criteria
The learner can: 2.1 Justify the **use of research sources** 2.2 Evaluate the importance of **using primary information** sources 2.3 Describe a **recognised system for referencing**

Range
Use of research sources Literature research review Research aims and objectives Comparison with other research sources Validity Copyright Bias/Unbiased Topics strengths and/or weaknesses **Using primary information** Conveying accurate knowledge and ideas to others Validity Copyright Unbiased information **Recognised system for referencing** Organised review Listing sources of information Titles of journals, article and date Authors URL details Bibliography Referencing to set guidelines

Learning outcome
The learner will: 3. Be able to present a research proposal
Assessment criteria
The learner can: 3.1 Present a **research proposal** to a defined audience utilising appropriate survey techniques 3.2 Discuss the **role of ethics in research**

Range
Research proposal Research/programme description/summary Future tense Hypotheses Expected results Literature reviews Preliminary results Details of the researcher(s) Researchers subject competencies **The role of ethics in research** Honesty Integrity Respect Objectivity Accuracy Confidentiality Copyright Open to criticism Responsibility Legal issues Non-Discriminator

Learning outcome
The learner will: 4. Be able to contribute to a research seminar
Assessment criteria
The learner can: 4.1 **Prepare an extract from the research proposal** appropriate to a seminar environment 4.2 Provide **constructive feedback on proposals** presented within the seminar environment

Range
Prepare an extract from the research proposal Audience Interest Time Topics strengths and/or weaknesses **Constructive feedback on proposals** Communication skills Open to criticism Justification Honesty Integrity Accuracy Sources of information Confidentiality

Unit 425 Routing concepts

UAN:	**Y/601/1423**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with an understanding of the impact of routing technologies. Learners will also develop their skills to design, implement, troubleshoot, and monitor complex routed environments.

Learning outcome
The learner will: 1. Understand the impact of routing technologies
Assessment criteria
The learner can: 1.1 Evaluate current **routing hardware** and **routing protocols** 1.2 Evaluate device and network **management** 1.3 Evaluate current security requirements

Range
routing hardware: access routers, distribution routers, core switches, layer 3 switches, gateways, **routing protocols** OSPF, IS-IS, IGRP, EIGRP, BGP, RIP, static routing **Management** device: password control, access levels, configuration storage, remote access network: address allocation, interface configuration, load balancing, mirroring, route costing, changing metrics, hop-count

Learning outcome
The learner will: 2. Be able to design complex routed environments
Assessment criteria
The learner can: 2.1 Design a **routed environment** to meet a given specification 2.2 Evaluate design and analyse user feedback

Range
Routed environment: Location: Server room, devices, workstations, peripherals, Devices: access routers, distribution routers, core switches, layer 3 switches; installation of routing devices; allocation of networks; routing device configuration Purpose: usage and functions, Users: Stakeholders, quality expectations Services: DHCP, DNS, SMTP, FTP, monitoring Specialised configuration: routing protocol, redistribution, interfaces, network address allocation, security features, VLAN, Security: ACL's (Access Control Lists), MD5 authentication, routing device, quality of service needs Connectivity: suitable bandwidth, communication infrastructure, throughput Standards: 802.x Bandwidth: expected average load; anticipated peak load; local internet availability Communications: suited to devices, suited to users, supportive of business/ lifestyle aims and objectives Constraints; cost, distances, infrastructure Scalable: redundancy, able to support device growth & addition of communication devices, able to cope with bandwidth use & trend changes, protocol utilisation, addressing Testing: local communication, end-to-end communication; security; bandwidth; routing table validity **Feedback:** performance, user.

Learning outcome
The learner will: 3. Be able to implement complex routed environments
Assessment criteria
The learner can: 3.1 **implement** a routed environment from a design specification 3.2 **test** the routed environment 3.3 document and analyse test results

Range
Implement: install, configure **Test:** baseline, throughput, Range (wireless), configuration, connectivity, security, share, remote access

Learning outcome
The learner will: 4. Be able to troubleshoot and monitor routed environments
Assessment criteria
The learner can: 4.1 Monitor and evaluate **infrastructure performance** against a given specification 4.2 Resolve issues to **improve performance**

Range
Infrastructure performance: network monitoring tools, user access, traffic analysis, bandwidth monitoring, delay, packet loss, throughput, checking configuration, checking rules, show commands, traceroute, system logs, sniffers, end user metrics **Improve performance:** use troubleshooting methodology; make change to resolve issue; prove resolution

Unit 426 Software applications testing

UAN:	**L/601/1984**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with the principles of software application testing. Learners will develop their skills to test, implement and evaluate software applications prior to commercial deployment regardless of the software language being used.

Learning outcome
The learner will: 1. Understand the principles of software application testing
Assessment criteria
The learner can: 1.1 Evaluate testing techniques applicable to the testing opportunity 1.2 Compare the relative benefits of different testing methodologies 1.3 Justify a proposed testing methodology

Learning outcome
The learner will: 2. Be able to design test strategies
Assessment criteria
The learner can: 2.1 Design a test strategy for a given testing opportunity 2.2 Design a test plan for a given testing opportunity 2.3 Justify the test plan proposition and testing strategy

Learning outcome
The learner will: 3. Be able to implement test plans
Assessment criteria
The learner can: 3.1 **Implement a test plan** based on a given testing opportunity

Range
Implement a test plan Test plan Test data Test log Reporting of malfunctions Developers not to test own work

Learning outcome
The learner will: 4. Be able to evaluate test plans
Assessment criteria
The learner can: 4.1 Critically **review the test outcomes** 4.2 **Justify the validity of the test** and identify any potential issues

Range
Review the test outcomes Testing report Critical review of any failures Analyse all test results Comparison to design specification End user/tester feedback Peer reviews **Justify the validity of the test** Test results Compare test used with alternatives Maximised test coverage Technical documentation Recording changes resulting from testing

Unit 427 Solving problems by making effective decisions in the workplace

UAN:	**A/503/9642**
Level:	Level 4
Credit value:	3
GLH:	14
Aim:	The purpose of this unit is to enable learners to make effective decisions to solve complex decisions in the workplace

Learning outcome
The learner will: 1. Be able to analyse a complex problem in the context of the workplace
Assessment criteria
The learner can: 1.1 Define a complex problem in the workplace including its scope and impact 1.2 Analyse information on the identified problem, to help inform the decision-making process

Guidance
Complex problems with multiple possible solutions as a challenge and an opportunity for improvement Ways to recognise, investigate, and analyse complex problems such as Root Cause Analysis (RCA), Cause and Effect, Ishikawa, Why-Why, and brainstorming and a range of other creative thinking techniques Framing and scoping problems with a 'Problem Definition' Setting objectives in relation to problems Collecting primary and secondary data for decision making Data analysis techniques for quantitative and qualitative data Differences between 'data' and 'information'

Learning outcome
The learner will: 2. Be able to apply decision making techniques when assessing possible solutions

Assessment criteria
The learner can: 2.1 Propose a range of alternative solutions to the problem 2.2 Using a decision-making technique, evaluate a range of solutions to identify the most appropriate option

Guidance
Conditions under which decisions are made (certainty, uncertainty) Creative and rational decision-making Techniques for generating creative solutions and rational solutions in decision-making Establishing criteria for decision-making Setting priorities Evaluating options Rational decision-making models and techniques such as grid analysis, paired comparison analysis, decision trees, 'pros and cons' Creative decision-making using brainstorming and a range of other creative thinking techniques Types of decisions (routine, adaptive, innovative etc) Decision making in relation to goals which specify the quality or quantity of the desired results

Learning outcome
The learner will: 3. Be able to plan how you will implement the solution
Assessment criteria
The learner can: 3.1 Develop a detailed plan for implementing the solution 3.2 Communicate the plan to relevant stakeholders 3.3 Assess appropriate monitoring and review techniques to ensure successful implementation of solution

Guidance
Implementation planning (for example – human resources, finance, marketing, operations, health and safety) Resource allocation (money, people, facilities, equipment etc) Implementation planning tools and techniques such as GANTT charts, PDCA Cycle (plan-do-check-act), PDSA (plan-do-study-act) SMART objectives Communication plans Monitoring and review techniques such as Critical Path Analysis (CPA), Programme Evaluation and Review (PERT)

Unit 428 Systems analysis and design

UAN:	**K/601/1281**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with the skills and knowledge needed in order to undertake a systems analysis and design investigation using recognised methodologies.

Learning outcome
The learner will: 1. Understand different systems life cycles
Assessment criteria
The learner can: 1.1 Evaluate **different systems** lifecycle models 1.2 Discuss the importance of **following a procedural/staged lifecycle** in a systems investigation

Range
different systems Waterfall Spiral Agile V-shape SDLC Hybrid Model strengths/weaknesses **Following a procedural/staged lifecycle** Standardisation Methodical approach Analyse each step Collate information Ensuring correct design Minimising costs Robust evaluation to aid future development

Learning outcome
The learner will: 2. Understand the importance of a feasibility study
Assessment criteria
The learner can: 2.1 Discuss the components of a feasibility report 2.2 Assess the **impact of different feasibility criteria** on a systems investigation

Range
Impact of different feasibility criteria Strategic review of the project Risks to existing business Spiralling costs Lack of control Cancellation of project Advantages/disadvantages of any proposals

Learning outcome
The learner will: 3. Be able to perform a systems investigation
Assessment criteria
The learner can: 3.1 Undertake a **systems investigation to meet a business need** 3.2 Use appropriate **systems analysis tools and techniques** to carry out a systems investigation 3.3 Create documentation to support a systems investigation 3.4 Evaluate how user and systems requirements have been addressed

Range
Systems investigation to meet a business need Selection of a modelling methodology The operation of the business The business goals/needs Justification of a modelling methodology **Systems analysis tools and techniques** Collation of information Interviews Research Client specifications

Unit 429 Systems architecture

UAN:	**A/601/3505**
Level:	Level 4
Credit value:	10
GLH:	80
Aim:	The purpose of this unit is to provide learners with an understanding of the architecture and components used in a computer system. On completion of this unit learners will have a fuller understanding of hardware and software architectures and could enable progression to further systems support units such as Windows Internals.

Learning outcome
The learner will: 1. Understand the representation of information within a computer and the way it is processed
Assessment criteria
The learner can: 1.1 Explain how **number systems** and **data representation** are used to store information in a computer 1.2 Explain the role of **input, output and storage devices** 1.3 Describe the characteristics of C.P.U. components and the operation of the Fetch Execute Cycle 1.4 Describe the operation of a peripheral device, controller hardware and physical connection using correct technical terminology and reference to relevant standards

Range
Number systems Denary; Hexadecimal; Binary and Octal **Data representation** Converting between number bases; Boolean Logic; truth tables; logic gates; coding of data; types of data **Input, output and storage devices** I/O Maps; Direct memory; ROM; Cache; RAM; Static; dynamic

Learning outcome
The learner will: 2. Use and develop the operating environment of current computer systems
Assessment criteria
The learner can: 2.1 Use and configure **operating system interfaces and functions** 2.2 Explain the role of **process management and concurrent processes** in computer operating systems 2.3 Describe how operating system features can contribute to data and system security

Range
Operating system interfaces and functions Modifications to suite user need; log ins; file systems; directory services **Process management and concurrent processes** Processes and threads; Main memory; File sytems; I/O; Protection and security

Learning outcome
The learner will: 3. Understand the communication process in distributed operating systems and computer networks
Assessment criteria
The learner can: 3.1 Describe the function and operation of **distributed operating systems** 3.2 Describe the functions of data communications systems in enabling network and distributed systems

Range
Distributed operating systems Filing; Automation; storage

Learning outcome
The learner will: 4. Understand distributed applications and transaction processing in mainframe systems
Assessment criteria
The learner can: 4.1 Describe the operation and functions of mainframe systems 4.2 Describe the evolution of and characteristics of distributed applications 4.3 Describe data and process distribution 4.4 Explain **distribution and transaction transparency**

Range
Distribution and transaction transparency ISO; Reference model of open distributed processing

Unit 430 Understanding financial management

UAN:	**F/503/9660**
Level:	Level 4
Credit value:	3
GLH:	12
Aim:	The purpose of this unit is for learners to develop an understanding of finance within the context of an organisation, as required by a practising or potential middle manager.

Learning outcome
The learner will: 1. Understand finance within the context of an organisation
Assessment criteria
The learner can: 1.1 Describe the organisation's sources of finance or funding 1.2 Analyse the range of financial stakeholders and explain their various expectations of the organisation 1.3 Explain the importance of cash flow forecasting and cash flow management to the organisation 1.4 Provide a general assessment of business/organisational performance using appropriate financial measures

Guidance
Financial information and its value for management and decision-making Principles of Management accounting Income & Expenditure Accounts (for non-profit organisations) Financial measures of business/organisational performance – calculation and interpretation of Accounting Ratios Cash, profit and cash flow forecasting and credit control Sources of finance/funding and their characteristics Range of stakeholders and their various expectations of the organisation Role of the management accountant – as provider of management information

Learning outcome
The learner will: 2. Understand the value of management accounting
Assessment criteria
The learner can: 2.1 Explain the role of financial performance indicators in monitoring the achievement of objectives 2.2 Explain the purposes of the main financial documents used within the organisation

Guidance
Performance indicators and their role in achieving objectives Source documents in accounting (invoices, etc) Balance Sheet, Profit & Loss Account

Learning outcome
The learner will: 3. Understand budgets for the management of own area of operation
Assessment criteria
The learner can: 3.1 Explain the process of budget setting used in the organisation 3.2 Explain how to use budgetary techniques to contribute to controlling cost in own area of operation

Guidance
Nature and purpose of financial and non-financial budgets Methods of preparing budgets Zero based budgets Budgetary techniques for controlling operations How variances are calculated and used to analyse extent, source and cause of budgetary deviation Variable budgets Techniques for monitoring and controlling costs

Unit 431 Website design

UAN:	**J/601/1286**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with the understanding and skills needed to design, implement and test interactive websites.

Learning outcome
The learner will: 1. Understand website design concepts
Assessment criteria
The learner can: 1.1 Discuss the **design concepts** that have to be considered when designing a web site

Range
design concepts Intended audience Intended users Information only Real-time environment Data capture Internal navigation External connectivity Graphics Interface Content Mobile devices Data Protection Copyright Animation/sound

Learning outcome
The learner will: 2. Be able to design interactive websites
Assessment criteria
The learner can: 2.1 Design an interactive website to meet given requirements 2.2 **Evaluate website design** with other users

Range
Evaluate website design
User feedback
User forums
Site comparison
Disaster recovery
Security

Learning outcome
The learner will: 3. Be able to implement interactive websites
Assessment criteria
The learner can: 3.1 implement a **fully-functional interactive website** using a design specification.

Range
Fully-functional interactive website
Specification
Layout
Navigation
Pages
Frames
Toolbox components
Internal navigation
External connectivity
Content
Animation/sound
Help files
Shopping cart
Compliances

Learning outcome
The learner will: 4. Be able to test interactive websites
Assessment criteria
The learner can: 4.1 Critically review and test the website 4.2 Analyse actual test results against expected results to identify discrepancies 4.3 Evaluate independent feedback and make recommendations for improvements 4.4 Create onscreen help to assist the users 4.5 Create documentation for the support and maintenance of the website

Unit 432 Website management

UAN:	**R/601/1288**
Level:	Level 4
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with the understanding and skills necessary for managing and maintaining websites.

Learning outcome
The learner will: 1. Understand the functions of website hosting
Assessment criteria
The learner can: 1.1 Explain the **methods and techniques required** to host a website 1.2 Evaluate the different **services offered by web host providers** 1.3 Explain **the legal requirements** of hosting an online website

Range
Methods and techniques required Web server Bandwidth Storage capacity IP address Direct internet connectivity Routers Listening software Performance/maintenance software **Services offered by web host providers** Data centre space Web management Protection Email hosting Redirection Visitor analysis

The legal requirements
Displaying company information Companies Act Business Names Act Privacy policy Data Protection Act Terms and Conditions Consumer Protection Regaulations EU Electronic Commerce Regulations Web Accessibility and the Disability Discrimination Act Payment Card Industry Data Security Standard (PCI DSS) e-Commerce Regulations Financial transaction security EU Anti Spam Opt in Opt out Statements EU Cookie Directive Consents

Learning outcome
The learner will: 2. Be able to upload and manage websites
Assessment criteria
The learner can: 2.1 Demonstrate the **upload of a website** to a web server 2.2 Perform **website maintenance to sustain maximum efficiency** and performance

Range
Upload of a website User account/ISP FTP Web files **Website maintenance to sustain maximum efficiency** Access speed Optimisation Connection speed testing Updating web files

Learning outcome
The learner will: 3. Be able to improve website performance
Assessment criteria
The learner can: 3.1 Discuss how to monitor the **performance of a website** 3.2 Analyse **statistics relating to visitors** accessing a website 3.3 Explain the **methods and techniques used to gather visitor feedback** for a website

Range
Performance of a website Access speed Connection speed testing Internal/external links Web host information/analysis Site visitor feedback **Statistics relating to visitors** Hit counter Visitor tracking services Visitor status/access history Visitor location Search keywords used by visitors Visitor browser information Visitor access times Tracking individual IP Sources of website traffic **Methods and techniques used to gather visitor feedback** Webpage feedback tools Web rating Email Visitor comments page Hit counter

Learning outcome
The learner will: 4. Be able to promote websites
Assessment criteria
The learner can: 4.1 Explain the methods and techniques required to promote a website 4.2 Evaluate the different **features that are available to enhance and upgrade a website**

Range
Features that are available to enhance and upgrade a website
User forums
Video/sound
Email
Improving access speeds
Free services/downloads
Visitor feedback
Currency of content
Ease of use
Site map
Payment facilities

Unit 437 Business intelligence

UAN:	**T/506/8167**
Level:	Level 4
Credit value:	15
GLH:	66
Aim:	The aim of this unit is to provide learners with an understanding of how technologies are used to deliver Business Intelligence (BI) software solutions. Learners will be able to design, create, implement and test BI solutions including associated reporting.

Learning outcome
The learner will: 1. Understand Business Intelligence (BI) system
Assessment criteria
The learner can: 1.1 Examine the **characteristics** of a Business Intelligence (BI) system 1.2 State the rationale for using Business Intelligence (BI) systems

Range
Characteristics
Online Analytical Processing (OLAP), multi-dimensional modelling, data warehouse, Extract Transform Load (ETL), reporting.

Learning outcome
The learner will: 2. Be able to design Business Intelligence solutions
Assessment criteria
The learner can: 2.1 Produce a data mapping document for the Extract Transform and Load (ETL) process 2.2 Design Extract Transform and Load (ETL) methods to prepare data for Business Intelligence systems 2.3 Design the Online Analytical Processing (OLAP) cube,

specifying dimensions and measures

Learning outcome
The learner will: 3. Be able to implement Business Intelligence solutions
Assessment criteria
The learner can: 3.1 Create a data warehouse according to design documentation 3.2 Create Extract Transform and Load (ETL) methods according to data mapping document 3.3 Use Extract Transform and Load (ETL) methods to populate a data warehouse 3.4 Implement reporting according to a specification

Learning outcome
The learner will: 4. Be able to test and document Business Intelligence solutions
Assessment criteria
The learner can: 4.1 Develop a test plan to evaluate whether the implementation of the Business Intelligence solution meets the design brief 4.2 Execute a test plan to generate test log 4.3 Critically review the Business Intelligence solution developed

Unit 438 Test-driven Development

UAN:	**F/506/8169**
Level:	Level 4
Credit value:	17
GLH:	56
Aim:	The aim of this unit is to provide learners with an understanding of how Test-driven Development techniques are used in programming. Learners will be able to create and implement solutions to problems using Test-driven Development.

Learning outcome
The learner will: 1. Understand the principles of Unit Testing and Test-driven Development.
Assessment criteria
The learner can: 1.1 Explain the **principles of Unit Testing** 1.2 Evaluate the **principles and benefits of Test-driven Development** as a software development methodology 1.3 Explain the Test-driven Development **life cycle**.

Range
Principles of Unit Testing Automated, repeatable, isolated, self-validating. **Principles and benefits of Test-driven Development** Test first programming, automated testing, encourage simple design, minimise code bloat, keep developer focused on specific requirements, refactoring to acceptable standards, refactoring with confidence. **Life cycle** Get requirement - write test - compile fails - write minimum to compile - run test - test fails - write minimum for test to pass - refactor - repeat with next requirement.

Learning outcome
The learner will: 2. Understand Test-driven Development techniques.
Assessment criteria
The learner can: 2.1 Select and use the **tools** required for Test-driven Development 2.2 Critically analyse the **design patterns** that can be used for Test-driven Development.

Range
Tools Unit testing framework (eg xUnit, jUnit, nUnit, MSTest etc.), setup, teardown, assertions, exception handling, stubs and mocking frameworks. **Design Patterns** Dependency injection: constructor injection, property/setter injection, factory pattern, inheritance (extract and override). Stubs: manually, external framework. Mocks.

Learning outcome
The learner will: 3. Be able to implement a Test-driven Development Solution.
Assessment criteria
The learner can: 3.1 Implement a solution to a given problem using Test-driven Development 3.2 Explain **dependencies** to a given problem 3.3 Implement a solution to a problem to deal with identified dependencies 3.4 Make effective use of an Integrated Development Environment (IDE), including code and screen templates.

Range
Dependencies Database, file system, time of day, email system, external web service.

Learning outcome
The learner will: 4. Be able to test and evaluate a solution using Test-driven Development.
Assessment criteria
The learner can: 4.1 **Test** a solution to a given problem built using Test-driven Development 4.2 Critically **review** a solution to a problem built using Test-driven Development.

Range
Test Range testing, exception, code coverage, external dependencies, refactoring. **Review** Trivial tests, severe/brittle tests, difference between mocks and stubs, test first approach.

Unit 500 Distributed software applications

UAN:	**M/601/1525**
Level:	Level 5
Credit value:	15
GLH:	60
Aim:	The aim of this unit is to give learners a fuller understanding of the principles of distributed computing so that they can apply this to the design and building of software. On completion of this unit learners will have a fuller understanding of the purpose of distributed software applications that could lead to a role within software development.

Learning outcome
The learner will: 1. Understand the principles of distributed computing
Assessment criteria
The learner can: 1.1 Discuss the **principles, characteristics and features** of distributed computing 1.2 Critically evaluate the **impact** of distributed software applications delivered on distributed computing platforms

Range
Principles, characteristics and features Understanding frameworks and protocols, the selection classes and libraries, understand the suitability of existing system and communication between components **Impact** fault tolerance; availability; scalability; security

Learning outcome
The learner will: 2. Be able to design distributed software applications
Assessment criteria
The learner can: 2.1 **Design a distributed software application** for a given problem 2.2 Explain the **components and data and file structures** required to implement a given design

Range
Design a distributed software application Select a suitable language; selection of suitable development environment; select a suitable design methodology; use of appropriate diagrams. **Components and data and file structures** Input; output; processes; dependencies; remote and local exchange of data.

