QUALIFICATION SPECIFICATION

gateway qualifications

Suite of Digital and IT Qualifications (Level 3)

Access to HE
Apprenticeships
Digital
Employability & Enterprise
English & Maths
ESOL
Personal & Social Development
Professional Development
Vocational

This qualification specification covers the following qualifications:

Qualification Number	Qualification Title
603/6761/1	Gateway Qualifications Level 3 Certificate in Digital Business Solutions
603/6760/X	Gateway Qualifications Level 3 Diploma in Digital Business Solutions
603/6762/3	Gateway Qualifications Level 3 Certificate in Digital Engineering Design
603/6763/5	Gateway Qualifications Level 3 Diploma in Digital Engineering Design
603/6764/7	Gateway Qualifications Level 3 Certificate in Digital Product Design
603/6765/9	Gateway Qualifications Level 3 Diploma in Digital Product Design
603/6766/0	Gateway Qualifications Level 3 Certificate in Games Technologies
603/6767/2	Gateway Qualifications Level 3 Diploma in Games Technologies
603/6768/4	Gateway Qualifications Level 3 Certificate in Networking and Cybersecurity
603/6769/6	Gateway Qualifications Level 3 Diploma in Networking and Cybersecurity
603/6770/2	Gateway Qualifications Level 3 Certificate in Social Media for E-Commerce
603/6771/4	Gateway Qualifications Level 3 Diploma in Social Media for E-Commerce
603/6772/6	Gateway Qualifications Level 3 Certificate in Software Development
603/6773/8	Gateway Qualifications Level 3 Diploma in Software Development
603/6774/X	Gateway Qualifications Level 3 Certificate in Systems Infrastructure
603/6775/1	Gateway Qualifications Level 3 Diploma in Systems Infrastructure

Version and date	Change detail	Section/Page Reference
7.0 Feb 2023	New paragraph added to ‘4.4 Support materials and resources’	Page 24
6.0 Jan 2023	Removed mandatory unit & added new Project management unit to all quals.	Throughout
5.0 Nov 2022	Removed address and changed back cover	Page 31
4.0 Feb 2022	Amendment to unit	Page 21
3.0 Jun 2021	Various amendments	n/a
2.0 Feb 2021	Various amendments	n/a
1.0 Oct 2020	n/a	n/a

About this qualification specification

This qualification specification is intended for tutors, internal quality assurers, centre quality managers and other staff within Gateway Qualifications recognised centres and/or prospective centres.

It sets out what is required of the learner in order to achieve the qualifications. It also contains information specific to managing and delivering the qualifications including specific quality assurance requirements.

The specification should be read in conjunction with the Gateway Qualifications Centre Handbook and other publications available on the website which contain more detailed guidance on assessment and quality assurance practice.

In order to offer these qualifications you must be a Gateway Qualifications recognised centre and be approved to offer the qualifications.

If your centre is not yet recognised, please contact our Development Team to discuss becoming a Gateway Qualifications Recognised Centre:

Telephone: 01206 911211
Email: enquiries@gatewayqualifications.org.uk
Website: https://www.gatewayqualifications.org.uk/advice-guidance/delivering-our-qualifications/become-recognised-centre/

Contents

1. Qualification Information

1.1 About the qualifications

The qualifications have been approved by the Office of Qualifications and Examinations Regulation (Ofqual) that regulates qualifications, examinations and assessments in England and Qualifications Wales, the regulator of non-degree qualifications and the qualifications system in Wales.

These qualifications are for learners who want to develop and extend their digital and IT skills to prepare for different roles in the digital and creative industries, such as software and programming, network support and digital design. The qualifications are also designed for job roles in other industries where specific digital and IT skills are required, such as finance, marketing, machining and manufacturing. The qualifications include a mandatory unit along with optional units that relate directly to the skills, knowledge and behaviours expected by employers and cover a wide range and use of different digital technologies, systems and software.

1.2 Purpose

The qualifications' purpose are to:

- prepare learners to progress to a qualification in the same sector or a related area at a higher level
- prepare learners for employment within different roles in the digital and creative industries and in other industries that require specific digital and IT skill
- support progression to apprenticeships

1.3 Funding

For information on potential sources of funding in England please visit the Education and Skills Funding Agency:

https://www.gov.uk/government/organisations/education-and-skills-funding-agency

https://www.gov.uk/government/collections/qualifications-approved-for-public-funding

https://hub.fasst.org.uk/Pages/default.aspx

For information regarding potential sources of funding in Wales please visit Qualification Wales:

https://www.qualificationswales.org/

1.4 Geographical coverage

These qualifications are approved by Ofqual to be offered in England and by Qualification Wales to be delivered in Wales.

If a centre based outside England or Wales would like to offer these qualifications, they should make an enquiry to Gateway Qualifications. The qualifications are not available for delivery by centres based in Northern Ireland.

1.5 Progression opportunities

Learners can progress in a number of ways:

- broadening the range of skills they develop by increasing the size of their qualification (Certificate → Diploma)
- progressing to a higher level qualification
- progressing to an apprenticeship
- progressing to employment where they can apply their digital and IT knowledge and skills.

1.6 Equality, diversity and inclusion

It is Gateway Qualifications' aim that there shall be equal opportunities within this organisation and in all the services it provides and within its recognised centres and via the services they provide and so meet the organisation's legal responsibilities to prevent discrimination.

In particular it is the organisation's intention that there should be no discrimination on the grounds of a protected characteristic including age, disability, gender assignment, marriage and civil partnership, pregnancy and maternity, race, religion and belief, sex, sexual orientation. It is acknowledged that this is not an exhaustive list.

2. Learner Entry Requirements

2.1 Key information

Qualification Titles	
Age	16-18, 19+
Prior qualifications or units	There is no requirement for learners to have achieved prior qualifications or units prior to undertaking this/these qualifications.
Prior skills/knowledge/ understanding	There is no requirement for learners to have undertaken a specific qualification, but learners should be able to demonstrate the skills and ability to study at Level 3. English and Maths at Level 2 will provide a good foundation for successful progression
Restrictions	There are no restrictions to entry.
Initial Assessment	N/A
Additional requirements/guidance	There are no additional rules or guidance regarding learner entry requirements.