Learning outcome
The learner will: 3. Be able to implement distributed software applications
Assessment criteria
The learner can: 3.1 **Implement** a distributed software application solution based on a prepared design 3.2 Define relationships between components to implement design requirements 3.3 Identify and implement opportunities for **error handling and reporting** 3.4 **Make effective use of an Integrated Development Environment** (IDE) including code and screen templates

Range
Implement Controls; event handler; event-driven triggers, menus and debugging tools **Error handling and reporting** Debugging tools; **Make effective use of an Integrated Development Environment** Source code editor and compiler

Learning outcome
The learner will: 4. Be able to test distributed software applications
Assessment criteria
The learner can: 4.1 Critically review and **test** a distributed software application 4.2 Analyse actual test results against expected results to identify discrepancies 4.3 Evaluate **independent feedback** on a developed distributed software application and make recommendations for improvements 4.4 Create **user documentation** for the developed distributed software application 4.5 Create **technical documentation** for the support and maintenance of a distributed software application

Range
Test Debugging code; comment code; naming conventions; user requirements checks **Independent feedback** User groups; forums; questionnaire's **User documentation** Online / offline help files **Technical documentation** Designs; file structures and required maintenance

Unit 500 Distributed software applications

Supporting information

Guidance

There are both commercially available programming languages as well as free languages capable of supporting distributed components, mobile platforms must be covered within this unit; free emulators are available to support this.

Unit 501 Internet server management

UAN:	**A/601/1513**
Level:	Level 5
Credit value:	15
GLH:	60
Aim:	The aim of this unit is to enable and develop learners' skills in managing and securing internet servers. On completion of this unit learners will be better prepared to pursue a career in server support and server management, this could also lead to supporting the study of a vendor qualification.

Learning outcome
The learner will: 1. Understand Internet technologies
Assessment criteria
The learner can: 1.1 Critically evaluate **different Internet technologies** and **communication protocols** 1.2 Critically compare different **Internet services** and Internetworking servers 1.3 Discuss network **management concerns** and make recommendations to sustain network security, reliability and performance

Range
Different Internet technologies Technologies e.g. hub; switch; routers; firewalls; cabling; servers **Communication protocols** TCP/IP; OSI; DNS; DHCP also consider internet organisations such as ICANN and IEEE **Internet services** Intranet; email; certificate services; FTP; proxy servers and ecommerce servers

Management concerns
Ethical and legal issues; server performance and user access; costs

Learning outcome
The learner will: 2. Understand Internet server architectures
Assessment criteria
The learner can: 2.1 Critically analyse different internet **server technologies** and their performance 2.2 Explain the **hardware and software components** of an Internet server

Range
Server technologies Architecture and server structure **Hardware and software components** CPU; storage devices; operating system and memory

Learning outcome
The learner will: 3. Be able to implement Internet server and services
Assessment criteria
The learner can: 3.1 Produce a **system specification** to meet a given requirement 3.2 Evaluate the suitability of Internet server components 3.3 Build and **configure** an Internet server including services to meet a given requirement 3.4 Critically review and test an Internet server

Range
System specification evaluation of infrastructure; suitable servers; configuration; domain names and URL's **Configure** FTP; SMTP; Proxy; port numbering; address hosting and certificate authority

Learning outcome
The learner will: 4. Be able to manage Internet server and services
Assessment criteria
The learner can: 4.1 Install and **manage websites and services** to meet a given requirement 4.2 Implement secure network access to meet a given requirement 4.3 **Monitor and troubleshoot** an Internet server and services 4.4 Critically evaluate the performance of an Internet server

Range
Manage websites and services CGI (common Gateway Interface); Active server pages; FTP; SMTP; network security **Monitor and troubleshoot** Configuring sites; remote and centralised logging; service configurations and usage

Unit 502 IT virtualisation

UAN:	**A/601/1933**
Level:	Level 5
Credit value:	15
GLH:	60
Aim:	The aim of this unit is to provide learners with an understanding of virtual environments as an option to more traditional computing. Learners will understand virtual servers and desktop environments and develop their skills to design, implement and manage virtualisation environments, on completion of this unit learners will have a deeper understanding of the importance and relevance of virtualisation and be better prepared to pursue a career in this field.

Learning outcome
The learner will: 1. Understand the commercial impact and potential of virtualisation
Assessment criteria
The learner can: 1.1 Evaluate **current** virtualisation solutions 1.2 Discuss the **potential benefits** of virtualisation 1.3 Discuss the current **technology requirements** for implementing virtualisation

Range
Current Commercial and freeware and platforms **Potential benefits** Scalability; cost reductions; technology and support **Technology requirements** Virtual drivers, cloud solutions; network connection

Learning outcome
The learner will: 2. Be able to design virtualisation deployments
Assessment criteria
The learner can: 2.1 Complete a **needs analysis** for a virtualisation deployment 2.2 Design a **virtualisation solution** for a given virtualisation deployment

Range
Needs analysis user requirements; storage; solution needs; testing; interaction and hardware requirements **Virtualisation solution** selection of virtual environment; memory required, storage; security; network addressing and users

Learning outcome
The learner will: 3. Be able to implement virtualisation deployments
Assessment criteria
The learner can: 3.1 Maintain a virtualisation solution 3.2 Systematically **test** the virtualisation environment 3.3 Document and **analyse test results**

Range
Test and analyse test results Produce documentation, monitor hardware and software systems

Learning outcome
The learner will: 4. Be able to manage virtualisation environments
Assessment criteria
The learner can: 4.1 **Monitor** the virtualisation environment 4.2 **Maintain** a virtualisation environment 4.3 Critically review and analyse findings

Range
Monitor User access including privileges; performance levels; network access time

Maintain
Usability; compatibility and performance

Unit 503 Local area networking technologies

UAN:	**L/601/1547**
Level:	Level 5
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners within an understanding of local area networking concepts, models and management processes and apply them in a practical situation. Learners will design, build and test a Local Area Network and implement the systems and processes to manage and improve network security, performance and reliability.

Learning outcome
The learner will: 1. Understand the impact of LAN technologies
Assessment criteria
The learner can: 1.1 Critically evaluate different **LAN technologies** 1.2 Critically analyse **traffic intensive services** and their performance 1.3 Discuss **LAN concerns** and make recommendations to sustain network security, reliability and performance

Range
LAN technologies Types of network system: peer-to-peer, client-server, cluster, centralised Networking standards: IEEE 802 LAN and wireless; STP, Virtual LAN, VTP, DCHP; Conceptual models: OSI, TCP/IP Network topologies: logical (eg FDDI, Ethernet, token ring, wi-fi), physical (eg star, ring, bus) Domain structures Protocols: for addressing, for routing

LAN hardware such as switches, wireless devices, network interfaces, client dev ices

LAN concerns

Implications of failings of integrity, confidentiality and information security

Quality of service (QoS) eg DSCP, IP precedence, queues; human factors (stability, availability, delays, user information) technical factors (reliability, scalability, scheduling priorities, bit rate, data rate and delay, signal response time, packet dropping, loss, signal-to-noise ratio, interrupts, frequency response)

Access Control Lists, Media Access Control, port spanning, address filtering

Network congestion

Undesired traffic

Traffic intensive services

Traffic classification: sensitive, best-effort, undesired

Real-time streaming multimedia: eg VOIP, IP-TV, videoconferencing

Online games, industrial control systems

Service level agreements, bandwidth management, congestion avoidance

Learning outcome
The learner will: 2. Be able to design LAN infrastructures
Assessment criteria
The learner can: 2.1 Design a **LAN infrastructure** to meet a **given requirement** 2.2 Critically evaluate the suitability of **LAN components**

Range
Given requirement Intended users, network goals. Communications and internet requirements. System availability, performance, capacity, expected load. Security requirements, quality of service need. Quality expectations. Scalability and system growth. Internal and external factors, organisational culture, legislation requirements, business strategy and operating model; timescales, information requirements, business processes and functions to be supported. Cost constraints. Devices connected to network. **LAN infrastructure** Naming conventions and standards Technical schematic: topology, connection method, hub electronics, cabling

Selection of components
Security considerations; Traffic management; System monitoring; Device access

LAN components
Gateways, switches, routers, bridges, hubs, repeaters; hybrid devices
Proxy servers, firewalls,
Load balancers, and sensors
Wireless infrastructure, cabling
Workstations, wireless devices, mobile devices
Server: email, web, firewall, database, terminal services
Software components: server, client

Learning outcome
The learner will: 3. Be able to implement LAN infrastructures
Assessment criteria
The learner can: 3.1 **Build and configure** a **LAN (including services)** to meet a given requirement 3.2 Implement **network security** on a LAN 3.3 Critically **review** and **test a LAN**

Range
Build and configure Devices: server configuration, client configuration, server installation, allocation of addresses. Connectivity: Installation of communications media Documentation **LAN services** DNS, DHCP, NetBIOS, HTTP Directory services, authentication Email, printing, file storage **Network security** User authentication systems: password, biometrics, tokens Access policies: Firewall, threat management, virus protection, encryption, digital certificates **Test a LAN** Load testing, software testing, vulnerability testing, Security testing: confidentiality, integrity, authentication, availability, authorisation, non-repudiation Network monitoring tools and troubleshooting methods **Review** User access, system utilisation and performance,

System monitoring, maintenance schedule, backup schedule, upgrades, auditing. Policy review Monitor: change management and revision control

Learning outcome
The learner will: 4. Be able to manage LAN infrastructures
Assessment criteria
The learner can: 4.1 Monitor and **troubleshoot** a LAN 4.2 Resolve **LAN issues** to improve security, reliability and performance 4.3 Critically evaluate the **performance of a LAN**

Range
Troubleshoot Tools and techniques: System tools, system problem log, communications trace, status information, reason codes; error messages and error recovery Intrusion detection, Verify configuration, start-up processes **LAN issues** Relating to configuration: eg address conflicts Relating to communications: eg file and printer sharing, internet connection Relating to quality of service eg slow or intermittent connection Relating to security: eg security breach **LAN performance** Traffic loads and speeds, bandwidth utilisation, packet analysis

Unit 503 Local area networking technologies

Supporting information

Guidance

Recommended reading:

The practice of system and network administration. Second edition. Limoncelli, T, Hogan, C and Chalup, S. (Addison Wesley, 2007) ISBN 032149266

CCNA Cisco Certified Network Associate Study Guide, Exam 640-802 Lammis, T. (Cybex 2011). ISBN 0470901071

Burgess M – Principles of Network and System Administration, 2nd Edition (John Wiley and Sons Ltd, 2003) ISBN 0470868074

Unit 504 Networking infrastructure

UAN:	**A/601/1964**
Level:	Level 5
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with an understanding of the directory based infrastructure of large scale complex networked systems, their design, implementation and testing. Learners will explore concepts of addressing, resource management, privileges, security policies and naming of devices and develop their skills to design complex network infrastructure systems.

Learning outcome
The learner will: 1. Be able to design complex network infrastructure systems
Assessment criteria
The learner can: 1.1 Evaluate current **name resolution services** 1.2 Discuss the **technologies** that support network infrastructure management 1.3 Discuss **security** resources available in network infrastructure management

Range
Name resolution services For example Domain Name System (DNS), eDirectory, Active Directory; Services including addressing, access control, user management, management and security of resources; Network address translation (NAT); Internet protocols; Recursive and non-recursive queries; record caching. **Technologies** Including hardware elements: servers, clients, routers, switches, hubs, bridges, printers; Cabled, wireless, bluetooth

and 3G based systems; firewalls

Security

Provisions and policies; user and group management, access authorisation, user authentication, encryption, network traffic control; rights management;

Virtual Private network (VPN) technologies, tunnelling;

Remote Access Dial In Support (RADIUS); Terminal Access Controller Access-Control System (TACACS), IPSec,

Remote access; access lists, access times

Certificate authorities; Public Key Infrastructure (PKI)

Learning outcome
The learner will: 2. Understand the principles of network infrastructure management
Assessment criteria
The learner can: 2.1 **Design** a network infrastructure for a given networked environment 2.2 Evaluate **addressing** and **deployment solutions** for a given networked environment 2.3 Evaluate **rights** and **security requirements** for a given networked environment

Range
Design Business requirement; customer requirement; commercial requirement; service level; Mobile and remote access requirements Capacity planning; scalability; network configuration **Addressing** Naming methodologies, delivery of addresses, identification of devices and resources **Deployment solutions** Change management; resource optimisation; performance management Installing and configuring network services **Rights** User and group rights; access to files and network resources such as printers. Inheritance of rights. **Security requirements** Login and access control; auditing system activity; fault logging Remote access services; trust management

Learning outcome
The learner will: 3. Be able to implement complex network infrastructure systems
Assessment criteria
The learner can: 3.1 **Implement** a network infrastructure based on a prepared design

Range
Implementation Addressing; issue of rights; setting up security management, policies and procedures; System integration or interaction with other existing systems System documentation

Learning outcome
The learner will: 4. Be able to test complex network infrastructure systems
Assessment criteria
The learner can: 4.1 Critically review and **test** an implemented system 4.2 Evaluate **system and user assurance** of the implemented system

Guidance
System assurance Risk analysis: system security, system availability, resource utilisation, access controls Fault diagnosis and resolution Quality of Service management **User assurance** Access to files and network resources; individual and group rights **Testing** Test plan, test log, test results, troubleshooting Network performance analysis; traffic patterns and response times

Unit 505 Programming in .NET

UAN:	**H/601/1537**
Level:	Level 5
Credit value:	15
GLH:	60
Aim:	The aim of this unit is to provide learners with an understanding of the principles behind using a .Net environment. They will understand the concepts used and develop their skills to design, implement, test and document .Net solutions. On completing this unit learners will have a fuller understanding of the .Net environment and be better prepared to work with .Net languages, progression from this could be to a specific vendor qualification.

Learning outcome
The learner will: 1. Understand the principles of programming using a .NET framework
Assessment criteria
The learner can: 1.1 Discuss the **principles, characteristics and features** of programming using a .NET framework 1.2 Critically compare **different types of .NET framework** architectures 1.3 Critically evaluate the **components** that support the .NET framework

Range
Principles, characteristics and features backwards compatibility; interoperability; base class library, security **Different types of .NET framework** C#; C++; Powershell; Jscript; .NET and visualbasic **Components** Assemblies; metadata; security; memory management; .NET framework class libraries

Learning outcome
The learner will: 2. Be able to design .NET solutions
Assessment criteria
The learner can: 2.1 **Design a .NET programming solution** to a given problem 2.2 Explain the components and data and file structures required to implement a given design 2.3 Evaluate potential **delivery environments** and interaction

Range
Design a .NET programming solution Selection of .NET environment; .NET libraries; development environment **Delivery environments** Mobile; Web-based; server or desktop

Learning outcome
The learner will: 3. Be able to implement .NET solutions
Assessment criteria
The learner can: 3.1 **Implement a .NET programming solution** based on a prepared design 3.2 Implement event handling using control structures to meet the design algorithms 3.3 Identify and implement opportunities for error handling and reporting 3.4 Make effective use of an Integrated Development Environment (IDE) including code and screen templates

Range
Implement a .NET programming solution Selections; loops; use of tools boxes; objects and object properties; data types and constants

Learning outcome
The learner will: 4. Be able to test and document .NET solutions
Assessment criteria
The learner can: 4.1 Critically review and **test** a .NET programming solution 4.2 Analyse actual test results against expected results to identify discrepancies 4.3 Evaluate **independent feedback** on a developed .NET program solution and make recommendations for improvements 4.4 Create **user documentation** for the developed .NET program solution 4.5 Create technical documentation for the support and maintenance of a .NET program solution

Range
Test Range testing; input testing and system compatibility **Independent feedback** Surveys; questionnaires and interviews **User documentation** Help buttons, pop ups; technical designs and maintenance documentations

Unit 506 Programming in Java

UAN:	**F/601/1528**
Level:	Level 5
Credit value:	15
GLH:	60
Aim:	The aim of this unit is to provide learners with an understanding of the principles behind using a Java environment. They will understand the concepts used and develop their skills to design, implement, test and document Java solutions. On completing this unit learners will have a fuller understanding of the .Net environment and be better prepared to work with Java languages, progression from this could be to specific vendor qualification.

Learning outcome
The learner will: 1. Understand the principles of programming in Java
Assessment criteria
The learner can: 1.1 Discuss the **principles, characteristics and features** of programming in Java 1.2 Critically evaluate the environmental flexibility of programming in Java

Range
Principles, characteristics and features Java platforms; object oriented compilers; enforced error handling; multi platforms; data structures; data types; run time environment and programming syntax

Learning outcome
The learner will: 2. Be able to design Java solutions
Assessment criteria
The learner can: 2.1 **Design a Java programming solution** to a given problem

2.2	Explain the components and data and file structures required to implement a given design

Range
Design a Java programming solution User interface; Inputs; outputs; environment; structure design; data flow diagrams; pseudo code; class diagrams and data dictionary

Learning outcome
The learner will: 3. Be able to implement Java solutions
Assessment criteria
The learner can: 3.1 **Implement a Java programming** solution based on a prepared design 3.2 Define relationships between objects to implement design requirements 3.3 Implement object behaviours using control structures to meet the design algorithms 3.4 Identify and implement opportunities for error handling and reporting 3.5 Make effective use of an **Integrated Development Environment (IDE)** including code and screen templates

Range
Implement a Java programming Use of library classes; downloaded or imported classes **Integrated Development Environment** Reuse of objects; application of polymorphism and inheritance

Learning outcome
The learner will: 4. Be able to test and document Java solutions
Assessment criteria
The learner can: 4.1 Critically **review and test** a Java programming solution 4.2 Analyse actual test results against expected results to identify discrepancies 4.3 Evaluate **independent feedback** on a developed Java program solution and make recommendations for improvements 4.4 Create user **documentation** for the developed Java program solution 4.5 Create technical documentation for the support and maintenance of a Java program solution

Range
Review and test debugging code; naming conventions; user requirements; compiler errors and runtime errors **Independent feedback** questionnaire's; interviews and surveys **Documentation** test plans; user guides

Unit 507 Wide area networking technologies

UAN:	**F/601/1562**
Level:	Level 5
Credit value:	15
GLH:	60
Aim:	The purpose of this unit is to provide learners with an understanding of Wide Area Network (WAN) technologies and the delivery of a wide range of networked services across a WAN infrastructure.

Learning outcome
The learner will: 1. Understand the impact of WAN technologies
Assessment criteria
The learner can: 1.1 Critically evaluate different **WAN technologies** 1.2 Critically analyse **traffic intensive services** and their performance 1.3 Discuss WAN concerns and make recommendations to sustain **network security, reliability and performance** 1.4 Critically evaluate different trust systems on a WAN

Range
WAN technologies: Leased Lines, Circuit Switching, Message Switching, Packet Switching, Connectionless and Connection-Oriented Services, X.25 packet-switching networks, DTEs and DCEs, PADs Frame relay, Cell relay, ATM, ISCD, BIDSN, MPLS *FDDI; Multimode fibre optic cable, Single mode fibre optic cable, FDDI token passing, SONET* SMDS, WWAN **Traffic intensive services** quality of service management : DSCP (Differentiated Service Code Point), IP precedence, queues, base rules, congestion management; quality of service need i.e. VOIP, video streaming, audio streaming; **Network security, reliability and performance**

MD5 hash (Message Digest algorithm 5), broadcast reduction, filters, traffic rules, firewalls, access control lists, directed updates, tunnelling

Learning outcome
The learner will: 2. Be able to design WAN infrastructures
Assessment criteria
The learner can: 2.1 Design a **WAN infrastructure** to meet a given requirement 2.2 Critically evaluate the suitability of WAN components

Range
WAN infrastructure: Devices: expected / average number of devices on system; anticipated participation Bandwidth: expected / average load; anticipated peak load; cost constraint Users: quality expectations, concept of system growth Applications: security requirements, quality of service needs, redundancy Communications: suited to devices, suited to users, supportive of quality of service Scalable: able to support network growth, able to support addition of communication devices, able to cope with bandwidth use and trend change Security: network access, protocol management, peer authentication, tunnelling across untrusted domains Technology: network design, routing table reduction, protocol management

Learning outcome
The learner will: 3. Be able to implement WAN infrastructures
Assessment criteria
The learner can: 3.1 Build and configure a WAN (including services) to meet a given requirement 3.2 Implement network security on a WAN 3.3 Critically review and test a WAN

Range
Devices: installation of communication devices, allocation of networks, communication device configuration Services: DNS, data management, email, web, video, application Specialised configuration: routing protocol, interfaces, network address allocation, security features, security ACLs, MD5 authentication, tunnel creation Traffic management: system monitoring, traffic intensive, traffic precedence Connectivity: suitable bandwidth, communication infrastructure, throughput Testing: inter-communication, security, bandwidth,

Learning outcome
The learner will: 4. Be able to manage WAN infrastructures
Assessment criteria
The learner can: 4.1 Monitor and **troubleshoot** a WAN 4.2 Resolve WAN issues to improve **security, reliability and performance** 4.3 Critically evaluate the performance of a WAN

Range
Troubleshoot: using troubleshooting methodology; prove resolution **Security, reliability and performance** network monitoring tools, user access, traffic analysis, bandwidth monitoring, configuration checking, rules verification, ACLs, load balancing, broadband bonding, WAN optimization, QoS

Unit 508 Windows internals

UAN:	**H/600/4376**
Level:	Level 5
Credit value:	15
GLH:	104
Aim:	The aim of this unit is to give the learner an understanding of the internal components of the windows operating systems.

Learning outcome
The learner will: 1. Identify architectural components
Assessment criteria
The learner can: 1.1 Identify **memory types and mechanisms** 1.2 Identify **I/O mechanisms** 1.3 Identify **subsystems** 1.4 Identify **processor functions and architecture** 1.5 Identify **process and threads**

Range
Memory types and mechanisms paged and non-paged memory; physical memory; logical memory and heap memory **I/O mechanisms** Plug and play; IRQ levels; I/O request packets and device stacks **Subsystems** Object manager; process manager; memory manager and security **Processor functions and architecture** Interrupts; 64 bit and 32 bit **Process and threads** Thread scheduling; thread environment block; Process environment block

Learning outcome
The learner will: 2. Design solutions
Assessment criteria
The learner can: 2.1 **Optimize a system for its drivers** 2.2 **Design applications** 2.3 Deploy **compatible applications** 2.4 Identify **optimal I/O models** for applications

Range
Optimize a system for its drivers Driver signing; driver verifier; timers and deferred procedure call **Design applications** Memory mapped files; authentication and application verifier **Compatible applications** Application compatibility toolkit **Optimal I/O models** Synchronous and asynchronous I/O; multithreaded applications

Learning outcome
The learner will: 3. Monitor windows
Assessment criteria
The learner can: 3.1 Monitor **I/O latency** 3.2 Monitor **I/O throughput** 3.3 Monitor **memory usage** 3.4 Monitor **CPU utilization** 3.5 Monitor **handled and unhandled exceptions**

Range
I/O latency Disk I/O and device I/O **I/O throughput** Filter drivers and cache manager **Memory usage** Memory corruption; user memory; kernel memory and nonpaged v's paged pool

CPU utilization
Thread time; kernel v's user time and thread states

Handled and unhandled exceptions
Windows error reporting; Dr Watson and exception handling

Learning outcome
The learner will: 4. Analyse user mode
Assessment criteria
The learner can: 4.1 Analyse **heap leaks** 4.2 Analyse **heap corruption** 4.3 Handle **leaks** 4.4 Resolve **image load issues** 4.5 Analyse **services and host processes** 4.6 Analyse **cross-process application calls** 4.7 Analyse the **modification of executables at runtime** 4.8 Analyse **GUI performance issues**

Range
Heap leaks user mode stack tracing and application verifier **Heap corruption** Page heap and application verifier **Leaks** Process explorer and handle.exe **Image load issues** Load snaps; dll dependencies and tasklist **Services and host processes** sc.exe; service dependencies; service isolation and service registry entries **Cross-process application calls** Shared memory; named pipes; process start-up and Winsock **modification of executables at runtime** image corruption; detours and hot patches **GUI performance issues** Spy++; message queues and task manager

Learning outcome
The learner will: 5. Analyse kernel mode
Assessment criteria
The learner can: 5.1 Find and identify objects in **object manager namespaces and identify the objects' attributes** 5.2 Analyse **Plug and Play (PnP) device failure** 5.3 Analyse **pool corruption** 5.4 Analyse **pool leaks** 5.5 Isolate the **root cause of S state failure** 5.6 Analyse **kernel mode CPU utilization**

Range
Object manager namespaces and identify the objects' attributes Winobj.exe; object name space; security descriptors; global namespace; device objects and file objects **Plug and Play (PnP) device failure** Removal failures; WinDbg and power handling **Pool corruption** Driver verifier; pool tags and guard pages **Pool leaks** Crash dump analysis and cache trimming **Root cause of S state failure** System power states and Power IRP handling **Kernel mode CPU utilization** Kernrate.exe; WinDbg and deadlocks

Learning outcome
The learner will: 6. Debug windows
Assessment criteria
The learner can: 6.1 **Debug memory** 6.2 Identify a **pending I/O** 6.3 Identify a **blocking thread** 6.4 Identify a **runaway thread** 6.5 Debug **kernel crash dumps** 6.6 Debug **user crash dumps** 6.7 Set up the **debugger**

Range
Debug memory Heap; pool; stack and analysing crash dumps **Pending I/O** I/O manager and deadlocks **Blocking thread** Thread state; locks and synchronization objects **Runaway thread** Processor affinity and kern rate **Kernel crash dumps** Assembler, trap processing and register usage **User crash dumps** Dump types; forcing crash dumps and system resource utilization **Debugger** Physical connection; boot.ini and remoting

Unit 600 Introduction to networks

UAN:	**H/507/0173**
Level:	3
Credit value:	17
GLH:	83
Aim:	This unit introduces learners to the architecture, structure, functions, components, and models of the Internet and other computer networks. It covers the principles and structure of IP addressing and the fundamentals of Ethernet concepts, media, and operations. Successful completion of the unit would enable learners to build simple LANs, perform basic configurations for routers and switches, and implement IP addressing schemes. This unit includes content from Cisco CCNA Introduction to Networks curriculum.

Learning outcome
The learner will: 1. Understand networking within business.
Assessment criteria
The learner can: 1.1 explain how multiple networks are used in everyday life 1.2 explain how rules are used to facilitate communication 1.3 explain trends in networking that will affect the use of networks 1.4 describe how a host computer builds a message and sends it to a destination.

Learning outcome
The learner will: 2. Understand how standardisation supports interoperable end-to-end communications.
Assessment criteria
The learner can: 2.1 explain the topologies used in a network 2.2 explain the devices used in a network 2.3 explain the characteristics of a network that supports communications 2.4 explain the role of protocols in facilitating interoperability in network communications 2.5 explain the role of standards organisations in facilitating interoperability in network communications.

Learning outcome
The learner will: 3. Understand the process by which devices access resources using the TCP/IP suite.
Assessment criteria
The learner can: 3.1 explain how devices on a Local Area Network (LAN) access resources 3.2 explain how the **physical layer** supports communication across data networks (protocols and services) 3.3 explain the role of the **data link layer** in supporting communication across data networks (protocols and services) 3.4 compare media access control techniques with logical topologies used in networks 3.5 explain the role of the Address Resolution Protocol (ARP) in supporting network connectivity 3.6 explain the operation of Ethernet at the network access layer of TCP/IP within a LAN 3.7 explain how the **network layer** supports communication across data networks 3.8 explain how the **transport layer** supports communication across data networks 3.9 compare the operations of transport layer protocols in supporting end-to-end communication 3.10 explain the operation of the application layer in providing support to end-user applications 3.11 describe the features of the **application layer** 3.12 describe the operation of the application layer 3.13 describe the use of the application layer.

Range
network layer (protocols and services) **transport layer** (protocols and services)

application layer (protocols and services)

Learning outcome
The learner will: 4. Be able to design an IP addressing scheme to provide network connectivity.
Assessment criteria
The learner can: 4.1 explain the use of IPv4 addresses to provide connectivity 4.2 calculate **IPv4 addresses** to enable end-to-end connectivity 4.3 design an IP addressing scheme to provide connectivity to end users 4.4 explain the use of IPv6 addresses to provide connectivity 4.5 explain design considerations for implementing IPv6.

Range
IPv4 addresses (network, host, broadcast)

Learning outcome
The learner will: 5. Be able to implement network connectivity between devices.
Assessment criteria
The learner can: 5.1 connect network devices with media 5.2 configure IP address parameters on devices to provide end-to-end connectivity 5.3 explain how a network of directly connected segments is configured 5.4 explain how a network of directly connected segments is verified 5.5 configure wireless on an integrated router 5.6 use testing utilities to test network connectivity.

Learning outcome
The learner will: 6. Be able to configure network access.
Assessment criteria
The learner can: 6.1 determine the devices required to route traffic 6.2 explain how routers enable end-to-end connectivity 6.3 configure a router 6.4 explain how switches in enable end-to-end connectivity 6.5 implement LAN switching to enable end-to-end connectivity 6.6 use show commands to establish a relative performance baseline for the network.

Learning outcome
The learner will: 7. Be able to configure initial Inter Network Operating System (IOS) device settings.
Assessment criteria
The learner can: 7.1 explain features of IOS software 7.2 explain functions of IOS software 7.3 configure initial setting on a network using IOS software 7.4 configure connectivity devices with device hardening features to enhance security 7.5 manage IOS configuration files to ensure device operation.

Unit 601 Routing and switching essentials

UAN:	**K/507/0174**
Level:	4
Credit value:	27
GLH:	143
Aim:	This course provides for learners an understanding of the architecture, components, and operations of routers and switches in a small network. It develops skills related to configuring a router and a switch for basic functionality. On successful completion of this unit, learners will be able to configure and troubleshoot routers and switches and resolve common issues with RIPv1, RIPng, single-area and multi-area OSPF, virtual LANs, and inter-VLAN routing in both IPv4 This unit includes content from Cisco Introduction to Networks curriculum that is relevant to the Routing and Switching Essentials course.

Learning outcome
The learner will: 1. Be able to configure switch ports to manage network access.
Assessment criteria
The learner can: 1.1 explain how Layer 2 switches forward data in a Local Area Network (LAN) 1.2 explain how switched networks support business 1.3 configure switch configurations 1.4 configure a switch using security best practices.

Learning outcome
The learner will: 2. Be able to implement Virtual Local Area Networks (VLANs) to logically segment networks.
Assessment criteria
The learner can: 2.1 analyse how VLANs segment broadcast domains 2.2 implement VLANs to segment a network 2.3 configure routing between VLANs 2.4 configure VLAN 2.5 configure trunking security features 2.6 implement inter-VLAN routing using Layer 3 switching to forward data 2.7 troubleshoot issues in a switched, multi-VLAN routed environment.

Learning outcome
The learner will: 3. Be able to configure routing technologies to facilitate internetwork communications.
Assessment criteria
The learner can: 3.1 explain how routers use information in data packets to make forwarding decisions 3.2 explain the function of dynamic routing protocols 3.3 configure a router for multiple directly-connected networks 3.4 configure the RIP and RIPng routing protocol 3.5 compare how routers learn about remote networks 3.6 analyse a **routing table** to determine information.

Range
routing table (route source, administrative distance, metric)

Learning outcome
The learner will: 4. Be able to implement static routing to enable end-to-end connectivity.
Assessment criteria
The learner can: 4.1 explain the ways in which static routes can be implemented 4.2 configure static routes to enable connectivity 4.3 troubleshoot **route configurations**.

Range

route configurations (static, default)

Learning outcome
The learner will: 5. Be able to implement Open Shortest Path First (OSPF) to enable end-to-end connectivity.
Assessment criteria
The learner can: 5.1 explain the operation of a single-area OSPF as a link-sate routing protocol that enables dynamic routing 5.2 explain the function of link-state controls 5.3 configure OSPFv2 to enable internetwork communications in a IPv4 network 5.4 configure OSPFv3 to enable internetwork communications in an IPv6 network.

Learning outcome
The learner will: 6. Be able to automate IP addressing configuration for end devices.
Assessment criteria
The learner can: 6.1 design an IP addressing scheme to provide connectivity to end users 6.2 implement DHCPv4 to provide addressing services to end-devices across multiple LANs 6.3 implement DHCPv6 to provide IP addressing services to end-devices across multiple LANs.

Learning outcome
The learner will: 7. Be able to implement Access Control Lists (ACL) to filter traffic.
Assessment criteria
The learner can: 7.1 explain the purpose of ACLs 7.2 explain the operation of ACLs 7.3 implement IPV4 **ACLs** to filter traffic 7.4 implement IPV6 ACLs to filter traffic 7.5 troubleshoot ACL implementation issues affecting end-to-end connectivity.

Range
ACLs (standard, extended)

Learning outcome
The learner will: 8. Be able to implement Network Address Translation (NAT) for IP address conservation.
Assessment criteria
The learner can: 8.1 explain NAT services in providing IPv4 address scalability 8.2 configure NAT services on the edge router to provide IPv4 address scalability 8.3 interpret device output to correct NAT implementation issues affecting end-to-end connectivity from an internal to external LAN.

Unit 602 Scaling networks

UAN:	**M/507/0175**
Level:	3
Credit value:	15
GLH:	73
Aim:	This unit develops an understanding of the architecture, components, and operations of routers and switches in large, complex networks. Learners develop understanding and skills required to configure routers and switches for advanced functionality. Successful completion of the unit would enable learners to configure and troubleshoot routers and switches and resolve common issues with OSPF, EIGRP, and STP in both IPv4 and IPv6 networks. They will also develop the knowledge and skills needed to implement a WLAN in a small-to-medium network. This unit includes content from Cisco Introduction to Networks curriculum that is relevant to the Scaling Networks course.

Learning outcome
The learner will: 1. Be able to configure switching hardware that facilitates network access.
Assessment criteria
The learner can: 1.1 explain the need for hierarchical network design that is scalable 1.2 select network devices to meet requirements (feature compatibility, network) 1.3 explain the purpose of the spanning tree protocol in a switched Local Area Network (LAN) environment with redundant inter-switch links 1.4 explain the operation of Per Virtual LAN Spanning Tree (PVST+) in a switched LAN environment 1.5 configure PVST+ in a switched LAN 1.6 configure Rapid PVST+ in a switched LAN 1.7 explain the operation of link aggregation in a switched LAN environment 1.8 implement link aggregation to improve performance on

high-traffic switch links 1.9 verify First Hop Redundancy Protocols (FHRP) in a switched network.

Learning outcome
The learner will: 2. Be able to implement wireless Local Area Networks (LANs) to provide network access.
Assessment criteria
The learner can: 2.1 explain how standards ensure interoperability in wireless networks 2.2 explain how wireless LAN components are deployed 2.3 describe security features available in a wireless network 2.4 implement a wireless LAN using a wireless router.

Learning outcome
The learner will: 3. Be able to implement Open Shortest Path First (OSPF) to enable end-to-end connectivity.
Assessment criteria
The learner can: 3.1 explain the operation of multi-area OSPF 3.2 implement multi-area OSPF for IPV4 to enable internetwork communications 3.3 implement advanced OSPF features to enhance operation 3.4 troubleshoot singe-area OSPF configuration issues.

Learning outcome
The learner will: 4. Be able to implement Enhanced Interior Gateway Routing Protocol (EIGRP).
Assessment criteria
The learner can: 4.1 explain how the characteristics of EIGRP enable dynamic routing 4.2 explain the operation of EIGRP that enables end-to-end communication 4.3 implement EIGRP for IPv4 to enable internetwork communication 4.4 implement EIGRP for IPv6 to enable internetwork communications 4.5 implement advanced EIGRP features to enhance operations 4.6 troubleshoot EIGRP configuration issues.

Learning outcome
The learner will: 5. Be able to manage Inter Network Operating System (IOS) system image files.
Assessment criteria
The learner can: 5.1 select IOS system image files to support network requirements 5.2 configure a device to activate an upgrade IOS image.

Unit 603 Connecting networks

UAN:	**T/507/0176**
Level:	3
Credit value:	18
GLH:	91
Aim:	This unit covers the WAN technologies and network services required by converged applications in a complex network. It enables learners to understand the selection criteria of network devices and WAN technologies to meet network requirements. They will learn how to configure and troubleshoot network devices and resolve common issues with data link protocols. They will also develop the knowledge and skills needed to implement Virtual Private Network (VPN) operations in a complex network. This unit includes content from Cisco Introduction to Networks curriculum that is relevant to the Connecting Networks course.

Learning outcome
The learner will: 1. Understand hierarchical network design.
Assessment criteria
The learner can: 1.1 explain how a hierarchical network model is used to design networks 1.2 explain how a modular approach is used in network design 1.3 explain how business network architectures work in collaboration with enterprise architecture to allow organisations to support business.

Learning outcome
The learner will: 2. Understand Wide Area Network (WAN) access technologies for small to medium-sized networks.
Assessment criteria
The learner can: 2.1 describe WAN access technologies 2.2 select WAN access technologies to satisfy business requirements.

Learning outcome
The learner will: 3. Be able to configure a serial interface to enable WAN communication.
Assessment criteria
The learner can: 3.1 explain the operation of Point to Point Protocol (PPP) across a point-to-point serial link 3.2 configure PPP to enable internetwork communications 3.3 troubleshoot PPP issues that affect internetwork communications 3.4 configure High Level Data Link Control (HLDC) encapsulations on a point-to-point serial communication link to enable WAN connectivity 3.5 explain the benefits of Frame Relay 3.6 explain the operation of Frame Relay 3.7 configure Frame Relay issues that affect internetwork communications

Learning outcome
The learner will: 4. Be able to configure an Ethernet interface to enable broadband communication.
Assessment criteria
The learner can: 4.1 explain how broadband technologies support remove connectivity for business 4.2 select broadband solutions to support remote connectivity 4.3 configure a router Ethernet interface for connectivity.

Learning outcome
The learner will: 5. Be able to implement Network Address Translation (NAT) for IP conservation.
Assessment criteria
The learner can: 5.1 explain the operation of NAT services in providing IPv4 address scalability 5.2 configure NAT services on the edge router to provide IPv4 address scalability 5.3 troubleshoot NAT issues that affect internetwork communications.

Learning outcome
The learner will: 6. Be able to configure a tunnelling protocol to enable site-to-site communication.
Assessment criteria
The learner can: 6.1 explain the use of Virtual Private Networks (VPN) in securing site-to-site connectivity 6.2 configure a Generic Routing Encapsulation (GRE) to set the foundation for secure site-to-site connectivity 6.3 explain the operation of IPsec to secure VPN traffic 6.4 explain how **remote access technologies** are used to support remote connectivity.

Range
remote access technologies (Secure Socket Layer (SSL), IPsec)

Learning outcome
The learner will: 7. Be able to configure network monitoring.
Assessment criteria
The learner can: 7.1 configure Syslog to monitor network operations 7.2 configure Simple Network Management Protocol (SNMP) to monitor network operations.

Learning outcome
The learner will: 8. Be able to troubleshoot data networks.
Assessment criteria
The learner can: 8.1 determine troubleshooting approach required for network problems

8.2 troubleshoot end-to-end connectivity.

Unit 608 Fundamentals of Linux based operating systems

UAN:	**R/507/0184**
Level:	3
Credit value:	7
GLH:	40
Aim:	This unit has been designed to help a learner build an understanding and skills needed to work with Linux in these topics: commands, system architecture, file system hierarchy, installation and package management. On successful completion of this unit a learner will be able to perform straightforward administrative tasks including executing backup and restore and shutdown and reboot. This unit is linked to the CompTIA Linux+

Learning outcome
The learner will: 1. Be able to operate Linux based operating systems.
Assessment criteria
The learner can: 1.1 determine hardware settings 1.2 configure hardware settings 1.3 boot the system 1.4 change run levels 1.5 shut down the system 1.6 reboot the system.

Learning outcome
The learner will: 2. Be able to use package management.
Assessment criteria
The learner can: 2.1 design hard disk layout 2.2 install a boot manager

2.3 manage shared libraries 2.4 use package management

Learning outcome
The learner will: 3. Be able to use Linux based operating system commands.
Assessment criteria
The learner can: 3.1 use shell commands 3.2 process text streams using filters 3.3 perform file management 3.4 use pipes 3.5 use streams 3.6 use redirects 3.7 create processes 3.8 monitor processes 3.9 kill processes 3.10 modify process execution priorities 3.11 search text files using regular expressions 3.12 perform basic file editing operations.

Learning outcome
The learner will: 4. Be able to manage files.
Assessment criteria
The learner can: 4.1 create file systems 4.2 create partitions 4.3 maintain the integrity of file systems 4.4 control file systems 4.5 manage disk quotas 4.6 manage file permissions 4.7 create links 4.8 modify links 4.9 locate files.

Unit 609 Implementing and maintaining cloud technologies and infrastructure

UAN:	**Y/507/0185**
Level:	3
Credit value:	10
GLH:	50
Aim:	This unit develops in learners the knowledge and skills required to understand standard Cloud terminologies and methodologies and to implement, maintain, and deliver cloud technologies and infrastructures. Learners will develop an understanding of aspects of IT security and use of industry best practices related to cloud implementations and the application of virtualization. It is recommended that learners have prior learning related to cloud technologies or have experience of working in a networking role. Familiarity with any major hypervisor technologies for server virtualisation, would also be helpful. This unit covers the content of CompTIA Cloud+.

Learning outcome
The learner will: 1. Understand cloud concepts.
Assessment criteria
The learner can: 1.1 compare cloud services 1.2 compare cloud delivery models 1.3 summarise cloud characteristics 1.4 define cloud terminology 1.5 explain object storage concepts.

Learning outcome
The learner will: 2. Be able to create a cloud infrastructure.
Assessment criteria
The learner can: 2.1 explain the differences between hypervisor types 2.2 compare virtual components used to construct a cloud environment 2.3 explain the benefits of virtualised cloud environment 2.4 compare storage technologies 2.5 explain storage configuration concepts 2.6 explain the benefits offered by network optimisation 2.7 explain cloud network **infrastructure** 2.8 explain **hardware** used to enable virtual environments 2.9 configure storage provision 2.10 configure network for cloud services 2.11 troubleshoot network connectivity issues.

Range
infrastructure (protocols, ports, topologies) **hardware** (resources, features)

Learning outcome
The learner will: 3. Be able to manage networks associated with cloud computing.
Assessment criteria
The learner can: 3.1 explain how **security** is implemented in networks associated with cloud computing 3.2 compare encryption technologies 3.3 compare encryption methods 3.4 identify access control methods 3.5 implement resource monitoring techniques 3.6 allocate **resources** 3.7 implement **hardening techniques** 3.8 use remote access tools 3.9 compare **disaster recovery** 3.10 describe situations which would impact on the availability of the cloud 3.11 describe solutions to meet availability requirements.

Range
security (network, storage) **resources** (physical, virtual) **hardening techniques** (guest and host)

disaster recovery (methods, concepts)

Learning outcome
The learner will: 4. Be able to undertake systems management.
Assessment criteria
The learner can: 4.1 explain **cloud systems management** 4.2 explain the factors that affect **system performance** 4.3 test cloud services deployment 4.4 diagnose physical host performance issues 4.5 optimise physical host performance.

Range
cloud systems management (procedures, policies) **system performance** (relating to host, relating to guest)

Unit 610 Configure and manage Linux based operating systems

UAN:	**R/507/0198**
Level:	3
Credit value:	12
GLH:	71
Aim:	This unit relates to the Linux operating system. It develops in learners the skills needed to work at a junior level as a Linux administrator. This includes shells, scripting and data management, performing straightforward administrative tasks including managing user and group accounts and securing data. Learners will gain knowledge of networking fundamentals and how to connect a workstation to a LAN or a stand-alone PC via a modem to the Internet. Learners are advised to take this unit together with Fundamentals of Linux Based Operating Systems. This unit covers the content of CompTIA Linux+

Learning outcome
The learner will: 1. Be able to use shell scripting.
Assessment criteria
The learner can: 1.1 customise the shell environment 1.2 use the shell environment 1.3 write simple scripts 1.4 customise simple scripts 1.5 use Structured Query Language (SQL) commands.

Learning outcome
The learner will: 2. Be able to configure a user interface.
Assessment criteria
The learner can: 2.1 install a user interface 2.2 configure a user interface 2.3 setup a display manager 2.4 configure accessibility.

Learning outcome
The learner will: 3. Be able to administer systems.
Assessment criteria
The learner can: 3.1 manage user and group accounts 3.2 manage account system files 3.3 schedule system administration tasks 3.4 configure localisation 3.5 configure internationalisation **guidance** translations/language.

Learning outcome
The learner will: 4. Be able to manage system services.
Assessment criteria
The learner can: 4.1 maintain system time 4.2 implement system logging 4.3 configure Mail Transfer Agent (MTA) 4.4 manage printers.

Learning outcome
The learner will: 5. Be able to configure networks.
Assessment criteria
The learner can: 5.1 describe network masks 5.2 compare private and public IP addresses 5.3 set a default route 5.4 identify services related to **ports** 5.5 describe differences between UDP, TCP and ICMP 5.6 describe differences between IPv4 and IPv6 5.7 configure network interfaces 5.8 troubleshoot networks 5.9 configure client-side Domain Name Services (DNS).