2.2 Access to qualifications for learners with disabilities or specific needs

Gateway Qualifications and recognised centres have a responsibility to ensure that the process of assessment is robust and fair and allows the learner to show what they know and can do without compromising the assessment criteria.

Gateway Qualification has a duty to permit a reasonable adjustment where an assessment arrangement would put a disabled person at a substantial disadvantage in comparison to someone who is not disabled. Please refer to Section 4.11 Access Arrangement, Reasonable Adjustments and Special Considerations for further details

2.3 Recruiting learners with integrity

Centres must recruit learners with integrity. They must ensure that learners have the correct information and advice on their selected qualification and that the qualification will meet their needs.

Centres must assess each potential learner and make justifiable and professional judgements about their potential to successfully complete the assessment and achieve the qualification. Such an assessment must identify, where appropriate, the support that will be made available to the learner to facilitate access to the qualification.

2.4 Verifying learner identity

Under no circumstances should a learner be allowed to sit an assessment without prior registration and assessment booking.

Centres must verify each learner's identity prior to taking the assessment.

Any attempt of impersonation or to deceive by use of fake identification by an individual will be deemed as malpractice and will be dealt with as detailed in the Malpractice and Maladministration policy, https://www.gatewayqualifications.org.uk/wp-content/uploads/2017/10/Malpractice-and-Maladministration-Policy.pdf.

Where this may prove culturally challenging, for example, learners who wear face veils then centres may require female staff to perform the identity check in a private space.

3 Qualification Details

3.1 Achievement methodology

The qualification will be awarded to learners who successfully achieve an approved combination of units through a Portfolio of Evidence that has been successfully verified and monitored through Gateway Qualifications' Quality Assurance process. Achievement is therefore determined by successful completion of unit assessment with no further requirement for additional/summative assessment.

3.2 Qualification size

Qualification Title	Total Qualification Time	Guided Learning	Credit Value
Gateway Qualifications Level 3 Certificate in Digital Business Solutions	300	210	30
Gateway Qualifications Level 3 Diploma in Digital Business Solutions	420	294	42
Gateway Qualifications Level 3 Certificate in Digital Product Design	300	210	30
Gateway Qualifications Level 3 Diploma in Digital Product Design	420	294	42
Gateway Qualifications Level 3 Certificate in Engineering Design	300	210	30
Gateway Qualifications Level 3 Diploma in Engineering Design	420	294	42
Gateway Qualifications Level 3 Certificate in Games Technologies	300	210	30
Gateway Qualifications Level 3 Diploma in Games Technologies	420	294	42
Gateway Qualifications Level 3 Certificate in Networking and Cybersecurity	300	210	30
Gateway Qualifications Level 3 Diploma in Networking and Cybersecurity	420	294	42
Gateway Qualifications Level 3 Certificate in Social Media for E-Commerce	300	210	30
Gateway Qualifications Level 3 Diploma in Social Media for E-Commerce	420	294	42
Gateway Qualifications Level 3 Certificate in Software Development	300	210	30
Gateway Qualifications Level 3 Diploma in Software Development	420	294	42
Gateway Qualifications Level 3 Certificate in Systems Infrastructure	300	210	30
Gateway Qualifications Level 3 Diploma in Systems Infrastructure	420	294	42

Total Qualification Time is the number of notional hours which represents an estimate of the total amount of time that could be reasonably expected to be required for a Learner to achieve and demonstrate the achievement of the level of attainment necessary for the award of the qualification.

Total Qualification Time is comprised of the following two elements:

- the number of hours which an awarding organisation has assigned to a qualification for Guided Learning, and

- an estimate of the number of hours a Learner will reasonably be likely to spend in preparation, study or any other form of participation in education or training, including assessment, which takes place by – but, unlike Guided Learning, not under the Immediate Guidance or Supervision of – a lecturer, supervisor, tutor or other appropriate provider of education or training.

3.3 Qualification structure

The qualification requirements are provided below.

The knowledge, skills and understanding that will be assessed as part of the qualification are set out within unit specifications. Unit contents, including the learning outcomes and associated assessment criteria, are published on the Gateway Qualifications website, contained within this qualification specification and are also available to download from the qualification library in the online system Prism.

For information on Recognition of Prior Learning/Exempt and Equivalent units please see section **3.4 Recognition of Prior Learning (RPL).**

Gateway Qualifications Level 3 Certificate in Digital Business Solutions

Learners must achieve the mandatory unit and four units from the specialist unit group.

Gateway Qualifications Level 3 Diploma in Digital Business Solutions

Learners must achieve the mandatory unit and six units from the specialist unit group.

Mandatory Unit

Unit Number	Unit Title	Level	Credit Value	GLH
H/650/4998	Project Management (Digital Business Solutions)	3	6	42

Specialist Units

Unit Number	Unit Title	Level	Credit Value	GLH
J/618/5181	Business Processes	3	6	42
L/618/5182	CRM Databases	3	6	42
R/618/5183	Data Analytics	3	6	42
Y/618/5184	Digital Accounting	3	6	42
D/618/5185	Systems Analysis	3	6	42
H/618/5186	Web Development	3	6	42

Gateway Qualifications Level 3 Certificate in Digital Engineering Design

Learners must achieve the mandatory unit and four units from the specialist unit group.

Gateway Qualifications Level 3 Diploma in Digital Engineering Design

Learners must achieve the mandatory unit and six units from the specialist unit group.

Mandatory Unit

Learners must achieve the mandatory unit.

Unit Number	Unit Title	Level	Credit Value	GLH
J/650/4999	Project Management (Digital Engineering Design)	3	6	42

Specialist Units

Unit Number	Unit Title	Level	Credit Value	GLH
K/618/5187	CAD	3	6	42
A/618/5193	Digital Electronics	3	6	42
F/618/5194	Mechanical Principles	3	6	42
K/618/5190	Robot Technology	3	6	42
M/618/5191	User Experience (UX) Design	3	6	42
J/618/5620	Web Controlled Devices	3	6	42

Gateway Qualifications Level 3 Certificate in Digital Product Design

Learners must achieve the mandatory unit and four units from the specialist unit group.

Gateway Qualifications Level 3 Diploma in Digital Product Design

Learners must achieve the mandatory unit and all six units from the specialist unit group.