Range
ports (20, 21, 22, 23, 25, 53, 80,110, 119, 139, 143, 161, 443, 465, 993, 995)

Learning outcome
The learner will: 6. Be able to secure networks.
Assessment criteria
The learner can: 6.1 maintain network security 6.2 setup host security 6.3 secure data with encryption.

Unit 611 Implement and manage a network

UAN:	**F/507/0200**
Level:	3
Credit value:	10
GLH:	58
Aim:	Through this unit, learners will gain theoretical understanding of networking concepts and procedures for implementing and managing networks. They will develop skills needed to implement a defined network architecture with basic network security. On successful completion of this unit, learners should be able to configure, maintain and troubleshoot network devices using appropriate network tools. They will be able to make basic solution recommendation, analyse network traffic and be familiar with common protocols and media types. It is recommended that learners have achieved a qualification related to IT fundamentals or have some experience of working with networks. This unit covers the content of CompTIA Network+.

Learning outcome
The learner will: 1. Understand networking concepts.
Assessment criteria
The learner can: 1.1 compare layers of OSI with layers of TCP/IP models 1.2 identify the OSI model layer that is associated with different **services** 1.3 explain the purpose IP addressing 1.4 explain the properties of IP addressing 1.5 explain the purpose of routing and switching 1.6 explain the properties of routing and switching 1.7 identify default ports 1.8 explain the function of networking protocols 1.9 summarise Domain Naming Service (DNS) **concepts** 1.10 identify virtual network components 1.11 explain the purpose of Dynamic Host Control Protocol (DHCP) 1.12 explain the properties of DHCP.

Range
services (applications, devices and protocols **concepts** (DNS servers, DNS records, dynamic DNS)

Learning outcome
The learner will: 2. Be able to implement networks
Assessment criteria
The learner can: 2.1 configure routers and switches 2.2 configure a wireless network 2.3 troubleshoot wireless problems 2.4 troubleshoot router and switch problems 2.5 plan a Small Office Home Office (SOHO) network 2.6 implement a SOHO network

Learning outcome
The learner will: 3. Understand network infrastructure
Assessment criteria
The learner can: 3.1 match standard connector types to associated network media 3.2 compare wireless standards 3.3 compare Wide Area Network (WAN) technologies 3.4 describe network topologies 3.5 compare Local Area Network (LAN) technologies 3.6 identify components of wiring distribution

Learning outcome
The learner will: 4. Be able to manage networks
Assessment criteria
The learner can: 4.1 explain the features of network technologies 4.2 describe a network troubleshooting methodology 4.3 troubleshoot connectivity issues 4.4 use network monitoring resources 4.5 describe the purpose of configuration management documentation 4.6 explain methods of network performance optimisation

Learning outcome
The learner will: 5. Be able to secure networks
Assessment criteria
The learner can: 5.1 explain threats and vulnerabilities of networks 5.2 explain methods of user authentication 5.3 describe types of network security technologies 5.4 describe types of network security methods 5.5 explain how network threats and vulnerabilities are mitigated 5.6 implement wireless security measures 5.7 configure a basic firewall.

Unit 611 Implement and manage a network

Supporting information

Evidence requirements

For 4.3 you are required to use hardware tools and software tools

Unit 612 Securing ICT systems and networks

UAN:	**D/507/0219**
Level:	3
Credit value:	9
GLH:	51
Aim:	Learners will gain theoretical understanding of concepts and procedures for securing both ICT systems and networks. They will learn to identify risk and how to participate in risk mitigation activities, provide infrastructure, application, operational and information security and apply security controls to maintain confidentiality, integrity and availability. In addition, learners will gain knowledge of applicable policies, laws and regulations and the implications of these to their activities. This unit is of most benefit to individuals with prior learning related to IT security or experience of working in IT administration. This unit is linked to the CompTIA Security+ Exam.

Learning outcome
The learner will: 1. Be able to implement network security.
Assessment criteria
The learner can: 1.1 implement security **configuration parameters** 1.2 use network **administration principles** 1.3 explain **network design** 1.4 implement common protocols 1.5 implement common services 1.6 troubleshoot security issues related to wireless networking.

Range
configuration parameters (on network devices, on other technologies) **administration principles** (rule-based management, firewall rules, VLAN management, secure router configuration, access control lists, port security, 802.1x, floor guards, loop protection,

implicit deny, prevent network bridging by network separation, log analysis) **network design** (elements, components)

Learning outcome
The learner will: 2. Be able implement operational security in an ICT environment.
Assessment criteria
The learner can: 2.1 explain the importance of risk related concepts 2.2 summarise the security implications of integrating systems with third parties 2.3 implement risk mitigation strategies 2.4 implement forensic procedures 2.5 summarise incident response procedures 2.6 explain the importance of security awareness and training 2.7 explain physical security 2.8 explain **environmental controls** 2.9 summarise risk management best practices 2.10 select controls to meet security goals.

Range
environmental controls (HVAC, fire suppression, EMI shielding, hot and cold aisles, environmental monitoring, temperature and humidity controls, video monitoring)

Learning outcome
The learner will: 3. Be able to discover threats and vulnerabilities.
Assessment criteria
The learner can: 3.1 explain types of malware 3.2 explain types of attacks 3.3 summarise social engineering attacks 3.4 summarise effectiveness of social engineering attacks 3.5 select mitigation and deterrent techniques 3.6 use techniques to discover security threats and vulnerabilities 3.7 compare the proper use of penetration testing and vulnerability scanning.

Learning outcome
The learner will: 4. Be able to implement data host security.
Assessment criteria
The learner can: 4.1 explain the importance of application security controls 4.2 summarise **mobile security** 4.3 select solution to establish host security 4.4 implement controls to ensure data security 4.5 compare measures for mitigating security risks in static environments.

Range
mobile security (concepts and technologies).

Learning outcome
The learner will: 5. Be able to configure access control.
Assessment criteria
The learner can: 5.1 explain function of authentication services 5.2 select access control method to meet requirements 5.3 configure account management security controls.

Learning outcome
The learner will: 6. Be able to implement cryptography.
Assessment criteria
The learner can: 6.1 use cryptography techniques 6.2 use cryptographic methods 6.3 use Public Key **Infrastructure** (PKI).

Range
infrastructure (certificate management and associated components)

Unit 613 Install and configure a server

UAN:	**Y/507/0221**
Level:	3
Credit value:	9
GLH:	48
Aim:	This unit develops in learners the knowledge and skills required to build, maintain, troubleshoot and support server hardware and software technologies. Successful completion of the unit will enable learners to identify environmental issues; understand and comply with disaster recovery and security procedures and be familiar with industry terminology and concepts. This unit covers the content for CompTIA Server+.

Learning outcome
The learner will: 1. Be able to install system hardware.
Assessment criteria
The learner can: 1.1 explain the importance of a Hardware Compatibility List (HCL) 1.2 select **hardware components** 1.3 install hardware components into a server 1.4 configure firmware.

Range
hardware components (system boards, chassis, memory, processors, expansion cards)

Learning outcome
The learner will: 2. Be able to implement Network Operating System (NOS) software.
Assessment criteria
The learner can: 2.1 explain features of NOS security software 2.2 explain the interaction of server roles 2.3 describe **server virtualisation** 2.4 install NOS 2.5 deploy NOS 2.6 configure NOS 2.7 update NOS 2.8 implement NOS management features 2.9 select controls to meet security goals.

Range
server virtualisation (concepts, features, considerations)

Learning outcome
The learner will: 3. Be able to configure storage.
Assessment criteria
The learner can: 3.1 describe features of Redundant Array of Independent Disks (RAID) technologies 3.2 describe benefits of RAID technologies 3.3 select a RAID level 3.4 configure internal storage technologies 3.5 explain the purpose of external storage technologies.

Learning outcome
The learner will: 4. Be able to implement server access.
Assessment criteria
The learner can: 4.1 describe **elements** of networking essentials 4.2 create **system information** 4.3 utilise system information 4.4 maintain system information 4.5 determine a physical environment for a server location 4.6 describe physical security measures for a server location 4.7 describe methods of server access 4.8 implement server access 4.9 configure server access.

Range
elements (TCP/IP, Ethernet, VPN, VLAN, DMZ) **system information** (documentation, diagrams and procedures)

Learning outcome
The learner will: 5. Be able to implement disaster recovery.
Assessment criteria
The learner can: 5.1 compare backup and restoration methodologies 5.2 compare backup and restoration media types 5.3 compare types of replication methods 5.4 explain data retention and destruction concepts 5.5 implement the steps of a recovery plan.

Learning outcome
The learner will: 6. Be able to troubleshoot server problems.
Assessment criteria
The learner can: 6.1 explain troubleshooting methodologies 6.2 diagnose network problems 6.3 troubleshoot hardware problems 6.4 troubleshoot software problems 6.5 troubleshoot storage problems.

Unit 614 Implement and manage a mobile computing environment

UAN:	**K/507/0224**
Level:	3
Credit value:	8
GLH:	47
Aim:	This unit enables learners to develop the knowledge and skills required to understand and research capabilities of mobile devices and features of over-the-air technologies. Successful learners will also develop the skills needed to deploy, integrate, support and manage a mobile environment ensuring proper security measures are implemented for devices and platforms while maintaining usability. It is recommended that learners taking this unit have prior learning related to networking or have experience of working in IT administration.

Learning outcome
The learner will: 1. Be able to implement over-the-air technologies.
Assessment criteria
The learner can: 1.1 compare cellular technologies 1.2 compare Radio Frequency (RF) principles 1.3 compare RF functionality 1.4 interpret site survey for over the air communication issues 1.5 configure WiFi client technologies.

Learning outcome
The learner will: 2. Understand network infrastructure.
Assessment criteria
The learner can: 2.1 compare physical and **logical infrastructure** 2.2 describe network ports associated with mobile devices 2.3 describe network protocols associated with mobile devices 2.4 explain the technologies used for negotiating wireless to wired networks 2.5 explain the layers of the OSI model 2.6 explain disaster recovery principles 2.7 explain how disaster recovery affects mobile devices.

Range
logical infrastructure (technologies, protocols)

Learning outcome
The learner will: 3. Be able to manage mobiles devices.
Assessment criteria
The learner can: 3.1 explain policies required to certify device capabilities 3.2 compare mobility solutions to enterprise requirements 3.3 configure mobile solutions to meet requirements 3.4 implement **mobile devices** 3.5 describe emerging technologies in mobile computing 3.6 configure mobile applications 3.7 deploy mobile applications.

Range
mobile devices (procedures, operations)

Learning outcome
The learner will: 4. Understand mobile security issues.
Assessment criteria
The learner can: 4.1 identify encryption methods for securing mobile environments 4.2 configure access control on mobile devices 4.3 explain techniques used to address security requirements 4.4 explain how risks and threats to the mobile ecosystem are mitigated 4.5 implement **data integrity** on mobile devices 4.6 execute incident response steps

Range
data integrity (device backup, data recovery and data segregation)

Learning outcome
The learner will: 5. Be able to troubleshoot mobile problems.
Assessment criteria
The learner can: 5.1 troubleshoot device problems 5.2 troubleshoot application problems 5.3 troubleshoot over-the-air connectivity problems 5.4 troubleshoot security problems 5.5 implement the steps of a recovery plan.

Unit 615 Developing security for mobile apps on iOS

UAN:	**J/507/0229**
Level:	3
Credit value:	14
GLH:	77
Aim:	This unit is for those with experience of app development and familiarity with the iOS SDK and principles of secure application development. It will develop learners' knowledge of the fundamental principles of application security, the security model of iOS devices, Web services security model and vulnerabilities and common implementations of cryptography. Learners will develop skills needed to develop moderately complex applications using the iOS SDK, use the security features of the iOS operating system and APIs, implement secure coding techniques and harden an application against attack to levels appropriate for the risk model of the application.

Learning outcome
The learner will: 1. Understand application security
Assessment criteria
The learner can: 1.1 identify legislation for secure mobile development 1.2 describe security risks for mobile technologies 1.3 compare the relative severity of mobile security issues 1.4 explain a secure application development process 1.5 summarise application security best practices 1.6 identify the major architectural risks of weaknesses in an application

Learning outcome
The learner will: 2. Understand Objective-C coding
Assessment criteria
The learner can: 2.1 explain factors that should be considered when designing apps using Objective-C language 2.2 manage sensitive data in memory 2.3 explain Objective-C framework paradigms 2.4 explain Objective-C framework security impacts 2.5 identify code that gives correct interaction with iOS security facilities and objects

Learning outcome
The learner will: 3. Understand application security features
Assessment criteria
The learner can: 3.1 summarise the security features of the platform 3.2 explain the data protection Application Programming Interface (API) 3.3 explain the features of the security framework 3.4 explain the security of the keychain 3.5 explain the limitations of the keychain 3.6 use keychain for storing sensitive data

Learning outcome
The learner will: 4. Understand network security
Assessment criteria
The learner can: 4.1 summarise the risks in performing Web and network communications 4.2 implement a Secure Socket Layer (SSL) session with validation 4.3 explain threats to Web services 4.4 distinguish security protections for authentication 4.5 describe proper implementation of session security

Learning outcome
The learner will: 5. Understand data security
Assessment criteria
The learner can: 5.1 explain a secure data storage and encryption implementation 5.2 describe implementation of encryption in iOS to ensure data security 5.3 describe Apple Data Encryption APIs 5.4 explain how data is deleted securely 5.5 explain data recovery techniques for iOS 5.6 explain types of data 5.7 explain sensitivity of data 5.8 explain how data can leak

Learning outcome
The learner will: 6. Understand application hardening
Assessment criteria
The learner can: 6.1 explain application object binaries 6.2 explain application tools 6.3 explain Objective-C debugging 6.4 describe forms of abusive runtime manipulation 6.5 summarise counter-runtime abuse techniques

Unit 616 Developing security for mobile apps on android

UAN:	**T/507/0226**
Level:	3
Credit value:	13
GLH:	73
Aim:	This unit is for those with experience of app development and familiarity with Java, the Android SDK, and principles of secure application development. It will develop learners' knowledge of the fundamental principles of application security, the security model of Android devices, Web services security model and vulnerabilities and common implementations of cryptography. Learners will develop skills needed to develop moderately complex applications using the Android SDK, use the security features of the Android operating system and APIs, implement secure coding techniques and harden an application against attack to levels appropriate.

Learning outcome
The learner will: 1. Understand application security.
Assessment criteria
The learner can: 1.1 identify legislation for secure mobile development 1.2 compare the relative severity of security issues 1.3 explain a secure development process throughout application development 1.4 summarise application security best practices 1.5 identify the architectural risks to weaknesses in an application.

Learning outcome
The learner will: 2. Understand application security features.
Assessment criteria
The learner can: 2.1 summarise the Android security architecture 2.2 explain the Android permission model 2.3 describe secure inter-process communication 2.4 securely implement common features.

Learning outcome
The learner will: 3. Understand network security.
Assessment criteria
The learner can: 3.1 summarise the risks in performing web and network communications 3.2 implement an Secure Socket Layer (SSL) session with validation 3.3 explain threats to web services 3.4 explain protections to web services 3.5 distinguish security protections for authentication 3.6 describe proper implementation of session security.

Learning outcome
The learner will: 4. Understand data security.
Assessment criteria
The learner can: 4.1 explain how encryption works 4.2 explain how hashing works 4.3 summarise methods for securing stored data 4.4 distinguish implementation of encryption in an Android application 4.5 implement data security using the Android permissions model 4.6 explain reverse engineering 4.7 explain reverse engineering countermeasures.

Learning outcome
The learner will: 5. Understand secure Java coding.
Assessment criteria
The learner can: 5.1 explain Java language structure 5.2 explain object-oriented development 5.3 use techniques for dealing with sensitive information 5.4 explain secure Java coding best practices.

Unit 630 Administering server databases

UAN:	**A/507/0292**
Level:	3
Credit value:	12
GLH:	48
Aim:	This unit is intended for those who are looking to become database professionals. A learner that achieves this unit will be able to perform installation, maintenance, and configuration tasks, as well as take responsibility for aspects of other activities such as setting up database systems, ensuring systems operate efficiently, and the regular storing, backing up, and securing data from unauthorised access.

Learning outcome
The learner will: 1. Be able to install SQL Servers.
Assessment criteria
The learner can: 1.1 describe the SQL Server platform 1.2 use SQL Server tools 1.3 configure SQL Server services 1.4 describe the SQL Server architecture 1.5 plan for SQL Server resource requirements 1.6 conduct pre-installation stress testing for SQL Server 1.7 install SQL Server 1.8 upgrade SQL Server 1.9 automate the installation of SQL Server.

Learning outcome
The learner will: 2. Be able to use databases.
Assessment criteria
The learner can: 2.1 describe the role of SQL Server databases 2.2 describe the structure of SQL Server databases 2.3 administer files and filegroups 2.4 move database files 2.5 transfer data to and from SQL Server 2.6 optimise the bulk insert process.

Learning outcome
The learner will: 3. Be able to restore SLQ server databases.
Assessment criteria
The learner can: 3.1 describe the concepts of backup strategies 3.2 explain the transaction logging capabilities 3.3 plan a SQL Server backup strategy 3.4 manage database backups 3.5 describe the restore process 3.6 restore databases 3.7 use Point-in-time Recovery.

Learning outcome
The learner will: 4. Know how to authorise users.
Assessment criteria
The learner can: 4.1 describe how SQL Server authenticates connections 4.2 describe how logins are authorised to access databases 4.3 describe the requirements for authorisation across servers 4.4 authorise user access to objects 4.5 authorise users to execute code 4.6 configure permissions at the schema level 4.7 use **database server roles**.

Range
database server roles (fixed, user defined)

Learning outcome
The learner will: 5. Be able to audit SQL Server Environments.
Assessment criteria
The learner can: 5.1 describe the options for auditing data access in SQL Server 5.2 implement SQL Server Audit 5.3 manage SQL Server Audit.

Learning outcome
The learner will: 6. Be able to automate SQL Server Management.
Assessment criteria
The learner can: 6.1 automate SQL Server Management 6.2 use SQL Server Agent 6.3 manage SQL Server Agent jobs.

Learning outcome
The learner will: 7. Be able to configure security for SQL Server Agent.
Assessment criteria
The learner can: 7.1 explain SQL Server Agent security 7.2 configure credentials 7.3 configure Proxy accounts.

Learning outcome
The learner will: 8. Be able to perform ongoing database maintenance.
Assessment criteria
The learner can: 8.1 configure database mail 8.2 monitor SQL Server errors 8.3 configure operators 8.4 configure alerts 8.5 configure notifications 8.6 ensure database integrity 8.7 maintain indexes 8.8 automate routine database maintenance.

Learning outcome
The learner will: 9. Be able to use tracing options.
Assessment criteria
The learner can: 9.1 capture SQL Server activity 9.2 analyse performance data 9.3 improve SQL Server performance.

Learning outcome
The learner will: 10. Be able to manage multiple servers.
Assessment criteria
The learner can: 10.1 manage multiple servers 10.2 describe options for virtualising SQL Server 10.3 deploy Data-Tier Applications 10.4 upgrade Data-Tier Applications.

Learning outcome
The learner will: 11. Be able to troubleshoot SQL Server administrative issues.
Assessment criteria
The learner can: 11.1 explain SQL Server troubleshooting methodology 11.2 resolve administrative **issues**.

Range
issues (service-related, concurrency, login, connectivity)

Unit 631 Administering a Windows based server

UAN:	**A/507/0289**
Level:	3
Credit value:	11
GLH:	50
Aim:	This unit provides the skills and knowledge necessary to administer a Windows based Server. A learner achieving this unit will have the ability to administer the tasks required to maintain a Windows based Server infrastructure, such as user and group management, network access, and data security. This unit is linked to the Microsoft Official Academic Course (MOAC) and Exam for Administering Windows Server.

Learning outcome
The learner will: 1. Be able to deploy server images.
Assessment criteria
The learner can: 1.1 install Windows deployment services 1.2 describe how to create operating system images 1.3 configure **Windows deployment** services.

Range
Windows deployment (incorporates custom computer naming, deployment of images, administrative tasks)

Learning outcome
The learner will: 2. Be able to manage Domain Name Systems (DNS).
Assessment criteria
The learner can: 2.1 explain how to configure DNS zones and transfers 2.2 manage **DNS.**

Range
DNS (includes installing and configuring, troubleshooting( ) server roles, zones, conditional forwarding, resource records)

Learning outcome
The learner will: 3. Be able to maintain domain controllers.
Assessment criteria
The learner can: 3.1 explain the structure of directory services 3.2 describe how to implement **domain controllers** 3.3 implement domain controllers 3.4 configure directory services snapshots 3.5 describe the use of domain controller cloning.

Range
domain controllers (virtualised, read only (RODCs)) **3.3** includes configuring, implementing, administering, troubleshoot DC includes virtualised, read only (RODCs)

Learning outcome
The learner will: 4. Be able to implement a group policy infrastructure.
Assessment criteria
The learner can: 4.1 configure managed **service accounts** 4.2 explain the features of group policy 4.3 implement group policy preferences 4.4 manage group policy scope 4.5 describe administrative templates 4.6 manage group **policy objects** 4.7 describe how to deploy software using group policy objects.

Range
service accounts (create, associate, password policy, account lockout) **policy objects** (create, configure, monitor, process policy, troubleshoot)

Learning outcome
The learner will: 5. Be able to manage remote access.
Assessment criteria
The learner can: 5.1 manage **remote access role** in Windows 5.2 manage an **advanced remote access infrastructure** 5.3 explain web application proxy (implementation, validation).

Range
remote access role (install, configure, monitor, troubleshoot) **advanced remote access infrastructure** (installation, configuring, monitoring, validate, including VPN)

Learning outcome
The learner will: 6. Be able to manage the network server.
Assessment criteria
The learner can: 6.1 describe network policy authentication methods 6.2 manage the **network policy server** 6.3 configure RADIUS clients 6.4 configure RADIUS servers 6.5 describe how network access protection can help protect a network 6.6 describe Network Access Protection enforcement processes 6.7 manage Network Access Protection.

Range
network policy server (configure troubleshoot) **network access protection** (configure troubleshoot)

Learning outcome
The learner will: 7. Be able to optimise file services
Assessment criteria
The learner can: 7.1 describe file server resource manager 7.2 configure file services 7.3 implement classification tasks 7.4 implement file management tasks 7.5 describe the components of the distributed file system 7.6 configure **distributed file systems** 7.7 encrypt files using encrypting file system EFS 7.8 configure advanced auditing features

Range
distributed file systems (namespaces replication)

Learning outcome
The learner will: 8. Be able to manage group policy
Assessment criteria
The learner can: 8.1 describe the role of Windows server update services 8.2 describe the use of monitoring tools for Windows Server 8.3 describe how to monitor events 8.4 establish a performance baseline 8.5 identify the source of a performance problem 8.6 configure centralised event logs 8.7 interpret events

Unit 632 Configuring advanced Windows server services

UAN:	**R/507/0332**
Level:	3
Credit value:	12
GLH:	52
Aim:	This unit provides the skills and knowledge necessary to administer a Windows based Server. A learner achieving this unit will have the ability to perform the advanced configuring tasks required to deploy, manage, and maintain a Windows Server Infrastructure, such as fault tolerance, certificate services, and identity federation. This unit is linked to the Microsoft Official Academic Course (MOAC) and Exam for Configuring Advanced Windows Server Services.