Mandatory Unit

Learners must achieve the mandatory unit.

Unit Number	Unit Title	Level	Credit Value	GLH
K/650/5005	Project Management (Digital Product Design)	3	6	42

Specialist Units

Unit Number	Unit Title	Level	Credit Value	GLH
K/618/5187	CAD	3	6	42
M/618/5188	Digital Product Design	3	6	42
K/618/5190	Robot Technology	3	6	42
M/618/5191	User Experience (UX) Design	3	6	42
J/618/5620	Web Controlled Devices	3	6	42
H/618/5186	Web Development	3	6	42

Gateway Qualifications Level 3 Certificate in Games Technologies

Learners must achieve the mandatory unit and four units from the specialist unit group.

Gateway Qualifications Level 3 Diploma in Games Technologies

Learners must achieve the mandatory unit and six units from the specialist unit group.

Mandatory Unit

Learners must achieve the mandatory unit.

Unit Number	Unit Title	Level	Credit Value	GLH
R/650/5008	Project Management (Games Technologies)	3	6	42

Specialist Units

Unit Number	Unit Title	Level	Credit Value	GLH
J/618/5195	3D Game Models	3	6	42
L/618/5196	Concept Art and Design: Graphics for Games	3	6	42
D/618/5199	Game Engines	3	6	42
Y/618/5203	Mobile Games Development	3	6	42
H/618/5205	The Games Industry	3	6	42
T/618/5208	Virtual and Augmented Reality	3	6	42

Gateway Qualifications Level 3 Certificate in Networking and Cybersecurity

Learners must achieve the mandatory unit and four units from the specialist unit group.

Gateway Qualifications Level 3 Diploma in Networking and Cybersecurity

Learners must achieve the mandatory unit and six units from the specialist unit group.

Mandatory Unit

Learners must achieve the mandatory unit.

Unit Number	Unit Title	Level	Credit Value	GLH
T/650/5009	Project Management (Networking and Cybersecurity)	3	6	42

Specialist Units

Unit Number	Unit Title	Level	Credit Value	GLH
M/618/5210	Access Control	3	6	42
T/618/5211	Data Communications	3	6	42
F/618/5213	Ethical Hacking	3	6	42
Y/618/5217	Network Management	3	6	42
D/618/5218	Network Threats and Vulnerabilities	3	6	42
H/618/5219	Networking	3	6	42

Gateway Qualifications Level 3 Certificate in Social Media for E-Commerce

Learners must achieve the mandatory unit and four units from the specialist unit group.

Gateway Qualifications Level 3 Diploma in Social Media for E-Commerce

Learners must achieve the mandatory unit and six units from the specialist unit group.

Mandatory Unit

Learners must achieve the mandatory unit.

Unit Number	Unit Title	Level	Credit Value	GLH
D/650/5010	Project Management (Social Media for Ecommerce)	3	6	42

Specialist Units

Unit Number	Unit Title	Level	Credit Value	GLH
Y/618/5220	Content Management Systems	3	6	42
D/618/5221	Content Marketing	3	6	42
H/618/5608	Digital Graphics and Animation	3	6	42
L/618/5232	Digital Marketing	3	6	42
Y/618/5234	Digital Marketing Metrics and Analytics	3	6	42
D/618/5235	Social Media Marketing (SMM)	3	6	42

Gateway Qualifications Level 3 Certificate in Software Development

Learners must achieve the mandatory unit and four units from the specialist unit group.

Gateway Qualifications Level 3 Diploma in Software Development

Learners must achieve the mandatory unit and six units from the specialist unit group.

Mandatory Unit

Learners must achieve the mandatory unit.

Unit Number	Unit Title	Level	Credit Value	GLH
F/618/5180	Project Management	3	6	42

Specialist Units

Unit Number	Unit Title	Level	Credit Value	GLH
K/618/5237	JavaScript	3	6	42
M/618/5238	Maths for Computing	3	6	42
T/618/5239	Object Oriented Programming	3	6	42
K/618/5240	Programming Implementation	3	6	42
K/618/5190	Robot Technology	3	6	42
M/618/5241	Software Testing	3	6	42

Gateway Qualifications Level 3 Certificate in Systems Infrastructure

Learners must achieve the mandatory unit and four units from the specialist unit group.

Gateway Qualifications Level 3 Diploma in Systems Infrastructure

Learners must achieve the mandatory unit and six units from the specialist unit group.

Mandatory Unit

Learners must achieve the mandatory unit.

Unit Number	Unit Title	Level	Credit Value	GLH
J/650/5012	Project Management (IT Systems Infrastructure)	3	6	42

Specialist Units

Unit Number	Unit Title	Level	Credit Value	GLH
T/618/5242	Cloud Technologies	3	6	42
T/618/5211	Data Communications	3	6	42
H/618/5219	Networking	3	6	42
A/618/5243	System Management and Support	3	6	42
R/618/5247	System Security and Encryption	3	6	42
D/618/5185	Systems Analysis	3	6	42

3.4 Recognition of prior learning

Recognition of Prior Learning (RPL) provides learners and Centres with an alternative assessment method by which a learner's previous achievements can meet the assessment requirements for a unit/qualification through the knowledge, understanding or skills that they already possess and so, do not need to develop these through a course of learning.

It enables the recognition of achievement from a range of activities using any valid assessment methodology. Provided that the assessment requirements of a given unit or qualification have been met, the use of RPL is acceptable to contribute to a unit, units or a whole qualification according to the RPL criteria for a given qualification.

The recognition of prior learning is permitted for this qualification and includes the prior attainment of units on a qualification offered by Gateway Qualifications, e.g. where a learner progresses from a smaller qualification to a larger qualification and where the qualifications have shared content such as an Award, Certificate and/or Diploma.

Centres should refer to the Gateway Qualifications' Recognition of Prior Learning policy and follow the process available on the website.

4 Assessment

4.1 Assessment overview

Should a learner not achieve the required standard to pass an assessment, further teaching and learning should take place before attempting the assessment again.

4.2 Assessment format

The method of assessment for the qualification is through a portfolio of evidence.

4.3 Assessment language

The qualifications are assessed in English only.

4.4 Support materials and resources

In addition to this qualification specification, the following resources are available on the Gateway Qualifications website

- Centre Handbook

Level 3 Certificate and Diploma in Software Development
For the Gateway Qualifications Level 3 Certificate and Diploma in Software Development, centres are strongly recommended to use the learner management system and content provided by Code Institute to support teaching, learning and qualification delivery. Assessments will be completed outside the learner management system using a suitable integrated development environment and online hosting environment.

4.5 Access Arrangements, Reasonable Adjustments and Special Considerations

Gateway Qualifications and recognised centres have a responsibility to ensure that the process of assessment is robust and fair and allows the learner to show what they know and can do without compromising the assessment criteria. Gateway Qualifications understands its requirement as an awarding organisation to make reasonable adjustments where a learner, who is disabled within the meaning of the Equality Act 2010, would be at a substantial disadvantage in comparison to someone who is not disabled.

Gateway Qualifications has identified reasonable adjustments permissible as detailed below. A reasonable adjustment is unique to an individual and therefore may not be included in the list of available access arrangements.

Centres do not need to apply to Gateway Qualifications for approval of reasonable adjustments unless adaptation of externally set assessments is required.

Learners can have access to all forms of equipment, software and practical assistance, such as a reader or a scribe that reflect their normal way of working within the centre. However,

such adjustments must not affect the reliability or validity of assessment outcomes or give the candidate an assessment advantage over other candidates undertaking the same or similar assessments.

The following adaptations are examples of what may be considered for the purposes of facilitating access, as long as they do not impact on any competence standards being tested:

- adapting assessment materials;
- adaptation of the physical environment for access purposes;
- adaptation to equipment;
- assessment material in an enlarged format or Braille;
- assessment material on coloured paper or in audio format;
- British Sign Language (BSL);
- changing or adapting the assessment method;
- changing usual assessment arrangements;
- extra time, e.g. assignment extensions;
- language modified assessment material;
- practical assistant;
- prompter;
- providing assistance during assessment;
- reader;
- scribe;
- transcript;
- use of assistive software;
- using assistive technology;
- use of CCTV, coloured overlays, low vision aids;
- use of a different assessment location;
- use of ICT/responses using electronic devices.

It is important to note that not all the adjustments (as above) will be reasonable, permissible or practical in particular situations. The learner may not need, nor be allowed the same adjustment for all assessments.

Learners should be fully involved in any decisions about adjustments/adaptations. This will ensure that individual needs can be met, whilst still bearing in mind the specified assessment criteria for a particular qualification.

All reasonable adjustments made by the centre must be recorded on the Gateway Qualifications' Reasonable Adjustments Form and should be made available to Gateway Qualifications upon request. Guidance on the process for applying for formal adjustments can be found on the Forms and Guidance page of Gateway Qualifications' website.

All adjustments to assessment/s must be authorised by the centre's named Quality Assurance nominee or a member of staff with delegated authority where a centre is permitted to make reasonable adjustments, i.e. for internally marked assessments.

Centres should keep records of adjustments they have permitted and those they have requested from Gateway Qualifications. These records should normally be kept for 3 years following the assessment to which they apply.

It is recommended that centres nominate members of staff to take responsibility for demonstrating the implementation and recording of adjustments to assessments for monitoring by Gateway Qualifications or the regulatory authorities.

Special Considerations

Requests for special consideration should be submitted as soon as possible. Please refer to the Reasonable Adjustments and Special Consideration Policy.

5 Centre Recognition and Qualification Approval

5.1 Centre Recognition

Both centre recognition and qualification approval must be gained before centres are permitted to deliver these qualifications.

Guidance on the centre recognition and qualification approval processes is available on the website: https://www.gatewayqualifications.org.uk/advice-guidance/help-admin-tasks/centre-recognition/

5.2 Centre requirements

Centres must ensure that they have the appropriate resources in place when delivering performance units from vocational areas.

5.3 Qualification-specific staffing requirements

Please refer to the Staffing Requirements - Qualification Specific Roles section within the online centre handbook for tutor/assessor/IQA requirements: https://www.gatewayqualifications.org.uk/advice-guidance/delivering-our-qualifications/centre-handbook/quality-compliance/

Tutor/Assessors must be fully qualified and experienced in the subject area in which they are delivering, details of which must be provided to Gateway Qualifications as part of the Qualification Approval application.

6 Quality Assurance

Centres should refer to the online Centre Handbook for further guidance.

The quality assurance process for these qualifications is through risk-based external quality assurance monitoring through reviews of centres' internal quality assurance systems against key quality standards and sampling of assessment decisions and internal quality assurance activity to ensure that qualification standards are maintained.

Centre monitoring is undertaken by an External Quality Assurer (EQA) allocated to the centre. The EQA plays a critical role in the Gateway Qualifications approach to centre assessment standards scrutiny as they are responsible for:

- carrying out an annual compliance visit
- validating the centre's procedures for delivery of qualifications and assessment
- completing reports for each visit with clear action points where needed
- risk rating centres on the above.

The EQA carries out an initial risk assessment at the centre recognition stage and then annually on an on-going basis using Gateway Qualifications' risk assessment criteria, and gives a high/medium/low risk rating in each of the following categories:

- centre resourcing and arrangements: this includes consideration of centre staffing, induction and training, policies and compliance with our centre agreement
- internal assessment and delivery: including reference to staff knowledge and skills, understanding of requirements, and appropriateness of delivery arrangements; also, delivery of external assessments including invigilation, conduct of assessments and confidentiality (where appropriate)
- internal quality assurance: covering IQA procedures, whether staff are appropriately trained, and standardisation arrangements in place
- learner experience: that embraces appropriateness of initial assessment and learners being on the correct programme, learner induction and course support.

EQAs arrange quality monitoring visits to all recognised centres. These visits:

- monitor the centre's compliance with the centre recognition terms and conditions by reviewing programme documentation and meeting managers and centre staff
- identify any staff development needs
- ensure that all procedures are being complied with, through an audit trail, and make sure that the award of certificates of completion to learners is secure.

EQAs contact the centre in advance of a visit, however Gateway Qualifications reserves the right to undertake unannounced visits including during assessment times.