Learning outcome
The learner will: 1. Be able to implement advanced network services.
Assessment criteria
The learner can: 1.1 configure advanced DNS services 1.2 configure advanced DHCP services 1.3 implement Internet Protocol Address Management (IPAM).

Learning outcome
The learner will: 2. Be able to implement advanced file services.
Assessment criteria
The learner can: 2.1 configure Internet Small Computer Storage Interface (ISCSI) storage 2.2 configure **BranchCache** 2.3 configure the File Classification Infrastructure

2.4	monitor BranchCache
2.5	optimise storage usage.

Range
BranchCache (Main Officer Servers, Branch Officer Servers, client computers)

Learning outcome
The learner will: 3. Be able to implement Dynamic Access control.
Assessment criteria
The learner can: 3.1 plan Dynamic Access control implementation 3.2 configure **claims** 3.3 configure resource property definitions 3.4 configure **central access** 3.5 validate dynamic access controls 3.6 remediate dynamic access controls 3.7 implement resource policies.

Range
claims (user device) **central access** (rules, policies)

Learning outcome
The learner will: 4. Be able to implement directory services.
Assessment criteria
The learner can: 4.1 describe distributed directory services deployments 4.2 implement a distributed directory services deployment 4.3 implement Child Domains 4.4 implement Forest Trusts 4.5 manage **directory services** 4.6 create subnets.

Range
directory services (create, configure, monitor, modify, troubleshoot, trusts, replication, sites (including default sites)

Learning outcome
The learner will: 5. Be able to implement certificate services.
Assessment criteria
The learner can: 5.1 configure certificates 5.2 configure key recovery 5.3 describe the Public Key Infrastructure (PKI) 5.4 deploy a certification authority 5.5 configure the certification authority hierarchy 5.6 manage certificates.

Range
5.1 includes templates enrolment revocation **5.6** deploy, implement distribution, implement revocation, recovery

Learning outcome
The learner will: 6. Be able to implement Rights Management Services (RMS).
Assessment criteria
The learner can: 6.1 describe RMS 6.2 configure RMS 6.3 implement RMS trust policies 6.4 verify RMS deployment 6.5 deploy RMS infrastructure 6.6 manage an RMS infrastructure 6.7 configure RMS content protection 6.8 configure external access to RMS.

Learning outcome
The learner will: 7. Be able to implement Federation Services (FS).
Assessment criteria
The learner can: 7.1 describe FS 7.2 configure FS pre-requisites 7.3 configure FS 7.4 deploy FS.

Range
7.3 and 7.4 for a single organisation, for Federated business partners

Learning outcome
The learner will: 8. Be able to implement Network Load Balancing (NLB).
Assessment criteria
The learner can: 8.1 manage an NLB cluster 8.2 validate high availability for an NLB cluster.

Range
8.1 Plan, Configure, Implement, monitor

Learning outcome
The learner will: 9. Be able to implement failover clustering.
Assessment criteria
The learner can: 9.1 manage a failover cluster 9.2 configure cluster-aware updating on a failover cluster 9.3 manage a highly available file server 9.4 configure a highly available failover solution 9.5 configuring a virtualised failover cluster for virtualisation 9.6 configure a Highly Available Virtual Machine 9.7 implement virtualisation of machines on failover clusters 9.8 implement virtual machine movement 9.9 manage virtual environments.

Range
9.1 includes implement, configure, maintain multi-site and single site **9.3** includes deploy, configure, validate **9.4** for services, for applications

Learning outcome
The learner will: 10. Be able to implement disaster recovery.
Assessment criteria
The learner can: 10.1 describe disaster recovery 10.2 implement server recovery 10.3 implement data recovery 10.4 back up data on a Windows server 10.5 use cloud services for disaster recovery.

Unit 633 Configuring Windows based systems

UAN:	**D/507/0334**
Level:	3
Credit value:	12
GLH:	52
Aim:	This unit provides the skills and knowledge necessary to configure or support Windows based systems. A learner achieving this unit will have the ability configure or support Windows computers, devices, users, and associated network and security resources. The networks will typically be configured as domain-based or peer-to-peer environments with access to the Internet and cloud services. This unit is linked to the Microsoft Official Academic Course (MOAC) and Exam for Configuring Windows.

Learning outcome
The learner will: 1. Be able to install Windows.
Assessment criteria
The learner can: 1.1 describe the different editions of Windows 1.2 describe options for upgrading a Windows based operating system 1.3 prepare a computer for Windows installation 1.4 install a Windows operating system 1.5 automate the installation of a Windows operating system 1.6 configure device drivers 1.7 explain Windows operating system licensing and activation 1.8 customise an image for deployment 1.9 prepare an image for deployment 1.10 describe volume activation 1.11 deploy a Windows Image.

Learning outcome
The learner will: 2. Be able to manage user state.
Assessment criteria
The learner can: 2.1 create User State Migration Tool (USMT) XML files 2.2 customise USMT XML files 2.3 manage user accounts 2.4 configure user state virtualization 2.5 migrate user state 2.6 optimise storage usage.

Learning outcome
The learner will: 3. Be able to use Windows tools.
Assessment criteria
The learner can: 3.1 managing Windows Using Group Policy 3.2 implement Windows remote management 3.3 describe the tools to use for Windows management 3.4 manage Windows using command line based tools.

Guidance
3.2 this could be PowerShell Remoting 3.4 this could be Powershell

Learning outcome
The learner will: 4. Be able to configure network connections.
Assessment criteria
The learner can: 4.1 configure a local area network (LAN) connection 4.2 implement automatic IP address allocation 4.3 implement name resolution 4.4 resolve network connectivity problems 4.5 implement wireless network connectivity 4.6 describe **wireless network connections.**

Range
4.1 (IPv4, IPv6) **Wireless network connections** (standards, technologies)

Learning outcome
The learner will: 5. Be able to configure resource access.
Assessment criteria
The learner can: 5.1 configure domain access for Windows devices 5.2 manage non-domain devices 5.3 configure workplace join 5.4 configure work folders.

Learning outcome
The learner will: 6. Be able to secure networks.
Assessment criteria
The learner can: 6.1 Describe network security threats 6.2 Mitigate threats to network security 6.3 Secure network traffic

Learning outcome
The learner will: 7. Be able to manage file access.
Assessment criteria
The learner can: 7.1 manage **hard disks** 7.2 describe cloud-based storage services 7.3 manage file and folder access 7.4 manage shared folder access 7.5 configure file and folder compression 7.6 manage **printers.**

Range
hard disks (local, virtual) **printers** (local, network)

Learning outcome
The learner will: 8. Be able to secure Windows devices.
Assessment criteria
The learner can: 8.1 describe methods used for authentication in Windows 8.2 describe methods used for authorization in Windows 8.3 describe how to use local Group Policy Objects (GPOs) to secure Windows 8.4 create multiple local GPOs 8.5 secure data 8.6 configure User Account Control (UAC).

Range
8.5 with EFS and with BitLocker

Learning outcome
The learner will: 9. Be able to maintain Windows client computers.
Assessment criteria
The learner can: 9.1 optimise Windows performance 9.2 manage the Windows reliability 9.3 manage software updates.

Learning outcome
The learner will: 10. Be able to configure applications for Windows.
Assessment criteria
The learner can: 10.1 describe application deployment options 10.2 manage apps on a Windows based operating system 10.3 configure Internet browser settings 10.4 configure application restrictions.

Learning outcome
The learner will: 11. Be able to configure remote access.
Assessment criteria
The learner can: 11.1 configure Windows settings for mobile computing devices 11.2 configure Virtual Private Network (VPN) access 11.3 configure DirectAccess 11.4 configure remote desktop 11.5 configure remote assistance.

Learning outcome
The learner will: 12. Be able to configure desktop virtualisation.
Assessment criteria
The learner can: 12.1 describe a client hypervisor 12.2 create virtual machines 12.3 manage virtual hard disks 12.4 manage checkpoints.

Guidance
12.1 could be Hyper-V

Learning outcome
The learner will: 13. Be able to recover a Windows based operating system.
Assessment criteria
The learner can: 13.1 explain Windows recovery options 13.2 back up files 13.3 restore files.

Unit 634 Installing and configuring Windows based servers

UAN:	**H/507/0335**
Level:	3
Credit value:	11
GLH:	57
Aim:	This unit provides the skills and knowledge necessary to implement a core Windows Server infrastructure. A learner achieving this unit will have the ability to implement and configure Windows Server core services, such as Active Directory and the networking services. This unit is linked to the Microsoft Official Academic Course (MOAC) and Exam for Installing and Configuring Windows Server.

Learning outcome
The learner will: 1. Be able to deploy Windows based servers.
Assessment criteria
The learner can: 1.1 describe the features of a Window based server 1.2 describe the server management **tools** 1.3 plan for a server installation 1.4 configure a server.

Range
tools (development, testing, connecting)

Learning outcome
The learner will: 2. Understand domain controllers.
Assessment criteria
The learner can: 2.1 describe the structure of domain controller services 2.2 describe the purpose of domain controllers

2.3 explain how to install a domain controller.

Learning outcome
The learner will: 3. Be able to manage user accounts.
Assessment criteria
The learner can: 3.1 **manage accounts** 3.2 delegate permissions 3.3 explain how to automate user account management.

Range
manage (create, configure, troubleshooting) **accounts** (user, group, computer)

Learning outcome
The learner will: 4. Be able to implement Internet Protocol (IP).
Assessment criteria
The learner can: 4.1 describe the TCP/IP protocol suite 4.2 describe **IP addressing options** 4.3 determine a **subnet mask** 4.4 configure IP options 4.5 troubleshoot IP options 4.6 describe the benefits of IPv6 4.7 describe the **interoperability** between IPv4 and IPv6.

Range
IP addressing options (IPv4, IPv6) **subnet mask** (subnetting or supernetting) **Interoperability** (Coexistence, transition)

Learning outcome
The learner will: 5. Be able to implement Dynamic Host Configuration Protocols (DHCP).
Assessment criteria
The learner can: 5.1 **configure** DHCP **server roles** 5.2 manage a DHCP database 5.3 manage the DHCP server role.

Range
configure (Also includes securing server role)

server roles (Also includes scopes)

Learning outcome
The learner will: 6. Be able to implement Domain Name Systems (DNS).
Assessment criteria
The learner can: 6.1 install DNS server services 6.2 configure DNS 6.3 **manage** DNS.

Range
manage (also includes DNS zones, creating host records and server cache)

Learning outcome
The learner will: 7. Be able to configure server storage.
Assessment criteria
The learner can: 7.1 describe storage technologies 7.2 **configure storage** 7.3 **configure shared files and folders** 7.4 configure a printer pool.

Range
Configure storage (also includes resizing volumes, redundant storage space) **Configure shared files and folder** (a file share, shadow copies, protection, security)

Learning outcome
The learner will: 8. Be able to manage group policy.
Assessment criteria
The learner can: 8.1 **manage** group policy objects 8.2 describe server operating system security 8.3 configure software application restriction policies 8.4 audit **system access.**

Range
manage (also includes creating group policy objects, implementing a central store for administrative templates, security, restrict running of unauthorised software, a firewall with advanced security)

system access (domain logons, file system access)

Learning outcome
The learner will: 9. Be able to implement server virtualization.
Assessment criteria
The learner can: 9.1 describe virtualisation technologies 9.2 configure a virtual machine 9.3 manage virtual machine storage 9.4 **manage** virtual networks.

Range
manage (to also include configure)

Unit 634 Installing and configuring Windows based servers

Supporting information

Guidance

Configuration of any aspect of the server also requires installation

For learners to know the benefits of IPV6, they should also learn the features

1.4 this includes admin tasks.

3.3 automation should be through command line tools

Unit 635 Programming in HTML5 with JavaScript and CSS3

UAN:	**A/507/0275**
Level:	3
Credit value:	11
GLH:	43
Aim:	This unit is designed to provide an introduction to HTML5, CSS3, and JavaScript. The unit focuses on using HTML5/CSS3/JavaScript to implement programming logic, define and use variables, perform looping and branching, develop user interfaces, capture and validate user input, store data, and create well-structured application. This unit is linked to the Microsoft Official Academic Course (MOAC) and Exam for the Programming in HTML5 with JavaScript and CSS3.

Learning outcome
The learner will: 1. Be able to create HTML5 pages.
Assessment criteria
The learner can: 1.1 describe basic **HTML5** 1.2 explain the structure of Cascading Style Sheets (CSS) 1.3 describe Integrated Development Environment (IDE) tools available for building Web applications 1.4 create static pages using features of HTML5 1.5 apply styling to the elements in an HTML5 page.

Range
HTML5 (elements, attributes)

Learning outcome
The learner will: 2. Be able to code using JavaScript.
Assessment criteria
The learner can: 2.1 explain the syntax of JavaScript 2.2 describe how to use JavaScript with HTML5 2.3 write JavaScript code that manipulates the HTML DOM 2.4 write JavaScript code that handles events 2.5 describe how to use jQuery to simplify code 2.6 describe the benefits of structuring JavaScript code 2.7 explain best practices for creating custom objects in JavaScript 2.8 describe how to extend objects to add functionality.

Learning outcome
The learner will: 3. Be able to create forms using HTML5.
Assessment criteria
The learner can: 3.1 create forms using HTML5 3.2 validate user input using HTML5 attributes 3.3 create feedback using HTML5 attributes 3.4 write JavaScript code to validate user input.

Learning outcome
The learner will: 4. Be able to communicate with a remote data source.
Assessment criteria
The learner can: 4.1 communicate data by using **XMLHttpRequest** objects 4.2 simplify code that communicates data using the jQuery ajax method.

Range
XMLHttpRequest (has member types: Events, Methods, Properties)

Learning outcome
The learner will: 5. Be able to style HTML5 by using CSS3.
Assessment criteria
The learner can: 5.1 style text elements on an HTML5 page by using CSS3 5.2 apply styling to block elements by using CSS3 5.3 use CSS3 selectors to specify the elements to be styled in a Web application 5.4 implement effects by using **CSS3 properties**.

Range
CSS3 properties (graphical, transformations)

Learning outcome
The learner will: 6. Be able to create interactive pages using HTML5 Application Programming Interfaces (APIs).
Assessment criteria
The learner can: 6.1 use APIs to interact with files in a Web application 6.2 incorporate media into a **Web application** 6.3 detect the location of the user running a Web application 6.4 explain how to debug a Web application 6.5 explain how to profile a Web application.

Range
Web application (video, audio)

Learning outcome
The learner will: 7. Be able to add offline support to web applications.
Assessment criteria
The learner can: 7.1 save data locally on the user's computer 7.2 retrieve data locally on the user's computer 7.3 incorporate offline support for a Web application.

Learning outcome
The learner will: 8. Be able to implement an adaptive User Interface (UI).
Assessment criteria
The learner can: 8.1 describe the need for a Web application to detect device capabilities 8.2 describe the need for a Web application to react to different form factors 8.3 create a Web page that can dynamically adapt its layout to match different form factors.

Learning outcome
The learner will: 9. Be able to create graphics.
Assessment criteria
The learner can: 9.1 add interactive graphics to an **application** 9.2 draw complex graphics on an HTML5 Canvas element by using JavaScript code.

Range
application (guidance using Scalable Vector Graphics)

Learning outcome
The learner will: 10. Be able to animate the User Interface (UI).
Assessment criteria
The learner can: 10.1 describe the types of transitions available with CSS3 10.2 apply CSS transitions to elements on an HTML5 page 10.3 implement complex **animations** 10.4 write JavaScript code to detect when a transition has occurred.

Range
animations (using CSS key-frames, using JavaScript code)

Learning outcome
The learner will: 11. Be able to implement Real-Time communications by using Web sockets.
Assessment criteria
The learner can: 11.1 explain how Web Sockets work 11.2 describe how to communicate data through a Web Socket 11.3 use the Web Socket API with JavaScript to **communicate** with a Web Socket server.

Range
communicate (send and receive data, and handle the different events that can occur when a message is sent or received)

Learning outcome
The learner will: 12. Be able to create a Web Worker Process.
Assessment criteria
The learner can: 12.1 describe the **purpose** of a Web Worker process 12.2 use the Web Worker APIs from JavaScript code for a Web Worker **process**.

Range
purpose (perform asynchronous processing, provide isolation for sensitive operations) **process** (create, run, and monitor

Unit 636 Implementing a Windows based data warehouse

UAN:	**T/507/0338**
Level:	3
Credit value:	10
GLH:	41
Aim:	This unit is aimed at those who will be involved in Extract Transform Load (ETL) and data warehouse development creating Business Intelligence (BI) solutions and have some responsibilities for data cleansing and data warehouse implementation.

Learning outcome
The learner will: 1. Understand the requirements for data warehouse hardware.
Assessment criteria
The learner can: 1.1 describe the main hardware considerations for building a data warehouse 1.2 explain how to use reference architectures to create a data warehouse 1.3 explain how to use data warehouse appliances to create a data warehouse.

Learning outcome
The learner will: 2. Be able to implement a data warehouse.
Assessment criteria
The learner can: 2.1 describe the key elements of a data warehousing solution 2.2 describe the key considerations for a data warehousing project 2.3 implement a logical design for a data warehouse 2.4 implement a physical design for a data warehouse.

Learning outcome
The learner will: 3. Be able to create an Extract, Transform and Load (ETL) Solution.
Assessment criteria
The learner can: 3.1 describe the key features of SQL Server Integration Services (SSIS) 3.2 explore source data for an ETL solution 3.3 implement a data flow using SSIS 3.4 implement control flow with **constraints** 3.5 create dynamic packages 3.6 use containers in a package control flow 3.7 enforce **consistency** 3.8 manage an **SSIS package**.

Range
constraints (tasks, precedence) **consistency** (with transactions, with checkpoints) **SSIS package** (debug, logging, error handling

Learning outcome
The learner will: 4. Be able to implement an incremental ETL process.
Assessment criteria
The learner can: 4.1 describe the considerations for implementing an incremental ETL solution 4.2 extract data from source systems 4.3 insert data into a data warehouse.

Learning outcome
The learner will: 5. Be able use a cloud data warehousing solution.
Assessment criteria
The learner can: 5.1 describe cloud data scenarios 5.2 describe cloud database software 5.3 implement a **cloud-based database.**

Range
cloud based database (guidance create, extract and obtain data from cloud services)

Learning outcome
The learner will: 6. Be able to use Data Quality Services (DQS).
Assessment criteria
The learner can: 6.1 describe how DQS can help manage data quality 6.2 use DQS to cleanse data 6.3 use DQS to match data.

Learning outcome
The learner will: 7. Be able to use Master Data Services.
Assessment criteria
The learner can: 7.1 describe key Master Data Services concepts 7.2 implement a Master Data Services model 7.3 use the Master Data Services **add-in for spreadsheets.**

Range
add-in for spreadsheets (to view a model, to modify a model) (guidance Excel for spreadsheet)

Learning outcome
The learner will: 8. Be able to use SSIS packages.
Assessment criteria
The learner can: 8.1 describe how custom components can be used to extend SSIS 8.2 describe how to use custom scripts in an SSIS package 8.3 describe SSIS deployment 8.4 plan SSIS package execution.

Learning outcome
The learner will: 9. Understand Business Intelligence (BI).
Assessment criteria
The learner can: 9.1 describe BI scenarios 9.2 explain the key features of SQL Server Reporting Services 9.3 explain the key features of SQL Server Analysis Services.

Unit 637 Managing a Windows based system

UAN:	**A/507/0342**
Level:	3
Credit value:	11
GLH:	49
Aim:	Candidates for this exam are IT professionals who configure or support Windows 8 computers, devices, users, and associated network and security resources. The networks with which these professionals typically work are configured as domain-based or peer-to-peer environments with access to the Internet and cloud services. The IT professional could be a consultant, a full-time desktop support technician or an IT generalist who administers Windows–based computers and devices as a portion of their broader technical responsibilities.

Learning outcome
The learner will: 1. Be able to implement management of a Windows based operating system.
Assessment criteria
The learner can: 1.1 perform local management of Windows 1.2 perform remote management of Windows 1.3 manage Windows using Group Policy 1.4 describe management tools for Windows.

Guidance
1.2 this could be PowerShell

Learning outcome
The learner will: 2. Be able to implement an installation strategy.
Assessment criteria
The learner can: 2.1 determine a Windows deployment strategy 2.2 implement a Windows migration strategy 2.3 plan Windows deployment methods 2.4 implement Windows deployment methods 2.5 plan for operating system virtualisation 2.6 create an unattended answer file 2.7 modify a Windows image offline 2.8 configure boot to Virtual Hard Drive (VHD).

Learning outcome
The learner will: 3. Be able to implement Windows authentication.
Assessment criteria
The learner can: 3.1 plan user authentication 3.2 plan domain-based security 3.3 implement authentication 3.4 troubleshoot domain authentication.

Learning outcome
The learner will: 4. Be able to implement intranet connectivity.
Assessment criteria
The learner can: 4.1 describe methods for obtaining IPv4 configurations 4.2 plan intranet connectivity 4.3 configure IPv4 4.4 describe how name resolution works 4.5 describe tools for troubleshooting network issues 4.6 troubleshoot common network issues.

Learning outcome
The learner will: 5. Be able to implement an application strategy for Windows.
Assessment criteria
The learner can: 5.1 manage application installers 5.2 design application deployment 5.3 plan an application compatibility strategy 5.4 manage applications.

Learning outcome
The learner will: 6. Be able to implement a solution for user settings.
Assessment criteria
The learner can: 6.1 plan a solution for implementation of user settings 6.2 manage user profiles 6.3 explain User Experience Virtualization (UE-V) 6.4 deploy UE-V.

Learning outcome
The learner will: 7. Be able to configure access to cloud service.
Assessment criteria
The learner can: 7.1 describe **cloud services** that support Windows management 7.2 plan for cloud services deployment 7.3 deploy cloud services 7.4 configure Windows cloud based services.

Range
cloud services (purpose, functionality, policies, updates)

Learning outcome
The learner will: 8. Be able to implement access to file and print services.
Assessment criteria
The learner can: 8.1 manage local storage 8.2 implement access to files 8.3 implement access to file shares 8.4 implement file caching 8.5 plan client-side printing 8.6 configure client-side printing.