EQAs will request information from the centre in advance of a planned visit to help inform the evidence to be reviewed during the visit. Centres are obliged to comply with any requests for access to premises, people and records for the purposes of the monitoring visit. If a centre fails to provide access, then Gateway Qualifications will take appropriate action.

Once a visit date has been agreed, the centre should ensure that the appropriate members of staff attend the meeting, all requested documentation is provided and access to qualification, learner and staff records is available.

If a centre cancels a pre-arranged monitoring visit at short notice the EQA must be satisfied that there was a legitimate reason for the cancellation. If this cannot be established, Gateway Qualifications reserves the right to withhold certification claims until a monitoring visit is completed.

Following the visit, the EQA completes a monitoring report which will be sent to the centre for reference afterwards.

The frequency of the quality monitoring visits will be determined by the volume of learner registrations and the actions arising from previous monitoring activity.
Centres found in breach of these procedures may be subject to sanctions by Gateway Qualifications. Please refer to the Gateway Qualifications Sanctions Policy.

6.1 Internal Quality Assurance

As the assessments are tutor marked the centre must operate an internal quality assurance process. This ensures that qualification standards are being applied consistently within a centre through training, standardisation, sampling of marking and feedback. A centre's internal quality assurance process is led by the Internal Quality Assurer (IQA) who is responsible for ensuring that all tutors are marking assessments in line with the standards set by Gateway Qualifications.

Internal Standardisation
Internal standardisation is a collaborative process by which tutors within a centre consider work that they have marked and, using pre-determined criteria, reach a common agreement on standards as being typical of work at a particular level by comparing samples and providing peer evaluation.

Standardisation will be facilitated by the Centre's IQA and should include all those involved in marking assessments. Centre standardisation events should be held at regular intervals and to a schedule which reflects delivery patterns and supports the marking of live assessments. Centres will be required to keep records of each internal standardisation event including the date, attendees and notes on any outcomes and actions. Centres will be required to store these reports securely for three years and Gateway Qualifications may ask to see these records as part of the centre quality assurance and monitoring activities.

6.2 Quality assuring centre marking

Once the internal quality assurance process is complete, an EQA will be allocated to a centre to sample the centre marking.

The sample selected is based on the number of learners and the centre's risk rating, derived from centre monitoring.

Evidence of the inconsistent marking and actions taken informs the centre's risk rating and this information will be taken into account with the sampling of future assessments, for example, leading to an increase in sampling size.

6.3 Malpractice

Malpractice is any deliberate activity, neglect, default or other practice that compromises the integrity of the internal and external assessment process, and/or the validity of certificates. It covers any deliberate actions, neglect, default or other practice that compromises, or could compromise:

- the assessment process
- the integrity of a regulated qualification
- the validity of a result or certificate
- the reputation and credibility of Gateway Qualifications
- the qualification to the public at large.

Centre staff should be familiar with the contents of Gateway Qualifications Malpractice and Maladministration Policy, https://www.gatewayqualifications.org.uk/wp-content/uploads/2017/10/Malpractice-and-Maladministration-Policy.pdf

6.4 Additional quality assurance requirements

There are no additional internal/external quality assurance requirements for this/these qualification/s.

7 Learner Registration and Results

7.1 Registration

Centres will register learners via the online registration portal. Learner registration guidance is available on our website, https://www.gatewayqualifications.org.uk/advice-guidance/help-admin-tasks/registering-learners/.

7.2 Awarding

The qualifications will be awarded as Pass.

7.3 Issuing results

Results for learners who do not reach the minimum standard for a pass will be recorded as fail.

7.4 Appeals

Centres must have internal appeal arrangements which learners can access if they wish to appeal against a decision taken by Centres, which will include a named contact at the Centre. These arrangements have to be transparent and accessible in order that appeals from learners can be received, considered and resolved fairly.
Please refer to the Gateway Qualifications' Appeals policy:
https://www.gatewayqualifications.org.uk/wp-content/uploads/2017/09/Appeals-Policy.pdf

7.5 Enquiries

Enquiries about assessment decisions should be made once the centre has followed its internal enquiries and appeal procedures.

Contact details are available on our website:
https://www.gatewayqualifications.org.uk/contact-us/

8 What to do next

For existing centres please contact your named Development Manager or Development Officer.

Tel: 01206 911211

Email: enquiries@gatewayqualifications.org.uk

9 Gateway Qualifications

Gateway Qualifications, a not for profit registered charity, is an Awarding Organisation based in Colchester.

We work with learning providers and industry experts to design and develop qualifications that benefit the learner and the employer.

We support flexible, responsive and quality assured learning opportunities whether it's in the classroom, at work, in the community or through distance learning.

We are recognised by Ofqual, to design, develop and submit qualifications to the Regulated Qualifications Framework (RQF) and Qualification Wales to offer regulated qualifications in Wales.

10 Appendices

10.1 Appendix 1 – Unit Details

Gateway Qualifications Level 3 Certificate and Diploma in Business Solutions

Mandatory Unit

Project Management (Digital Business Solutions)

Unit Number:	H/650/4998
Level:	Level 3
Credit Value:	6
GLH:	42
Unit Aim:	Learners will understand project management concepts and the processes and tools used by organisations to plan and manage digital business solutions projects. They will learn about project management methodologies and use project management software to plan a digital business solutions project, track progress, and review outcomes to determine project success.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:		ASSESSMENT CRITERIA The learner can:	
1	Understand the principles of project management and the methodologies used by organisations to manage digital business solutions projects.	1.1	Explain the stages of the project lifecycle and how they apply to digital business solutions projects.
		1.2	Describe key concepts, issues and risks when managing digital business solutions projects.
		1.3	Compare the characteristics of different project management methodologies used by organisations.
2	Be able to use project management software to plan a digital business solutions project.	2.1	Produce a project specification for a digital business solutions project in line with requirements.
		2.2	Use project management software to plan a digital business solutions project.
3	Be able to use project management software to monitor and review a digital business solutions project.	3.1	Use project management software to monitor a project plan and track progress against the plan.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
	3.2 Carry out a post-project review to determine project outcomes.

Indicative Content: Project Management (Digital Business Solutions)

Learning Outcome 1:

Example digital business solutions project could include:

- Customer Relationship Management (CRM) database
- Collaboration and communication tools
- Automation tools for scheduling, i.e., social media posts, tools for search engine optimisation, brand tracking, email campaigns, content marketing, online PR, pay-per-click advertising
- Spreadsheets and numerical processing tools for budgeting, analysis, forecasting, spotting trends, reporting

Project life cycle:
Conception and start up: project mandate, client requirements, and feasibility.
Definition of the project: set up project team, create the Project Initiation Document (PID)
Planning: timescales, costs, quality management, risk management and controls.
Launch and execution: carrying out the plan, monitoring activity, checking progress.
Closure: handover of the product, user acceptance testing, disbanding project team.
Post-project evaluation: reviewing the project against success criteria.

Concepts include the key factors, processes and stages that make up a project, such as:
Costs and timescales: project budget, setting milestones and deadlines, interim reviews.
Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project.

Quality and deliverables:
Application of current quality standards, for example: ISO/IEC 25010:2011 as a benchmark for software development, World Wide Web Consortium for website design and functionality standards.
Defining success criteria and using SMART objectives to define project outcomes.
Customer requirements in terms of functional requirements and non-functional requirements.
Product description or product breakdown structure, to describe the product to be delivered.

Issues: effects of changing external factors, monitoring progress, taking corrective actions where necessary, communications, working within relevant guidelines (internal and external) and legislation, dealing with conflict, impact of project outputs on other systems, e.g. staff, organisational structures.

Benefits: saving money, maintaining or increasing profits, improving services, growing the business, increasing market share, improving productivity, expected return on investment, justification for the project, forecasting project success.

Risks: identifying typical project risks (internal/external risks), risk management cycle, identification of risks, assessing the severity of risks, accept the risk, plan contingency or avoid the risk, monitor and control the risks through the project, handling issues when a risk occurs.

Project management methodologies:
PRINCE2 – suitable for most projects.
Rapid Application Development (RAD) – suitable for short-term, large-scale, big-budget projects.
Waterfall – suitable for websites, database or network projects.

Indicative Content: Project Management (Digital Business Solutions)
Agile – suitable for medium/long term projects where user requirements frequently change and outputs are required at regular intervals.
Learning Outcome 2: The project must be sufficiently complex to allow planning and management to take place. It must also allow learners the opportunity to manage some resources and the time allocated for completion. Interpreting the business case (the business case as a driver of the project): reasons for the project, options that should be considered, expected business benefits, timescale, including major milestones, budget available, risks. Project specification: identification of stakeholders, business case requirements, specific objectives or deliverables, benefits and success factors, project boundaries or scope, constraints, consideration of options, other, e.g. ethical issues, sustainable issues, understanding consequences of failure to hit deadlines or produce product, risks and risk mitigation. Project plan: purpose, content, e.g. identification of phases and activities, potential for parallel or sequential processes, resources needed for each activity, timescales, review points, e.g. milestones, checkpoints, deadlines. Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project, use of other appropriate and available software and applications, e.g. spreadsheets, graphics, databases etc.
Learning Outcome 3: Monitor: routine communications with stakeholders, interim reviews, use of logbooks, routine updating of plan where necessary, others, e.g. accessing additional resources where necessary, reacting to unforeseen circumstances. Tracking progress: project baseline and variance, monitoring and recording progress, checkpoint reports as a way of recording milestones achieved, monitoring risk and managing issues, recording quality management activity. Review of project success in terms of key factors, SMART objectives and views of stakeholders: review of lessons learned, review project performance against the baseline and project objectives, review of final cost, delivery date and quality of product delivered, review feedback from key stakeholders (clients, end users). Methods to obtain feedback: interviews, questionnaires, surveys, observation of resulting processes. Recommendations for future actions based on the outcome of the post-project review, communication and presenting requirements for reviews.

Specialist Units

Business Processes

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	J/618/5181
Unit Aim:	Learners will develop an understanding of the IT systems, platforms and information security requirements that support different business functions in organisations. They will also learn about the different skills required for dealing with end users when supporting and delivering IT services in organisations.

This unit has 4 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the IT systems, platforms and information security requirements that support business functions.	1.1 Explain the purpose and features of IT systems and platforms used to support business functions. 1.2 Explain the information security requirements and procedures that underpin business functions.
2 Understand the IT skills needed to support the delivery of IT systems and platforms to end users.	2.1 Analyse the different skills required to support the delivery of IT systems and platforms to end users.
3 Understand organisational IT requirements and operating procedures that support business functions.	3.1 Explain how the CIA framework can be used to protect data and information. 3.2 Summarise the policies and procedures required to support the use of different IT systems and platforms in organisations. 3.3 Explain the stages of a business continuity and disaster recovery plan.
4 Understand document management processes and how they support business functions.	4.1 Explain how document management is used to support business functions.

Indicative Content: Business Processes
Learning Outcome 1: Business functions: strategy, design, transition, operations, continual improvement, Standard Operating Procedures (SOP). Purpose and features: cross-functional, desktop applications, messaging systems, document management, HR systems, human resource information system (HRIS), sales/marketing, Customer Relationship Manager (CRM), finance systems, Enterprise Resource Planner (ERP), production flow systems (continuous, intermittent), network support (remote access, asset management, troubleshooting), help desk systems (fault management, troubleshooting. Information security requirements: organisation procedures, ML (Joiner, Mover, Leaver), awareness, training (induction, etc), information security. Security procedures: anti-malware checks, scheduling regular backups, authentication of credentials, password management and enforcement, patching software, configuration and setup of hardware and software, minimising human error, identifying and mitigating internal/external threats. Legislation: Human Rights Act, Data Protection Act, Computer Misuse Act, information security (CIA framework), confidentiality.
Learning Outcome 2: Service management skills: customer service skills, customer relationships, stakeholder management, technical skills, analytics, testing, design/architecture, service strategy skills, business modelling, business analysis, business process, business continuity, service operation skills. Business skills (customer/stakeholder management): communication skills (oral, written, face-to-face, managing expectations, building rapport), time management skills (prioritisation, planning, collaboration), working to SLAs (compliance to contractual obligations, meeting expectations). Technical skills: analytics (trend analysis, fault analysis, user profiling), testing (tool selection, methodologies), design (methodologies, requirements gathering, prototyping), hardware/software (configuration, installation, testing) fault logging (escalation, prioritisation).
Learning Outcome 3: CIA framework (confidentiality, integrity, availability).Types of information that should be protected (employee information, management information, organisational information). Confidentiality authentication (multi-factor, two factor) no confidential information left out on desks not leaving confidential information visible on screens non-repudiation non-disclosure agreements (NDA) non-compete clauses safe storage of information: (locked rooms, password-protected drives, controlled access). Integrity: encryption firewalls backups access control (permissions, geolocation, time-restricted logon, concurrent logons, device filtering) reporting (whistleblowing, escalation, information commissioner)