Learning outcome
The learner will: 9. Be able to implement encryption for Windows.
Assessment criteria
The learner can: 9.1 plan the implementation of an Encrypting File System (EFS) 9.2 plan the use of BitLocker 9.3 implement BitLocker 9.4 manage BitLocker.

Learning outcome
The learner will: 10. Be able to implement endpoint security.
Assessment criteria
The learner can: 10.1 plan endpoint security 10.2 implement centralised configuration for Windows updates 10.3 implement Windows cloud services endpoint protection 10.4 configure applications restrictions.

Learning outcome
The learner will: 11. Be able to implement extranet connectivity.
Assessment criteria
The learner can: 11.1 explain how DirectAccess provides seamless remote access to intranet resources 11.2 configure Virtual Private Network (VPN) Access 11.3 manage mobile device connectivity to extranet.

Learning outcome
The learner will: 12. Be able to implement recovery solutions.
Assessment criteria
The learner can: 12.1 plan a recovery solution 12.2 diagnose problems with the Windows boot process 12.3 repair Windows stability issues 12.4 implement a user data recovery strategy for Windows.

Unit 638 Designing and implementing a Windows desktop infrastructure

UAN:	**T/507/0341**
Level:	4
Credit value:	13
GLH:	56
Aim:	This unit provides the skills and knowledge necessary to as part of designing, implementing, and maintaining a Windows Server desktop infrastructure. A learner achieving this unit will have the ability to plan, configure, and implement the Windows based Server desktop services, such as desktop imaging and deployment, application/desktop virtualization, and RDP access and infrastructure. This unit is linked to the Microsoft Official Academic Course (MOAC) and Exam for Implementing a Desktop Infrastructure.

Learning outcome
The learner will: 1. Understand desktop deployment options.
Assessment criteria
The learner can: 1.1 describe the enterprise desktop life cycle 1.2 explain how to assess readiness for a desktop deployment 1.3 describe the available methods for deploying enterprise desktops 1.4 describe volume activation technologies for enterprise desktops 1.5 plan a desktop deployment strategy 1.6 implement a volume activation solution.

Learning outcome
The learner will: 2. Understand how to plan an image management strategy.
Assessment criteria
The learner can: 2.1 determine the type of **images** used in an image management strategy 2.2 determine the content of images used in an image management strategy 2.3 assess business requirements to support an image management strategy.

Learning outcome
The learner will: 3. Be able to implement desktop security.
Assessment criteria
The learner can: 3.1 implement a centralised secure desktop solution by using Group Policy settings 3.2 plan device encryption by using BitLocker 3.3 implement device encryption by using BitLocker 3.4 plan a centrally managed EFS solution 3.5 implement a centrally managed EFS solution 3.6 configure desktop security.

Learning outcome
The learner will: 4. Be able to manage a desktop operating system image.
Assessment criteria
The learner can: 4.1 identify the key features of the Windows *ADK* 4.2 describe the Windows *PE* environment 4.3 describe how answer files are used in Windows installations 4.4 capture a reference image 4.5 service a reference image 4.6 configure Windows DS 4.7 configure a custom windows PE environment 4.8 build a custom answer file 4.9 generalise a reference computer 4.10 configure Windows deployment services server role.

Range
4.6 for image capture and for image deployment

Learning outcome
The learner will: 5. Be able to implement user state migration.
Assessment criteria
The learner can: 5.1 plan user state migration 5.2 migrate user state by using the User State Migration Tool (USMT) 5.3 create USMT XML Files 5.4 customise USMT XML Files.

Learning outcome
The learner will: 6. Be able to design an Active Directory Domain Services physical infrastructure.
Assessment criteria
The learner can: 6.1 plan for the LTI environment 6.2 implement MDT for LTI 6.3 integrate Windows Deployment Services (DS) with the MDT 6.4 plan the ZTI environment 6.5 prepare the site for operating system deployment 6.6 build a reference image by using a configuration manager task sequence 6.7 deploy client images by using MDT task sequences.

Learning outcome
The learner will: 7. Be able to implement a remote desktop services infrastructure.
Assessment criteria
The learner can: 7.1 plan the Remote Desktop Services environment 7.2 configure desktop deployments 7.3 extend the Remote Desktop Services environment to the Internet.

Range
7.2 for virtual machine–based and session-based

Learning outcome
The learner will: 8. Be able to manage user state virtualization for enterprise desktops.
Assessment criteria
The learner can: 8.1 describe considerations for implementing an enterprise-based updates infrastructure 8.2 describe how to use System Center Configuration Manager for software updates 8.3 describe how to manage software updates 8.4 describe how to configure Windows Intune for software updates 8.5 determine software update compliance 8.6 deploy software updates to clients.

Range
8.2 deploy, manage 8.3 for virtual machine, for images 8.4 deploy, manage

Learning outcome
The learner will: 9. Be able to design network access services.
Assessment criteria
The learner can: 9.1 design remote access services 9.2 implement remote access services 9.3 design a perimeter network.

Guidance
9.1 and 9.2 Remote Authentication Dial-In User Service (RADIUS), DirectAccess.

Learning outcome
The learner will: 10. Be able to protect enterprise desktops.
Assessment criteria
The learner can: 10.1 configure System Center Endpoint Protection 10.2 describe how to use Windows Intune endpoint protection 10.3 describe how to protect desktops by using DPM 10.4 monitor endpoint protection 10.5 configure client data protection

Guidance
10.1 to include protection point, protection policies, client

settings, monitoring status

Learning outcome
The learner will: 11. Be able to monitor the performance of the desktop infrastructure
Assessment criteria
The learner can: 11.1 configure performance monitoring of desktops 11.2 configure reliability monitoring of desktops 11.3 configure operations manager for monitoring virtual environments 11.4 monitor the desktop infrastructure

Guidance
11.4 to include health, performance and VDI

Unit 639 Implementing Windows desktop application environments

UAN:	**M/507/0340**
Level:	4
Credit value:	12
GLH:	50
Aim:	This unit provides the skills and knowledge necessary to design, implement, and maintain a Windows Server desktop infrastructure. A learner achieving this unit will have the ability to plan, configure, and implement the Windows Server desktop services, such as desktop imaging and deployment, application/desktop virtualisation, and RDP access and infrastructure.

Learning outcome
The learner will: 1. Be able to design an application distribution strategy.
Assessment criteria
The learner can: 1.1 describe how to develop an application lifecycle strategy 1.2 describe the factors affecting application distribution design 1.3 design an application distribution strategy.

Learning outcome
The learner will: 2. Be able to resolve application compatibility.
Assessment criteria
The learner can: 2.1 explain considerations for diagnosing application compatibility issues 2.2 explain solutions available for remediating application compatibility issues 2.3 resolve application compatibility issues with the Application Compatibility Toolkit (ACT).

Learning outcome
The learner will: 3. Be able to deploy software.
Assessment criteria
The learner can: 3.1 deploy software 3.2 install Windows apps using sideloading.

Range
3.1 centrally using Group Policy, to clients

Learning outcome
The learner will: 4. Be able to configure self-service applications.
Assessment criteria
The learner can: 4.1 plan self-service application deployment 4.2 configure self-service application deployment 4.3 describe how to improve the self-service application deployment process.

Learning outcome
The learner will: 5. Be able to implement presentation virtualisation infrastructure.
Assessment criteria
The learner can: 5.1 describe how to assess presentation virtualisation requirements 5.2 describe how to plan presentation virtualisation infrastructure 5.3 describe how to extend presentation virtualisation infrastructure 5.4 assess capacity requirements for presentation virtualisation

5.5 configure presentation virtualisation infrastructure.

Range
5.5 to include high availability, remote access)

Learning outcome
The learner will: 6. Be able to deploy presentation virtualisation applications.
Assessment criteria
The learner can: 6.1 determine a presentation virtualisation application strategy 6.2 plan how to deploy applications to Remote Desktop Session Host (RD Session Host) servers 6.3 deploy applications to RD Session Host servers 6.4 configure access to RD Session Host resources 6.5 deploy RD Session Host desktop applications 6.6 configure remote applications 6.7 verify remote applications.

Learning outcome
The learner will: 7. Be able to deploy an application virtualisation environment.
Assessment criteria
The learner can: 7.1 determine an application virtualisation model to meet business requirements 7.2 deploy components to support an application virtualisation model 7.3 deploy the Windows application virtualisation client 7.4 configure the Windows application virtualisation client.

Learning outcome
The learner will: 8. Be able to deploy virtual applications.
Assessment criteria
The learner can: 8.1 configure the Windows Application Virtualisation Sequencer 8.2 sequence applications 8.3 deploy sequenced applications deploy software updates to clients.

Learning outcome
The learner will: 9. Be able to implement application updates.
Assessment criteria
The learner can: 9.1 plan application updates 9.2 deploy application updates 9.3 implement application update security.

Learning outcome
The learner will: 10. Be able to implement application upgrades.
Assessment criteria
The learner can: 10.1 plan application upgrades 10.2 implement application upgrades 10.3 plan application concurrency 10.4 implement application concurrency 10.5 configure application version coexistence.

Guidance
10.1 upgrades would naturally include supersedence

Learning outcome
The learner will: 11. Know how to monitor application deployment.
Assessment criteria
The learner can: 11.1 describe how to plan application monitoring 11.2 describe how to plan **software monitoring** 11.3 describe how to monitor application resource use 11.4 configure server monitoring.

Guidance
11.2 **software monitoring** (inventory and metering)

Unit 640 Supporting Microsoft exchange server solutions

UAN:	**J/507/0344**
Level:	4
Credit value:	12
GLH:	52
Aim:	This unit is designed to provide learners with the knowledge and skills to plan, deploy, manage, secure, and support Microsoft Exchange Server. It covers monitoring, maintaining, and troubleshooting an Exchange Server that will include guidelines, best practices, and considerations to help optimize performance and minimize errors and security threats. This is an ideal for those aspiring to be enterprise-level messaging administrators, though it would also benefit those seeking a career as an IT generalist and or help desk professional.

Learning outcome
The learner will: 1. Be able to manage Microsoft Exchange Server.
Assessment criteria
The learner can: 1.1 describe Exchange Server prerequisites 1.2 deploy an Exchange Server 1.3 manage Exchange Server 1.4 evaluate requirements for an Exchange Server installation 1.5 monitor Exchange Server 1.6 maintain Exchange Server 1.7 troubleshoot Exchange Server.

Learning outcome
The learner will: 2. Be able to configure Mailbox Servers.
Assessment criteria
The learner can: 2.1 describe the Mailbox Server role 2.2 plan for a Mailbox Server role deployment 2.3 configure the Mailbox Server 2.4 configure Storage on the Mailbox Server 2.5 configure Mailbox Databases.

Learning outcome
The learner will: 3. Be able to manage recipient objects.
Assessment criteria
The learner can: 3.1 manage Exchange Server mailboxes 3.2 manage Exchange Server recipients 3.3 implement public folders 3.4 configure address lists 3.5 configure policies.

Learning outcome
The learner will: 4. Be able to configure self-service applications.
Assessment criteria
The learner can: 4.1 plan self-service application deployment 4.2 configure self-service application deployment 4.3 describe how to improve the self-service application deployment process.

Learning outcome
The learner will: 5. Be able to configure messaging client connectivity.
Assessment criteria
The learner can: 5.1 describe the Exchange Server client services 5.2 configure messaging client web Application 5.3 plan mobile messaging 5.4 configure mobile messaging 5.5 configure secure Internet access for Client Access server.

Learning outcome
The learner will: 6. Be able to configure high availability.
Assessment criteria
The learner can: 6.1 describe a highly available Exchange Server 6.2 configure highly available Mailbox Databases 6.3 configure highly available Client Access servers.

Learning outcome
The learner will: 7. Be able to implement disaster recovery.
Assessment criteria
The learner can: 7.1 plan disaster mitigation 7.2 plan Exchange Server backup 7.3 implement Exchange Server backup 7.4 plan Exchange Server recovery 7.5 implement Exchange Server recovery.

Learning outcome
The learner will: 8. Be able to deploy virtual applications.
Assessment criteria
The learner can: 8.1 describe how message transport operates in Exchange Server 8.2 plan message transport 8.3 configure message transport 8.4 manage transport rules.

Learning outcome
The learner will: 9. Be able to implement message security.
Assessment criteria
The learner can: 9.1 plan messaging security 9.2 implement an antivirus solution for Exchange Server 9.3 implement an anti-spam solution for Exchange Server.

Learning outcome
The learner will: 10. Be able to configure administrative security.
Assessment criteria
The learner can: 10.1 configure Role Based Access Control (RBAC) permissions

10.2 configure audit logging.

Unit 641 Designing and implementing a Windows server infrastructure

UAN:	**M/507/0337**
Level:	4
Credit value:	13
GLH:	54
Aim:	This unit provides the skills and knowledge necessary design, implement, and maintain a Windows based Server infrastructure. A learner achieving this unit will have the ability to plan, configure, and implement Windows based Server services, such as server deployment, server virtualization, and network access and infrastructure. This unit is linked to the Microsoft Official Academic Course (MOAC) and Exam for Designing and Implementing a Server Infrastructure.

Learning outcome
The learner will: 1. Understand how to plan a server upgrade or migration.
Assessment criteria
The learner can: 1.1 describe server upgrade considerations 1.2 describe server migration considerations 1.3 explain how to plan for server virtualization 1.4 plan a server upgrade and migration strategy.

Learning outcome
The learner will: 2. Be able to implement a server deployment strategy.
Assessment criteria
The learner can: 2.1 explain how to plan for an automated server installation and deployment strategy 2.2 determine a deployment automation strategy

2.3 implement an automated deployment strategy.

Learning outcome
The learner will: 3. Be able to implement an address management solution.
Assessment criteria
The learner can: 3.1 design a Dynamic Host Configuration Protocol (DHCP) strategy 3.2 implement DHCP strategy.

Guidance
3.1 and 3.2 to include DNCP scope configuration, IP address management (IPAM))

Learning outcome
The learner will: 4. Be able to implement a name resolution strategy.
Assessment criteria
The learner can: 4.1 design a Domain Name System (DNS) server implementation strategy 4.2 implement a DNS zone strategy 4.3 configure DNS zone replication 4.4 optimise the DNS server configuration.

Guidance
4.1 to include DNS namespace, DNS zone strategy, DNS zone replication, DNS for high availability and security

Learning outcome
The learner will: 5. Be able to implement Active Directory Domain Services logical infrastructures.
Assessment criteria
The learner can: 5.1 design an Active Directory Domain Services (AD DS) infrastructure 5.2 implement an Active Directory Domain Services (AD DS) infrastructure 5.3 plan an AD DS administrative tasks delegation model 5.4 design an Organizational Unit (OU) structure 5.5 design an AD DS group strategy 5.6 implement an AD DS group strategy 5.7 determine information required to facilitate a Group Policy Object (GPO) design 5.8 analyse the information required to facilitate a GPO design 5.9 create a GPO design 5.10 implement a GPO design.

Guidance
5.1 and 5.2 to include forest, forest trusts, domains, domain trusts, namespaces

Learning outcome
The learner will: 6. Be able to design an Active Directory Domain Services physical infrastructure.
Assessment criteria
The learner can: 6.1 design AD DS sites 6.2 design AD DS replication 6.3 design domain controller placement 6.4 design domain controller deployments 6.5 implement active directory sites 6.6 implement domain controllers.

Guidance
6.4 to include highly available and on virtual machines

Learning outcome
The learner will: 7. Be able to implement storage.
Assessment criteria
The learner can: 7.1 plan a **storage solution** 7.2 implement a storage solution 7.3 configure redundant storage space.

Range
storage solution (storage spaces, efficient storage, Internet Small Computer System Interface (iSCSI) storage area network (SAN))

Learning outcome
The learner will: 8. Be able to implement file services.
Assessment criteria

The learner can:

8.1 plan a Distributed File System (DFS)

8.2 implement a DFS

8.3 plan Windows BranchCache

8.4 implement Windows BranchCache

8.5 plan Dynamic Access Control

8.6 implement Dynamic Access Control.

Learning outcome
The learner will: 9. Be able to design network access services.
Assessment criteria
The learner can: 9.1 design **remote access services** 9.2 implement remote access services 9.3 design a perimeter network.

Range
remote access services (Remote Authentication Dial-In User Service (RADIUS), DirectAccess

Learning outcome
The learner will: 10. Be able to design network protection.
Assessment criteria
The learner can: 10.1 design **network security** 10.2 implement network security 10.3 identify network security threats 10.4 describe how to mitigate network security threats.

Range
network security (Windows Firewall, Network Access Protection (NAP))

Unit 642 Creating an event-driven computer program

UAN:	**Y/503/7090**
Level:	3
Credit value:	12
GLH:	90
Aim:	This unit covers more advanced concepts of event-driven computer languages and their use to implement, refine and test computer programs.

Learning outcome
The learner will: 1. Implement a software design using event-driven programming
Assessment criteria
The learner can: 1.1 Identify the screen components and data and file structures required to implement a given design 1.2 Select, declare and initialise variable and data structure types and sizes to implement design requirements 1.3 Select and assign properties to screen components to implement design requirements 1.4 Select and associate events (including parameter passing) to screen components to implement design requirements 1.5 Implement event handling using control structures to meet the design algorithms 1.6 Select and declare file structures to meet design file storage requirements 1.7 Select and declare file structures to meet design file storage requirements 1.8 Make effective use of operators and predefined functions 1.9 Make effective use of an Integrated Development Environment (IDE) including code and screen templates

Learning outcome
The learner will: 2. Refine an event-driven program to improve quality
Assessment criteria
The learner can: 2.1 Use an agreed standard for naming, comments and code layout 2.2 Define user functions to replace repeating code sequences 2.3 Implement data validation for inputs 2.4 Identify and implement opportunities for error handling and reporting

Learning outcome
The learner will: 3. Test the operation of an event-driven program
Assessment criteria
The learner can: 3.1 Make effective use of the debugging facilities available in the IDE 3.2 Prepare a test strategy 3.3 Select suitable test data and determine expected test results 3.4 Record actual test results to enable comparison with expected results 3.5 Analyse actual test results against expected results to identify discrepancies 3.6 Investigate test discrepancies to identify and rectify their causes

Learning outcome
The learner will: 4. Document an event-driven program
Assessment criteria
The learner can: 4.1 Create on-screen help to assist the users of a computer program 4.2 Create documentation for the support and maintenance of a computer program

Unit 857 Principles of information governance and assurance

UAN:	**K/505/5786**
Level:	3
Credit value:	15
GLH:	75
Aim:	This unit develops the knowledge and skills required to implement information governance. Upon completion of this unit, learners will have an understanding of the procedures involved in implementing information governance and the legislation that must be complied with.

Learning outcome
The learner will: 1. Understand the purpose of information governance
Assessment criteria
The learner can: 1.1 explain the importance of confidentiality, integrity and availability for information systems 1.2 explain the role of identity in information security 1.3 explain the importance and use of cryptographic techniques in information security 1.4 describe the information security procedures required by different types of organisations 1.5 outline the legal requirements for information security for individuals and organisations

Learning outcome
The learner will: 2. Understand information security threats and vulnerabilities
Assessment criteria
The learner can: 2.1 describe the types of threats facing the information security of individuals and organisations 2.2 explain the development of threats to the information security of individuals and organisations 2.3 describe sources of threats to information security in

terms of opportunity, ability and motive 2.4 describe the types of information security vulnerabilities that can arise in hardware and software components 2.5 explain how hardware and software vulnerabilities can be identified and resolved

Learning outcome
The learner will: 3. Understand information security techniques and technologies
Assessment criteria
The learner can: 3.1 describe common cryptographic techniques including examples of their use in information security 3.2 explain the limitations of cryptography and their impact on information security 3.3 explain how physical and logical access controls can be used to protect information systems 3.4 design an access control system incorporating levels of access and the use of identity to protect a given information asset 3.5 compare proactive and reactive information security techniques 3.6 explain the information security features of hardware and network components 3.7 compare ethical and unethical hacking 3.8 describe how ethical hacking can contribute to information security testing

Learning outcome
The learner will: 4. Understand information security risk assessment and management
Assessment criteria
The learner can: 4.1 describe how to identify information assets which may be at risk 4.2 assess the probability and impact of given risks 4.3 describe available methods for preserving and restoring the integrity and availability of information assets 4.4 explain the responsibilities of system users for information security.

Unit 858 Testing the security of information systems

UAN:	**T/505/5788**
Level:	3
Credit value:	12
GLH:	40
Aim:	This unit aims to develop the knowledge and skills required to test the information security implemented on a system to establish its effectiveness. Upon completion of this unit, learners will be able to plan and carry out the security testing of information systems.

Learning outcome
The learner will: 1. Be able to conduct security testing
Assessment criteria
The learner can: 1.1 develop test scripts for specified information assurance requirements testing 1.2 create plans that ensure that specified information assurance requirements are tested 1.3 implement specified preparations prior to carrying out tests 1.4 apply specified test methods, tools and techniques following organisational procedures 1.5 record the results of tests using standard documentation 1.6 implement specified activities following the completion of testing

Learning outcome
The learner will: 2. Be able to report on test results
Assessment criteria
The learner can: 2.1 examine the results of testing to identify security vulnerabilities 2.2 prioritise identified vulnerabilities against specified

	information assurance requirements
2.3	report any high priority vulnerabilities to the relevant persons following organisational procedures
2.4	identify the type of actions required to mitigate identified vulnerabilities
2.5	report the results of test activities using standard documentation following organisational procedures

Unit 859 Carrying out information security risk assessment

UAN:	**T/505/5791**
Level:	3
Credit value:	9
GLH:	30
Aim:	This unit develops the knowledge and skills required to assess information security risks. Learners achieving this unit will be able to gather information that can be used to develop information security risk contingency plans and manage the identified risks.

Learning outcome
The learner will: 1. Be able to gather information on information security risks
Assessment criteria
The learner can: 1.1 verify the scope of information assets and system components to be assessed with relevant persons 1.2 use specified investigative methods following organisational procedures 1.3 gather information to enable the security of specified information assets and system components to be assessed 1.4 record all gathered information using standard documentation

Learning outcome
The learner will: 2. Be able to assess and report on information security risks
Assessment criteria
The learner can: 2.1 examine gathered information to identify risks to the security of specified information assets and system components 2.2 categorise the priority of identified risks by determining their probability of occurrence and potential impact

2.3	report high priority risks to the relevant persons following organisational procedures
2.4	determine the types of actions required to mitigate identified risks
2.5	report the results of risk assessment activities using standard documentation following organisational procedures

Unit 860 Investigating information security incidents

UAN:	**F/505/5793**
Level:	3
Credit value:	9
GLH:	23
Aim:	This unit aims to develop the knowledge and skills required to investigate a security incident. Upon completion of this unit, learners will be able to gather information that can be used to determine the impact of a security incident and make recommendations regarding the mitigation of the associated risks.