Indicative Content: Business Processes
Availability: backups redundancy (Redundant Array of Independent Disks (RAID) devices, clustering, cloud) bandwidth planned downtime upgrades/patches. Policies and procedures: Acceptable Use Policy, Password Policy, Security Policy, Disaster Recovery Policy, capacity planning and planned downtime, asset management, Service Level Agreements (SLA) IT Service Management (ITSM). Standard Operating Procedures (SOP): step-by-step instructions to help employees carry out complex tasks to improve efficiency, to ensure uniformity, to reduce miscommunications, to ensure quality, to ensure compliance with standards/regulations. Stages of a business continuity and disaster recovery plan: prioritisation of business restoration, preventative measures, test plan, planned maintenance, recovery strategies, IT systems, backup of data, transfer of services.
Learning Outcome 4: Document management processes: backup strategy (archive, full, partial, incremental, differential), centralised storage (cloud, network), version control (naming conventions, file types, update history, publication), access control (password protection, classification, encryption), watermarking (copyright, draft, confidential), collaboration tools (mark-up, track changes, commenting, acceptance).

CRM Databases

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	L/618/5182
Unit Aim:	Learners will investigate Customer Relationship Management (CRM) databases and how they have become an essential repository of customer information. They will also apply practical skills to design and develop a CRM database.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the purpose and features of Customer Relationship Management (CRM) databases.	1.1 Explain the purpose and features of CRM databases and how they are used in business. 1.2 Explain the role and stages of normalisation when developing data structures.
2 Be able to design, develop and populate a CRM database to meet requirements.	2.1 Design a CRM database to meet business objectives. 2.2 Develop and populate a CRM database using data from an external source. 2.3 Develop features in data entry forms to ensure validity and integrity of data 2.4 Perform queries using multiple tables and multiple criteria. 2.5 Output CRM data in suitable formats for different purposes and audiences. 2.6 Implement an automated function into the CRM database to enhance productivity.
3 Be able to test and evaluate a CRM database to meet requirements.	3.1 Use appropriate techniques to test a CRM database to ensure fitness for purpose. 3.2 Evaluate how effectively the CRM database meets requirements, making suggestions for improvements.

Indicative Content: CRM Databases

Learning Outcome 1:

CRM databases consolidates customer information into a single repository so users can better organise and manage relationships, automates common processes, and provide tools to monitor performance and productivity.

Purpose: easy access to customer data, streamlined processes through automation, actionable insights into business performance and customer behaviour.

Features: email integration, document management, quotes/proposal management, pipeline management, workflow automation, reporting/analytics, forecasting, contact management, interaction tracking, lead management.

CRM is based relational database management systems (RDBMS):

- Relational data structures: relation, attribute, domain, tuple, degree, cardinality, relational database.
- Relational algebra sets: symbols, union, intersect, join and select.
- Database relations, e.g. entity relationship, generic, semantic.
- Relational keys: super key, candidate key, primary key, foreign key.
- Integrity constraints: entity integrity, referential integrity.
- Entity relationships: one-to-one, one-to-many, many-to-many.

Manipulating data structures and data in relational databases: defining, modifying and removing data structures and data: updating, inserting, modifying and deletion, retrieval of data for queries and reports, administration of users, security, integrity and recovery.

Normalisation: anomalies (update, insertion, deletion), primary keys, foreign keys, composite keys, indexing, referential integrity, data dictionary, cascading update, deletion techniques, joins, unions and intersects

Stages of normalisation: un-normalised form (UNF), first normal form (1NF), second normal form (2NF), third normal form (3NF), Boyce-Codd normal form (BCNF).

Learning Outcome 2:

Design specification to include:

Requirements of the brief (audience, purpose and client requirements), legal and ethical considerations.

Data structure designs: data dictionaries, e.g. tables, field names, data types and validation, data flow diagrams, entity relationship diagrams, normalisation.

Application (user interface) design: data entry/input (verification, validation, calculated fields, masks, directed input), reports (queries, presentation of data, layouts), task automation (imports, updates, deletions), queries using multiple criteria, form values and wild cards, action queries, calculated queries, hardware, software and other resources required, test plans to check correctness of data, functionality, accessibility and usability, implementation, maintenance, and support plans (including training schedule to users), timescales, technical constraints, e.g. data stores, capacity, performance of hardware/software.

Indicative Content: CRM Databases

Use of an appropriate software to develop a CRM database solution to meet requirements including:

- Creating, setting up and maintaining data tables
- Creating links/relationships between data tables
- Applying data validation rules
- Generating outputs, e.g. user-generated queries, automated queries, reports
- Application and user interface, e.g. navigation, data entry forms, subforms
- Automated functions
- Populating the database
- SQL statements to extract, manipulate and modify data
- Applying security measures to control access to data, e.g. user access levels, policies.

Learning Outcome 3:

Testing the CRM database: referential integrity, functionality, security, stability, selection and use of appropriate test data, e.g. erroneous data, extreme data, selecting suitable test users, gathering feedback from users, producing appropriate test documentation, making use of testing outcomes to improve and/or refine the database solution.

Reviewing the CRM database (criteria): quality of the database, fitness for purpose, suitability against the original requirements, legal and ethical constraints, technology constraints, strengths and improvements, platforms and compatibility.

Optimising the CRM database: data types, data sizes, e.g. size on disk, many tables, e.g. overheads for many tables, query optimising, e.g. select specific columns.