Learning outcome
The learner will: 1. Be able to gather information to investigate information security incidents
Assessment criteria
The learner can: 1.1 identify the information assets and system components that may be impacted by detected incidents 1.2 verify the scope of detected incidents with relevant persons 1.3 obtain and preserve evidence relating to detected incidents

Learning outcome
The learner will: 2. Be able to investigate information security incidents
Assessment criteria
The learner can: 2.1 undertake agreed investigative actions 2.2 examine how access to the affected information assets and system components was obtained 2.3 report to the relevant persons any incidents for which the

	mode of access cannot be identified
2.4	make recommendations on the need for detailed forensic examinations
2.5	report on incident investigation activities using standard documentation
2.6	follow organisational procedures for investigation activities

Unit 862 Carrying out information security incident management activities

UAN:	**F/505/5812**
Level:	3
Credit value:	9
GLH:	25
Aim:	This unit aims to develop the knowledge and skills required to manage information security risks., Learners will be able to gather information that can be used to develop information security risk contingency plans and manage the identified risks.

Learning outcome
The learner will: 1. Be able to gather information to manage information security incidents
Assessment criteria
The learner can: 1.1 follow organisational procedures for the detection and classification of incidents 1.2 identify the information assets and system components that may be impacted by detected incidents 1.3 verify the scope of detected incidents with relevant persons 1.4 obtain information and data on incidents to assess their impact on information assets and system components

Learning outcome
The learner will: 2. Be able to carry out information security incident management activities
Assessment criteria
The learner can: 2.1 identify types of actions required to resolve incidents or mitigate their impact 2.2 report any incidents which cannot be resolved or

	mitigated to the relevant persons following organisational procedures
2.3	make recommendations for specific actions to be taken to respond to incidents
2.4	report on incident management activities using standard documentation following organisational procedures
2.5	follow organisational procedures for the closure of incidents

Unit 863 Carrying out information security forensic examinations

UAN:	**R/505/5801**
Level:	3
Credit value:	6
GLH:	10
Aim:	This unit develops in learners the knowledge and skills required to undertake forensic examinations following an issue involving information, to ensure that evidence is preserved. Learners achieving this unit will know how to carry out the actions required to prevent evidence being compromised by activities undertaken when investigating an issue involving information security.

Learning outcome
The learner will: 1. Be able to carry out information security forensic examinations
Assessment criteria
The learner can: 1.1 follow organisational procedures for forensic examinations 1.2 undertake specified actions to secure information assets and system components subject to actual or attempted breaches of security 1.3 apply forensic methods to examine specified system information for evidence of actual or attempted breaches of security policy or legislation 1.4 report any identified sources of actual or attempted breaches of security to the relevant persons 1.5 use specified tools to analyse the integrity of software 1.6 report on forensic examination activities using standard documentation

Unit 865 Carrying out information security audits

UAN:	**A/505/5808**
Level:	3
Credit value:	6
GLH:	10
Aim:	This unit provides the skills and knowledge necessary to plan and undertake information security audits. Upon completion of this unit, learners will be able to plan and undertake security audits that can be used to manage any identified risks.

Learning outcome
The learner will: 1. Be able to carry out information security audit activities
Assessment criteria
The learner can: 1.1 verify the scope of information assets and system components to be audited with relevant persons 1.2 use specified audit methods to obtain information and data relating to information assets and system components to assess security compliance 1.3 examine information and data relating to information assets and system components to assess security compliance 1.4 report any security non-compliance to the relevant persons 1.5 report on audit activities using standard documentation 1.6 follow organisational procedures for information security audits

Unit 866 System operation

UAN:	**A/500/7340**
Level:	3
Credit value:	12
GLH:	100
Aim:	This unit develops knowledge of the architecture used in IT systems. Upon completion, learners will have developed an understanding of maintaining IT systems and reviewing existing configurations, making recommendations regarding how these may be optimised.

Learning outcome
The learner will: 1. Know how to operate the system
Assessment criteria
The learner can: 1.1 explain the operating procedures that are applicable to the system, such as: a. required service levels (e.g. availability, quality); b. routine maintenance; c. monitoring; d. data integrity (e.g. backups, anti-virus); e. consumables use, storage & disposal; f. health & safety; g. escalation; h. information recording and reporting; i. obtaining work permissions; j. security & confidentiality. 1.2 describe system functionality during normal operation. 1.3 describe the effects of operational activities on system functionality

Learning outcome
The learner will: 2. Be able to operate systems
Assessment criteria
The learner can: 2.1 use and operate the system following appropriate

procedures. 2.2 identify system faults and resolve or escalate system faults as appropriate. 2.3 gather and record specified operational information. 2.4 assess and minimise risks such as: a. loss or corruption of data; b. loss of service; c. damage to equipment; d. effects on customer operations

Learning outcome
The learner will: 3. Be able to maintain and implement system operating procedures
Assessment criteria
The learner can: 3.1 provide advice and guidance on system operation to immediate colleagues. 3.2 select the procedures to be followed. 3.3 schedule operational activities to minimise disruption to system functionality. 3.4 collate operational information

Unit 867 System management

UAN:	**D/500/7332**
Level:	3
Credit value:	12
GLH:	100
Aim:	This unit aims to develop the knowledge and skills required to manage systems. Upon completion of the unit, learners will have developed an understanding of how to configure systems to meet customer requirements and review existing configurations, making recommendations regarding how these may be optimised.

Learning outcome
The learner will: 1. Understand how to administer a system
Assessment criteria
The learner can: 1.1 describe how to configure the system. 1.2 describe ICT asset and configuration information applicable to the system such as: a. physical attributes (e.g. manufacturer, type, revision, serial number, location, value); b. configuration (e.g. physical and logical addresses, options set, connections). 1.3 describe how available options for system configuration affect functionality and capacity.

Learning outcome
The learner will: 2. Be able to administer a system and change system configurations
Assessment criteria
The learner can: 2.1 select configuration options to optimise system functionality and capacity. 2.2 make changes to system configuration. 2.3 specify items for which ICT asset and configuration

information is to be recorded.

Unit 868 User profile administration

UAN:	**K/500/7379**
Level:	3
Credit value:	9
GLH:	80
Aim:	This unit provides the underpinning knowledge to enable learners to configure and administer user profiles. Upon completion of this unit, learners will understand types of user profiles and how to assign permissions.

Learning outcome
The learner will: 3. Know how to administer user profiles
Assessment criteria
The learner can: 3.1 describe the organisational policy on user profiles such as: a. user identifier (eg. username); b. password and related information (e.g. change frequency); c. allowed system access (e.g. times, locations) 3.2 allowed access to facilities (e.g. data, software).. 3.3 describe how to create and edit user and standard profiles 3.4 describe how user profiles affect access to system facilities such as; a. shared resources (e.g. data storage, printers); b. software; c. data.

Learning outcome
The learner will: 4. Be able to administer user profiles
Assessment criteria
The learner can: 4.1 make specified changes to user profiles

4.2	specify user profiles to meet individual requirements
4.3	create standard profiles for groups of users
4.4	provide guidance on user profiles to immediate colleagues

Unit 869 Network management and security

UAN:	**H/501/4010**
Level:	3
Credit value:	14
GLH:	95
Endorsement by a sector or regulatory body:	This unit is endorsed by e-skills UK
Aim:	This unit will enable the candidate to configure, manage and troubleshoot the performance of Computer Networks.

Learning outcome	
The learner will:	
1.	Know the principles of network design, performance and management
Assessment criteria	
The learner can:	
1.1	explain that network performance is reliant upon three basic principles.
1.2	explain how a hierarchical network design can be used to manage network traffic and help to optimise network performance.
1.3	describe the network characteristics of routers, switches and bridges and their potential effects upon network traffic management.
1.4	describe the effect of broadcast traffic on an ip network, broadcast domains and how to manage such traffic.
1.5	describe how the performance of a switched network typically differs from that of one using hubs.
1.6	describe how differing routing protocol characteristics can affect network performance.
1.7	describe how the selection of appropriate routing protocols can be a factor in understanding and managing network traffic on network links.
1.8	explain how different applications are more sensitive to

delay and jitter in congested network. 1.9 explain how network congestion affects differing types of network traffic. 1.10 describe at least 2 possible unauthorised networked applications that may cause excess network traffic problems and relate this to acceptable use and security policies within an organisation.

Learning outcome
The learner will: 2. Know the principles of network security
Assessment criteria
The learner can: 2.1 describe how filters and queuing techniques quality of service (QOS) can be applied to network traffic to address congestion issues relating to differing protocol types. 2.2 describe the use of a software network protocol analyser (sniffer) tool to monitor networks and identify problems

Learning outcome
The learner will: 3. Perform network management functions
Assessment criteria
The learner can: 3.1 describe the difference between a network management system (NMS) and operational support system (OSS) 3.2 describe the elements of an NMS/OSS 3.3 explain the function of MIBS as a collection of access points with agents which report to the management station(s) 3.4 identify and describe the operation of network management protocols 3.5 identify examples of network management software (NMS) 3.6 explain that management software (NMS) and operational support systems (OSS) can be used to remotely configure and alter operating parameters of network devices in real time. 3.7 explain the terms mean time between failure (MTBF), mean time to repair (MTTR), up time, down time and useful life cycle 3.8 explain the terms redundancy, failover and single point of failure in a networking context and the relationship to MTBF (mean time between failure) and MTTR (mean time to repair).

Learning outcome
The learner will: 4. Perform network security functions
Assessment criteria

The learner can:	
4.1	identify network equipment that can be remotely monitored and managed.
4.2	describe and justify at least 3 scenarios where it would be desirable to deploy redundant systems.

Unit 870 Advanced data representation and manipulation for IT

UAN:	**F/601/3246**
Level:	3
Credit value:	7
GLH:	60
Endorsement by a sector or regulatory body:	This unit is endorsed by e-skills UK
Aim:	The aim of this unit is to cover the advanced data representation and manipulation for IT purposes to include matrix methods, applying expressions and graph theory.

Learning outcome
The learner will: 1. Be able to apply matrix methods
Assessment criteria
The learner can: 1.1 Explain matrices as a method of representing ordered data and their relationship with computer program variable arrays 1.2 Use index notation to reference the cells of a matrix 1.3 Perform add, subtract and scalar multiplication operations on a matrix 1.4 Multiply two matrices 1.5 Find: the inverse of a matrix by elementary row operations the transpose of a matrix 1.6 Apply matrix techniques to a range of applications including: solving simultaneous linear equations vector transformation and rotation maps and graphs.

Learning outcome
The learner will: 2. Be able to apply series, probability and recursions
Assessment criteria
The learner can: 2.1 Give a functional expression for a series 2.2 Express a series recursively 2.3 Find the sum of a series 2.4 Express probabilities as percentages, fractions and decimals 2.5 Apply series, probability and recursion techniques to develop a solution to a range of problems.

Learning outcome
The learner will: 3. Be able to apply graph theory
Assessment criteria
The learner can: 3.1 Describe the components of a graph and their properties 3.2 Explain the characteristics of undirected, directed and mixed graphs 3.3 Represent a set of connected objects as a graph 3.4 Describe the type of problem which can be modelled by a weighted graph.

Unit 871 Principles of information security testing

UAN:	**R/505/5815**
Level:	3
Credit value:	12
GLH:	69
Aim:	This unit provides the skills and knowledge necessary to test the information security that has been implemented on a system to establish its effectiveness. Upon successful completion of this unit, learners will be able to plan and carry out the security testing of information systems.

Learning outcome
The learner will: 1. Understand the test process and testing techniques in relation to information security
Assessment criteria
The learner can: 1.1 describe the impact on organisations and individuals of failures to preserve the confidentiality, integrity and availability of information systems 1.2 explain the role of testing in preserving the confidentiality, integrity and availability of information systems 1.3 explain the impact of information security on the test process 1.4 compare how static and dynamic testing techniques are applied to information security testing 1.5 describe how standard testing techniques are used when testing information security

Learning outcome
The learner will: 2. Understand the use of common tools for information security testing
Assessment criteria
The learner can: 2.1 describe how tools can be used to improve efficiency and reliability of information security testing

2.2	explain how to develop plans for information security testing

Learning outcome
The learner will: 3. Be able to carry out penetration testing
Assessment criteria
The learner can: 3.1 describe the role and applicability of penetration testing 3.2 describe common penetration testing techniques 3.3 carry out penetration testing according to given specifications

Unit 872 Principles of secure system development

UAN:	**K/505/5819**
Level:	3
Credit value:	6
GLH:	34
Aim:	This unit provides knowledge and skills required to ensure the secure development of systems. Upon completion of this unit, learners will understand the stages of the systems development life cycle (SDLC) and the associated security requirements.

Learning outcome
The learner will: 1. Understand the role of security in the systems development life cycle (SDLC)
Assessment criteria
The learner can: 1.1 describe common systems development life cycle (SDLC) models 1.2 explain the implications of not including security requirements in each stage of the SDLC 1.3 describe the factors that can influence security requirements including: 1.4 how critical the system is to the organisation 1.5 system requirements for confidentiality, integrity and availability 1.6 applicable regulations and policies 1.7 actual or potential threats in the environment where the system will operate 1.8 identify opportunities for including security requirements in each stage of the SDLC.

Unit 873 Investigating and defining customer requirements for ICT systems

UAN:	**R/601/3249**
Level:	3
Credit value:	12
GLH:	75
Endorsement by a sector or regulatory body:	This unit is endorsed by e-skills UK
Aim:	The aim of this unit is to teach the learner, how to investigate the needs of users by looking into their existing systems and will explore all of the techniques needed to do this effectively. The learner will then learn how to analyse this information, as well as learning the techniques needed to record the results on standard documentation.

Learning outcome
The learner will: 1. Investigate existing systems and processes
Assessment criteria
The learner can: 1.1 Use three of the following investigative methods: observations examination of existing documents, records or software questionnaires site surveys 1.2 Record the results of investigations using standard documentation 1.3 Explain the importance of preserving the confidentiality of customer information.

Learning outcome
The learner will: 2. Analyse information to identify needs and constraints
Assessment criteria

The learner can:

2.1 Describe the type of defect, including inaccuracy, duplication and omission, which can arise in information

2.2 Describe the types of customer needs and constraints which can affect the design of an ICT system

2.3 Analyse information to identify customer needs for:

data to be stored and processed

functionality in terms of inputs, processes and outputs

capacity including numbers of users, throughput, and data storage

2.4 Analyse information to identify customer constraints

2.5 Record the results of analyses using standard documentation.

Unit 874 Data modelling

UAN:	**L/601/3203**
Level:	3
Credit value:	9
GLH:	75
Aim:	The aim of this unit is to teach the concepts of data modelling. The learner will be taught about the basic concepts including entities, attributes and relationships, and will also learn the objectives of normalisation to 3rd normal form as well as putting this into practice. The learner will use what they have learnt to produce logical data model.

Learning outcome
The learner will: 1. Understand the concepts of logical data modelling
Assessment criteria
The learner can: 1.1 describe entities and the types of attributes which can be assigned to them 1.2 describe the type of relationships which can exist between entities 1.3 explain the objectives of data normalisation and describe the third normal form (3nf) 1.4 explain the purpose of keys 1.5 describe an application where un-normalized or de-normalised data may be used 1.6 describe the types of standard notation which can be used to represent data sets as logical data models

Learning outcome
The learner will: 2. Be able to use data modelling techniques to create logical data models
Assessment criteria
The learner can: 2.1 identify and name entities, assigning the correct attributes 2.2 identify and represent entity relationships, assigning the correct type

2.3 normalise a data set to third normal form (3nf)

Learning outcome
The learner will: 3. Be able to use data modelling techniques to refine logical data models
Assessment criteria
The learner can: 3.1 identify entities which will be accessed for enquiry and/or update 3.2 identify access sequences and triggers 3.3 create access rules/methods 3.4 use a standard notation to describe the logical data model of a normalised data set

Unit 875 Design and plan for an internal network cabling infrastructure

UAN:	**T/501/4013**
Level:	3
Credit value:	10
GLH:	65
Endorsement by a sector or regulatory body:	This unit is endorsed by e-skills UK
Aim:	This unit will provide the learner with the basic principles needed to plan an underground cable route. Learners will be able to develop an understanding of how internal or campus communications infrastructure is specified, planned and provided

Learning outcome
The learner will: 1. Know how to survey a site for the provision of an internal network cabling infrastructure
Assessment criteria
The learner can: 1.1 identify a range of data, equipment and tools required for an internal and external site survey 1.2 identify the hazards and environments constraints that could apply to the systems and equipment to be provided 1.3 work safely during a site survey 1.4 describe what actions could be taken when variations are identified between the survey findings and site records and plans 1.5 explain why it is important to accurately record survey findings.

Learning outcome
The learner will: 2. Survey a site for the provision of an internal network cabling infrastructure
Assessment criteria
The learner can: 2.1 identify the areas, systems, equipment and full range of data required for a survey from the planning request 2.2 collect and record data and obtain plans and records of the areas to be surveyed and interpret them.

Learning outcome
The learner will: 3. Identify a range of options for the provision of an internal network cabling infrastructure and select the optimum solution
Assessment criteria
The learner can: 3.1 consider viable options and, explain why it is important to: consider forecasts for both existing and proposed services consider the implications of existing and planned systems, equipment, support systems and new accommodation keep abreast of new and emerging technologies objectively evaluate information, compare and rank different options according to their relative merits cost options over the lifetime of the equipment or an accepted period 3.2 identify the capabilities of the communications system being planned 3.3 describe the basic principles of risk, cost benefit and sensitivity analysis when considering options 3.4 identify what details are critical to decision makers with regards to the proposed solution 3.5 explain what action could be taken when their authority limit has been exceeded.

Learning outcome
The learner will: 4. Produce schematic designs and detailed plans for the provision of an internal network cabling infrastructure
Assessment criteria
The learner can: 4.1 gather sufficient information to be able to identify future demands for: existing communications services, new communications services 4.2 plan the collection of the information in a timescale suitable for achieving the forecast future demand 4.3 evaluate the information objectively, and use it to identify a range of options 4.4 calculate the broad costs of the options 4.5 select and document the optimum solution in sufficient detail to meet the requirements of the customer 4.6 obtain authority to proceed 4.7 process the selected option to meet agreed timescale for the delivery of the requirements.

Learning outcome
The learner will: 5. Co-ordinate the provision of an internal network cabling infrastructure
Assessment criteria
The learner can: 5.1 identify the work activities to be scheduled and agree the resources available to undertake the work 5.2 obtain details of the work activities to enable the development of a realistic works programme 5.3 schedule the works packages taking into account: their required timescale the availability of resources the inter-dependency of work activities 5.4 allocate work so that it will: enable the effective and efficient use of resources take account of team and individual competencies

Unit 876 Design and maintain ICT networks software components

UAN:	**J/501/4002**
Level:	3
Credit value:	11
GLH:	70
Endorsement by a sector or regulatory body:	This unit is endorsed by e-skills UK
Aim:	The aim of this unit is to enable learners to develop the skills to specify data communication protocols and design and maintain network software components for different types of networks.

Learning outcome
The learner will: 1. Be able to explain network concepts
Assessment criteria
The learner can: 1.1 interpret node and routing diagrams 1.2 describe common terms and their advantages and disadvantages 1.3 explain the difference between different network types and topologies 1.4 identify the main: hardware components of a network functions of the Network Operating System functions of network connections 1.5 describe the role of various types of print server and the network printing process including device drivers 1.6 explain the software security requirements when connecting a LAN to an external network and transmitting data 1.7 explain the difference between centralised and distributed networks 1.8 describe common error detection methods 1.9 explain fixed routing techniques.

Learning outcome
The learner will: 2. Describe communication protocols
Assessment criteria
The learner can: 2.1 interpret data communication protocol specifications 2.2 identify and describe ASCII character codes used in data communication protocols 2.3 describe the most common data transmission formats 2.4 explain the purpose and use of different protocol parameters 2.5 describe the importance of using international standards for data communications and the function of each of the OSI layers 2.6 describe the function and construction of data packets in a network, how they are handled in OSI layers and advantages of using packets to transmit data over a network 2.7 describe the functions of protocols and how they are handled in the OSI layered structure 2.8 describe and compare the TCP/IP NetBEUI and IPX/SPX protocols 2.9 explain the operation of a token ring with reference to protocols, token passing and packets 2.10 explain the operation of a bus network with reference to protocols, collision detection and packets.

Learning outcome
The learner will: 3. Describe software design concepts for networks
Assessment criteria
The learner can: 3.1 list the factors that make data communications software different from other software 3.2 explain why data communications software is used 3.3 list the message accountability actions to be performed for incoming and outgoing data transmissions 3.4 explain why networks must be tested.

Learning outcome
The learner will: 4. Be able to explain protocol specification methods
Assessment criteria
The learner can: 4.1 interpret: a State Transition Diagram (STD) an Event-state table a program design language.

Learning outcome
The learner will: 5. Design software components
Assessment criteria
The learner can: 5.1 produce diagrams for a given specification 5.2 produce program design language algorithms for software components 5.3 identify: variable names and data types argument names and data types return values and data types 5.4 verify that the design conforms to the specification.

Unit 877 Carrying out electronic forensic examinations

Level:	4
Credit value:	12
GLH:	75
Aim:	This unit develops the skills necessary to undertake electronic forensic examinations following an issue involving information, to ensure that evidence is preserved. Upon completion, learners will be able to carry out the actions required to prevent evidence being compromised when investigating an issue involving information security.

Learning outcome
The learner will: 1. Be able to understand what evidence is
Assessment criteria
The learner can: 1.1 Describe different types of evidence 1.2 Discuss evidence's importance for e-disclosure as part of an investigation 1.3 Demonstrate how to balance the competing demands of business continuity with evidence gathering 1.4 Discuss the role of the expert witness and how it varies from a witness of fact

Learning outcome
The learner will: 2. Be able to understand what constitutes a crime
Assessment criteria
The learner can: 2.1 Describe the components of a crime 2.2 Explain the principle of "burden of proof" 2.3 Describe the importance of "burden of proof" to disclosure (e-disclosure)

Learning outcome
The learner will:

3. Be able to understand the roles that exist within an investigation
Assessment criteria
The learner can: 3.1 Describe the different types of investigation that could be undertaken 3.2 Describe the role of the forensic examiner 3.3 Explain the responsibilities and liabilities of a forensic examiner

Learning outcome
The learner will: 4. Be able to understand the investigation steps
Assessment criteria
The learner can: 4.1 Describe the investigation steps that are usually undertaken 4.2 Explain how the investigation steps influence the forensic strategy 4.3 Explain the importance of the chain of custody 4.4 Discuss the key principles and methods that would be used in an investigation 4.5 Explain the impact of the key principles and methods may have on an investigation 4.6 Demonstrate recording of actions to withstand the scrutiny from independent third parties

Learning outcome
The learner will: 5. Be able to understand data storage and digital devices
Assessment criteria
The learner can: 5.1 Describe where data can be stored and relevant storage devices 5.2 Explain the problems posed for an investigation by the way data is stored 5.3 Explain why operating systems may pose a problem for the investigation 5.4 Discuss the problems posed by various digital devices for a forensic investigator

Learning outcome
The learner will: 6. Be able to understand different “anti-Forensic” techniques
Assessment criteria
The learner can: 6.1 Describe a range of anti-forensic techniques 6.2 Explain how to identify methods used for anti-forensic purposes 6.3 Discuss what may be done to overcome anti-forensic techniques

Learning outcome
The learner will: 7. Be able to understand different methods of forensic examination and analysis
Assessment criteria

The learner can: 7.1 Describe the advantages and disadvantages of live forensics 7.2 Describe the advantages and disadvantages of dead forensics 7.3 Explain when you would use live and dead forensics

Unit 878 Carrying out information security audits

UAN:	**A/505/5811**
Level:	4
Credit value:	12
GLH:	30
Aim:	This unit provides the knowledge and skills required to plan and undertake information security audits. Upon completion of this unit, learners will be able to plan and undertake security audits that can be used to manage any identified risks.

Learning outcome
The learner will: 1. Be able to prepare for information security audit activities
Assessment criteria
The learner can: 1.1 interpret given information security audit briefs to identify the information assets and system components to be audited 1.2 identify sources of information relating to the information assets and system components in scope 1.3 develop audit plans, following organisational procedures, which will ensure a thorough assessment of security compliance across the whole scope of the audit 1.4 verify audit scope and plans with relevant persons

Learning outcome
The learner will: 2. Be able to carry out information security audit activities
Assessment criteria
The learner can: 2.1 carry out information security audits following

	organisational procedures
2.2	critically review information and data relating to information assets and system components to assess security compliance
2.3	report any security non-compliance to the relevant persons in line with organisational procedures and timelines
2.4	report on audit activities following organisational procedures
2.5	make justified recommendations for actions to be taken to improve security compliance to relevant persons using media, format and structures which meet the needs of the intended audience

Unit 879 Carrying out information security forensic examinations

UAN:	**M/505/5806**
Level:	4
Credit value:	9
GLH:	20
Aim:	This unit covers the knowledge and skills necessary to undertake forensic examinations following issues involving information to ensure evidence is preserved. Learners achieving this unit will be able to carry out the activities necessary to prevent evidence being compromised when investigating an issue involving information security.

Learning outcome
The learner will: 1. Be able to carry out information security forensic examinations
Assessment criteria
The learner can: 1.1 carry out forensic examinations following organisational procedures 1.2 analyse system information for evidence of actual or attempted breaches of security policy or legislation 1.3 report any identified actual or attempted breaches of security to the relevant persons following organisational procedures and timelines 1.4 use security tools to analyse the integrity of software 1.5 take actions to secure information assets and system components subject to actual or attempted breaches of security in line with organisational timelines 1.6 with the authorisation of relevant persons, seize evidence in accordance with legislation and following organisational procedures 1.7 seize evidence, minimising disruption to the organisation and maintaining evidential integrity

Unit 880 Carrying out information security incident management activities

UAN:	**J/505/5813**
Level:	4
Credit value:	12
GLH:	35
Aim:	This unit covers planning and undertaking activities involved in responding to an incident involving information security. Upon successful completion, learners can undertake activities associated with responding to an incident, making recommendations in line with organisational policies.

Learning outcome
The learner will: 1. Be able to prepare for information security incident management
Assessment criteria
The learner can: 1.1 interpret given incident investigation briefs to identify the scope of the incidents to be managed 1.2 verify the scope of identified incidents with relevant persons 1.3 evaluate sources of evidence relating to identified incidents.

Learning outcome
The learner will: 2. Be able to manage information security incidents
Assessment criteria
The learner can: 2.1 obtain evidence relating to identified incidents, following organisational procedures 2.2 critically review evidence to determine appropriate investigative actions 2.3 make justified recommendations for investigative actions to relevant persons using media, format and structures

	which meet the needs of the intended audience
2.4	report on incident investigation following organisational procedures
2.5	critically evaluate organisational procedures for Incident Investigation.

Unit 881 Carrying out information security risk assessment

UAN:	**A/505/5792**
Level:	4
Credit value:	12
GLH:	40
Aim:	This unit covers the knowledge and skills necessary to plan and undertake an information security risk assessment. Upon completion of the unit, learners will be able to interpret risk assessment briefs and identify the information required to allow them to plan and carry out an effective security risk assessment.

Learning outcome
The learner will: 1. Be able to prepare for information security risk assessments
Assessment criteria
The learner can: 1.1 interpret given risk assessment briefs to identify the information assets and system components to be assessed 1.2 verify the scope of identified information assets and system components with relevant persons 1.3 evaluate sources of information relating to potential risks that may impact on the security of identified information assets and system components

Learning outcome
The learner will: 2. Be able to carry out information security risk assessments
Assessment criteria
The learner can: 2.1 use a range of investigative methods to gather information relating to potential risks that may impact on the security of identified information assets and system components 2.2 record all gathered information in line with organisational

	requirements
2.3	analyse gathered information to identify risks to the security of identified information assets and system components
2.4	assess identified risks to determine their probability of occurrence and potential impact
2.5	evaluate risks against organisational risk tolerance levels
2.6	report any risks which exceed organisational risk tolerance levels to the relevant persons following organisational procedures and timelines
2.7	formulate actions to mitigate risks
2.8	report the results of risk assessment in line with organisational procedures
2.9	communicate the results and implications of risk assessments to relevant persons using media, format and structures which meet the needs of the intended audience
2.10	evaluate organisational procedures for risk assessment

Unit 882 Carrying out information security risk management

UAN:	**L/505/5814**
Level:	4
Credit value:	12
GLH:	40
Aim:	This unit enables learners to develop the knowledge and skills necessary to carry out information security risk management. Upon completion of the unit, learners will be able to plan and undertake tasks associated with risk management to mitigate any risks to systems and networks.

Learning outcome
The learner will: 1. Be able to develop information security risk contingency plans
Assessment criteria
The learner can: 1.1 interpret given risk management briefs to identify the information assets and system components to be covered by the risk contingency plan 1.2 verify the scope of identified information assets and system components with relevant persons 1.3 develop risk contingency plans on a given analysis of the probability and impact of all identified risks 1.4 justify the range of response actions that may be used to mitigate risks 1.5 evaluate risk contingency plans against external standards and legislation 1.6 record information security risk contingency plans in line with organisational requirements

Learning outcome
The learner will: 2. Be able to manage information security risks
Assessment criteria
The learner can:

2.1 manage defined response actions to risks which impact the integrity of information assets and system components following organisational procedures and timelines

2.2 report any risks arising for which no response actions have been defined to the relevant persons following organisational procedures and timelines

2.3 report on information security risk management activities following organisational procedures

2.4 communicate the results and implications of risk management activities to relevant persons using media, format and structures which meet the needs of the intended audience

2.5 evaluate organisational procedures for risk management

Unit 883 Designing and developing event-driven computer programs

UAN:	**J/601/3300**
Level:	4
Credit value:	15
GLH:	90
Aim:	The aim of this unit is to teach the concepts of event-driven programming. In order to do this the learner will learn some of the features of an event-driven environment such as using standard input and output commands and use the integrated development environment effectively. They will have an opportunity to use what they have learnt by modifying an existing program to improve its quality. The learner will test their amended cost against actual and expected outcomes. Lastly the learner will develop design documentation for use in program maintenance as well as end user documentation such as a user guide.

Learning outcome
The learner will: 1. Be able to design event-driven programs to address loosely defined problems
Assessment criteria
The learner can: 1.1 identify and structure the components and data required to address problems 1.2 select and use pre-defined components, specialising as required 1.3 identify the set of events that invoke behaviour of components and other programme elements 1.4 specify the behaviour of components and other program elements to allow efficient implementation, selecting appropriate data types, data and file structures and algorithms 1.5 record the design using well-established notations

Learning outcome
The learner will: 2. Be able to produce a working event-driven program which meets the design specification
Assessment criteria
The learner can: 2.1 make effective use of basic programming language features and programming concepts to implement a program that satisfies the design specification 2.2 make effective use of the features of the programming environment 2.3 make effective use of user interface components in the implementation of the program 2.4 make effective use of a range of debugging tools

Learning outcome
The learner will: 3. Be able to develop event-driven programs that reflect established programming and software engineering practice
Assessment criteria
The learner can: 3.1 apply standard naming, layout and comment conventions 3.2 apply appropriate data validation and error handling techniques

Learning outcome
The learner will: 4. Be able to develop test strategies and apply these to event-driven programs
Assessment criteria
The learner can: 4.1 develop and apply a test strategy consistent with the design identifying appropriate test data 4.2 apply regression testing consistent with the test strategy 4.3 use appropriate tools to estimate the performance of the program

Learning outcome
The learner will: 5. Be able to develop design documentation for use in program maintenance and end-user documentation
Assessment criteria

The learner can:
5.1 record the final state of the program in a form suitable for subsequent maintenance
5.2 provide end-user documentation that meets the user's needs

Unit 884 Designing and developing object-oriented computer programs

UAN:	**T/601/3308**
Level:	4
Credit value:	15
GLH:	90
Aim:	The aim of this unit is to teach the concepts of designing and developing object-orientated programs. As part this unit, the learner will learn some of the key elements of object-orientated languages such as how to declare file structures and how to use some of the predefined functions. The learner will have an opportunity to use what they have learnt to modify an existing program to improve its quality or write a new program. The learner will test the revised code and record expected and actual results.

Learning outcome
The learner will:
1. Be able to design object-oriented programs to address loosely defined problems
Assessment criteria
The learner can:
1.1 identify a set of classes and their interrelationships to address the problem
1.2 make effective use of encapsulation, inheritance and polymorphism
1.3 select and reuse pre-existing objects and templates specialising as required
1.4 structure the design so that objects communicate efficiently

1.5 specify the properties and behaviour of classes to allow efficient implementation, selecting appropriate data types, data and file structures and algorithms 1.6 record the design using well-established notations

Learning outcome
The learner will: 2. Be able to produce a working object-oriented program which meets the design specification
Assessment criteria
The learner can: 2.1 make effective use of basic programming language features and programming concepts to implement a program that satisfies the design specification 2.2 make effective use of the features of the programming environment 2.3 make effective use of user interface components in the implementation of the program 2.4 make effective use of a range of debugging tools

Learning outcome
The learner will: 3. Be able to develop object-oriented programs that reflect established programming and software engineering practice
Assessment criteria
The learner can: 3.1 apply standard naming, layout and comment conventions 3.2 apply appropriate data validation and error handling techniques

Learning outcome
The learner will: 4. Be able to develop test strategies and apply these to object-oriented programs
Assessment criteria
The learner can: 4.1 develop and apply a test strategy consistent with the design identifying appropriate test data 4.2 apply regression testing consistent with the test strategy 4.3 use appropriate tools to estimate the performance of the program

Learning outcome
The learner will: 5. Be able to develop design documentation for use in program maintenance and end-user documentation
Assessment criteria
The learner can: 5.1 record the final state of the program in a form suitable for subsequent maintenance 5.2 provide end-user documentation that meets the user's needs

Unit 885 Designing and developing procedural computer programs

UAN:	**T/601/3311**
Level:	4
Credit value:	15
GLH:	90
Aim:	The aim of this unit is to teach the concepts of procedural programming. As part this unit the learner will learn some of the key elements of a procedural language such as how to declare file structures and how to use some of the predefined functions. They will have an opportunity to use what they have learnt by modifying an existing program to improve its quality. They will test the revised code and record expected and actual results. Lastly the learner will develop design documentation for use in program maintenance as well as end user documentation such as a user guide.

Learning outcome
The learner will: 6. Be able to design procedural programs to address loosely defined problems
Assessment criteria
The learner can: 6.1 identify and structure procedures and functions to address problems 6.2 select and use library functions and procedures 6.3 structure the design with regard to coupling and cohesion 6.4 specify the behaviour of functions and procedures to allow efficient implementation, selecting appropriate data types, data and file structures and algorithms 6.5 record the design using well-established notations

Learning outcome
The learner will:

7. Be able to produce a working procedural program which meets the design specification
Assessment criteria
The learner can: 7.1 make effective use of basic programming language features and programming concepts to implement a program that satisfies the design specification 7.2 make effective use of the features of the programming environment 7.3 make effective use of user interface components in the implementation of the program 7.4 make effective use of a range of debugging tools

Learning outcome
The learner will: 8. Be able to develop procedural programs that reflect established programming and software engineering practice
Assessment criteria
The learner can: 8.1 apply standard naming, layout and comment conventions 8.2 apply appropriate data validation and error handling techniques

Learning outcome
The learner will: 9. Be able to develop test strategies and apply these to procedural programs
Assessment criteria
The learner can: 9.1 develop and apply a test strategy consistent with the design identifying appropriate test data 9.2 apply regression testing consistent with the test strategy 9.3 use appropriate tools to estimate the performance of the program

Learning outcome
The learner will: 10. Be able to develop design documentation for use in program maintenance and end-user documentation
Assessment criteria
The learner can: 10.1 record the final state of the program in a form suitable for

subsequent maintenance 10.2 provide end-user documentation that meets the user's needs

Unit 887 Investigating and defining customer requirements for ICT systems

UAN:	**R/602/1772**
Level:	4
Credit value:	15
GLH:	90
Aim:	This unit shows learners how to investigate and define customer requirements for ICT systems. Learners will use different methods of investigation, learn how to record their findings and present them to colleagues. They will also be shown how to analyse information and identify the needs and constraints in meeting the requirements of their customers.

Learning outcome
The learner will: 1. Be able to control the investigation of existing and proposed systems and processes
Assessment criteria
The learner can: 1.1 select and use the investigative methods which will elicit relevant information about existing and proposed systems and processes 1.2 create the documentation required to record the results of investigations 1.3 ensure that investigative methods are applied correctly, and all relevant information is recorded using standard documentation 1.4 ensure that the confidentiality of customer information is preserved 1.5 provide advice and guidance to colleagues on investigation and analysis of information

Learning outcome
The learner will: 2. Be able to analyse information to identify needs and constraints
Assessment criteria
The learner can: 2.1 explain the types of defects, and their causes which can arise in information 2.2 describe methods of minimising defects in information. 2.3 explain how customer needs and constraints can affect the design of an ICT system 2.4 analyse information to identify customer needs and priorities for: a. data to be stored and processed b. functionality in terms of inputs, processes and outputs c. capacity including numbers of users, throughput, and data storage 2.5 analyse information to identify customer constraints 2.6 verify that identified needs, priorities and constraints meet customer requirements

Unit 888 Investigating information security incidents

UAN:	**D/505/5798**
Level:	4
Credit value:	12
GLH:	35
Aim:	This units develops the necessary skills and knowledge to gather and analyse information regarding an information security incident. Learners will be able to interpret information gathered to identify the impact of the incident and make recommendations about the mitigation of risks.

Learning outcome
The learner will: 1. Be able to prepare for information security incident investigations
Assessment criteria
The learner can: 1.1 interpret given incident investigation briefs to identify the scope of the incidents to be investigated 1.2 verify the scope of identified incidents with relevant persons 1.3 evaluate sources of evidence relating to identified incidents

Learning outcome
The learner will: 2. Be able to investigate information security incidents
Assessment criteria
The learner can: 2.1 obtain evidence relating to identified incidents, following organisational procedures 2.2 critically review evidence to determine appropriate investigative actions 2.3 make justified recommendations for investigative actions to relevant persons using media, format and structures which meet the needs of the intended audience 2.4 report on incident investigation following organisational

	procedures
2.5	critically evaluate organisational procedures for incident investigation

Unit 889 IT and telecoms system management

UAN:	**M/504/5504**
Level:	4
Credit value:	15
GLH:	90
Aim:	This unit provides the understanding of managing IT & telecoms systems and the skills required. Upon completion of the unit, learners will know how to configure IT & telecoms systems to meet customer requirements and review existing configurations, making recommendations about how these may be optimised.

Learning outcome
The learner will: 1. Understand how to manage systems
Assessment criteria
The learner can: 1.1 explain how to align system functionality with organisational objectives and customer needs 1.2 explain the types of configuration and asset information associated with systems 1.3 explain the types and applications of system management and monitoring tools

Learning outcome
The learner will: 2. Be able to review the functionality and management of systems
Assessment criteria
The learner can: 2.1 evaluate the functionality of systems against organisational objectives and customer needs to identify possible improvements 2.2 evaluate current system configuration and asset information to identify possible enhancements to

	performance and capacity
2.3	assess current system management and monitoring tools, and their use, suggesting possible improvements
2.4	review, and where necessary update, working procedures for system management
2.5	evaluate the impact of regulatory requirements on system management

Learning outcome
The learner will: 3. Be able to manage systems
Assessment criteria
The learner can:
3.1 select and implement configuration options to optimise system performance and capacity
3.2 ensure that changes made to system configurations are effective
3.3 recognise and resolve any system problems arising from configuration changes
3.4 audit records of system configuration and asset information for completeness and accuracy
3.5 evaluate potential risks, including security threats, to systems
3.6 contribute to the development of the organisation's system management strategy

Unit 890 IT and telecoms system operation

UAN:	**R/504/5513**
Level:	4
Credit value:	15
GLH:	90
Aim:	This unit develops learners' understanding of the architecture used in IT & telecoms systems. Upon successful completion, learners will know how to maintain IT & telecoms systems and review existing configurations, making recommendations about how these may be optimised.

Learning outcome
The learner will: 1. Understand the technical architecture of it or telecom systems
Assessment criteria
The learner can: 1.1 explain the technical architecture of a system and describe alternative approaches 1.2 explain the contribution to overall system functionality of the main physical and logical components of the system 1.3 explain how system components can be physically and logically interconnected 1.4 describe the external connections of the system and how they are used 1.5 explain the facilities available for controlling and monitoring the operation of the system

Learning outcome
The learner will: 2. Understand how to specify system operation parameters
Assessment criteria
The learner can: 2.1 explain how the expected functionality and capacity of the system has been specified 2.2 explain how qualitative and quantitative measures of system operation have been derived from functionality

	and capacity specifications
2.3	explain how the system can be controlled to optimise performance
2.4	explain how monitoring can be used to measure the qualitative and quantitative operation of the system
2.5	describe the routine maintenance or replenishment required to maintain normal system operation

Learning outcome
The learner will: 3. Be able to control the operation of systems
Assessment criteria
The learner can:
3.1 select the control facilities to be used and document how they are to be used to optimise system operation
3.2 select the monitoring facilities to be used and document how they are to be used to identify actual and potential deviations from normal system operation
3.3 define and implement procedures to check the validity of reported deviations from normal system operation
3.4 define and implement procedures to investigate identified and reported deviations to identify required corrective actions
3.5 define the system performance information to be recorded

Learning outcome
The learner will: 4. Be able to control system maintenance
Assessment criteria
The learner can:
4.1 define and implement procedures to schedule maintenance and replenishment activities to minimise disruption to system operation
4.2 define and implement procedures to ensure that maintenance activities are carried out safely and in accordance with relevant regulations
4.3 define and implement procedures to ensure that system users are promptly informed of changes to system availability or performance during maintenance activities
4.4 define the maintenance and replenishment information to be recorded

Unit 891 Testing the security of information systems

UAN:	**A/505/5789**
Level:	4
Credit value:	15
GLH:	60
Aim:	This unit aims to develop the knowledge and skills required to test the information security implemented on a system to establish its effectiveness. Upon completion of this unit, learners will be able to plan and carry out the security testing of information systems using a verity of tools/methods.

Learning outcome
The learner will: 1. Be able to plan security testing
Assessment criteria
The learner can: 1.1 develop a context driven test approach to systematically test specified parts of a system in order to assess their information security status 1.2 analyse given information assurance requirements to produce information security test acceptance criteria 1.3 develop test scripts and plans to ensure that all information assurance requirements are tested 1.4 prioritise testing activity to target the most significant threats and vulnerabilities first 1.5 select, and where necessary adapt, methods, tools and techniques to conduct penetration testing 1.6 define all required test preparation and conclusion activities

Learning outcome
The learner will: 2. Be able to carry out security testing
Assessment criteria
The learner can: 2.1 ensure that all required preparations are implemented, in line with test plans, prior to carrying out tests

2.2	apply test methods, tools and techniques following organisational procedures
2.3	record the results of tests using organisational documentation
2.4	ensure that all required activities have been correctly implemented following the completion of testing in line with test plans
2.5	critically evaluate the results of testing to accurately identify specific vulnerabilities
2.6	prioritise identified vulnerabilities against information assurance requirements
2.7	determine and justify actions to mitigate identified vulnerabilities
2.8	report the results of test activities following organisational procedures
2.9	communicate the results and implications of test activities to relevant persons using media, format and structures which meet the needs of the intended audience
2.10	evaluate organisational procedures for carrying out security testing

Appendix 1 Relationships to other qualifications

Links to other qualifications

Mapping is provided as guidance and suggests areas of commonality between the qualifications. It does not imply that learners completing units in one qualification have automatically covered all of the content of another.

Centres are responsible for checking the different requirements of all qualifications they are delivering and ensuring that learners meet requirements of all units/qualifications.

This qualification has connections to the:

City & Guilds Level 4 Diploma in ICT Professional Competence (4520-04).

Appendix 2 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the Centre Document Library on www.cityandguilds.com or click on the links below:

Quality Assurance Standards: Centre Handbook
This document is for all approved centres and provides guidance to support their delivery of our qualifications. It includes information on

- Centre quality assurance criteria and monitoring activities
- Administration and assessment systems
- Centre-facing support teams at City & Guilds / ILM
- Centre quality assurance roles and responsibilities.

The Centre Handbook should be used to ensure compliance with the terms and conditions of the Centre Contract.

Quality Assurance Standards: Centre Assessment
This document sets out the minimum common quality assurance requirements for our regulated and non-regulated qualifications that feature centre assessed components. Specific guidance will also be included in relevant qualification handbooks and/or assessment documentation.

It incorporates our expectations for centre internal quality assurance and the external quality assurance methods we use to ensure that assessment standards are met and upheld. It also details the range of sanctions that may be put in place when centres do not comply with our requirements, or actions that will be taken to align centre marking/assessment to required standards. Additionally, it provides detailed guidance on the secure and valid administration of centre-assessments.

Access arrangements - When and how applications need to be made to City & Guilds provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

The *Centre Document Library* also contains useful information on such things as:

- Conducting examinations
- Registering learners
- Appeals and malpractice

Useful contacts
Please visit the Contact Us section of the City & Guilds website, *Contact us*

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As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. We offer over 500 qualifications across 28 industries through 8500 centres worldwide and award around two million certificates every year. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

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City & Guilds of London Institute
Giltspur House
5-6 Giltspur Street
London
EC1A 9DE

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