Data Analytics

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	R/618/5183
Unit Aim:	Learners will understand the role of business data and how it is collected, evaluated and organised. They will also develop skills and use tools such as dashboards, aggregators and web analytics to analyse, evaluate and report data for different business contexts and purposes.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the requirement to organise and evaluate business data.	1.1 Explain the purpose of organising and evaluating business data. 1.2 Compare primary and secondary research methods. 1.3 Compare quantitative and qualitative research methods. 1.4 Explain the role of market research and the different digital methods for collecting market research data.
2 Understand how to analyse and report business data.	2.1 Explain types of data analysis used in business. 2.2 Compare tools for data collection and analysis.
3 Be able to analyse and report business data for different business contexts and purposes.	3.1 Select relevant, valid and reliable business data to analyse. 3.2 Use analysis and evaluation tools and techniques to analyse business data. 3.3 Review business data to produce accurate, unbiased results and conclusions. 3.4 Present business data in an appropriate format and to an agreed timescale.

Indicative Content: Data Analytics
Learning Outcome 1: Purpose: measure if business objectives have been achieved, supports decision making, keeps staff updated, offers efficiency, drives marketing and sales campaigns Primary research: gathering of fresh data. Secondary research: involves the use of data, already collected through primary research. Quantitative data: quantities, numbers. Qualitative data: descriptive, can be observed but not measured, such as language. Market research data used to identify: market size, structure and trends, competitors and their activities, market segment, gaps in the market, consumer/buyer behaviour, customer satisfaction. Primary digital sources: web analytics, keyword research, social media, digital surveys/questionnaires/polls, interviews, focus groups, blog comments. Secondary digital sources: data companies, newspapers reports/e-journals, official statistics, professional bodies industry, sector and market reports government data/reports, online reviews.
Learning Outcome 2: Types of data analysis: descriptive analysis, diagnostic analysis, predictive analysis, prescriptive analysis. Tools: e.g. dashboards, aggregators, web analytics.
Learning Outcome 3: Relevant, valid and reliable data, for example: Website metrics: hit rate/visits, unique visitors, time of day, daily active users, etc. Emails: read rate, bounce backs, unsubscribers.

Digital Accounting

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	Y/618/5184
Unit Aim:	Digital accounting saves time and money and increases accuracy. Learners will develop the skills to use digital accounting software to manage and process accounting data. They will learn how to interpret and process both routine and non-routine transactions and produce accounting reports such as profit and loss accounts and balance sheets.

This unit has 4 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Be able to use digital accounting software to manage and process accounting data.	1.1 Create company records for nominal accounts, suppliers and customers. 1.2 Input invoices, credit notes and receipts and payments. 1.3 Create product records and record stock activity. 1.4 Write off balances and bad debts. 1.5 Create accounts in standard formats.
2 Be able to use digital accounting software to recognise and change account structures.	2.1 Create, delete and amend nominal codes. 2.2 Change control accounts to identify outstanding assets and liability, and record debit and credit. 2.3 Customise layouts for accounting data.
3 Be able to use digital accounting software to create accounting reports for management purposes.	3.1 Output a variety of routine and non-routine reports.
4 Be able to backup and restore accounting data.	4.1 Locate, backup and restore accounting data in line with local guidelines.

Indicative Content: Digital Accounting
Learning Outcome 1: Settlement terms, credit limits, contact details. By means of cash, cheques and credit cards, including VAT. Some software refers to: balance sheets, income statement, statement of financial position.
Learning Outcome 2: Invoices, payment, batch totals. Control account examples, a sale on credit to a customer, a purchase on credit from a supplier
Learning Outcome 3: Reports include: customer and supplier address lists, customer and supplier histories/activity, aged debtors and aged creditors analysis, tax liability, customer ledger reports, supplier ledger report, nominal ledger report, budget reports, audit trail, trial balance, profit and loss, balance sheet.

Systems Analysis

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	D/618/5185
Unit Aim:	Learners will investigate the principles of systems analysis and learn how to use systems analysis methods to examine an organisation and its current systems. They will also develop the skills needed to design a system solution to meet organisational requirements.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the principles of systems analysis.	1.1 Illustrate the stages of the systems lifecycle. 1.2 Compare different software development models used by industry. 1.3 Assess the suitability of different systems analysis tools and techniques for modelling business processes.
2 Be able to investigate IT requirements to meet business needs.	2.1 Produce a system requirements specification for an identified organisation.
3 Be able to develop a design for an IT system to meet business needs.	3.1 Produce a design for a system, justifying decisions. 3.2 Obtain feedback to refine the design.

Indicative Content: Systems Analysis
Learning Outcome 1: - Systems life cycle stages: definition, investigation and analysis, design, implementation, testing, documentation, evaluation, maintenance. - Development lifecycle models: Waterfall, other e.g. Spiral, Rapid Applications Development (RAD), agile methodologies, e.g. Scrum, dynamic systems development method (DSDM), adaptive software development (ASD), prototyping, benefits, stages e.g. initiation and feasibility, investigation, requirements analysis and specification, design (logical and physical), build systems, testing, implementation, maintenance. - Systems analysis tools and techniques: any contemporary methodology for systems analysis and design, typical e.g. activity diagrams, dataflow diagrams, computer-aided software engineering tools (CASE). - Structured systems analysis and design method (SSADM), Unified Modelling Language (UML), structure (static) diagrams, e.g. class diagram, component diagram, behaviour (dynamic) diagrams, e.g. activity diagram, use case diagram, interaction diagrams, suitability of methods for different programming paradigms, e.g. object-oriented, event-driven, procedural, business process reengineering (BPR). - Key drivers: business need, e.g. need for growth, company acquisition, need to increase productivity, legal requirements.
Learning Outcome 2: - Business needs of an identified organisation: the aims and requirements of an organisation, and how IT is used to support: the services an organisation provides, aims and goals of an organisation, customers – needs, expectations, how product/service is delivered, staff – needs, working styles and patterns, location – staff, customers, premises, market/service delivery point. - Investigation: techniques e.g. interview, questionnaire, meeting, observation, document analysis, data analysis, sensitivity in collecting information and observing individuals at work. - Analysis: as related to the chosen methodology, cost-benefit analysis. - Threats - factors affecting the success and failure of a current system: risks, e.g. completing tasks, budget, missed deadline(s), stakeholder support, staff involvement, constraints, e.g. costs, scope, time, provision of appropriate resources, e.g. people, time, budgets, maintenance system, change management, user involvement in the development process. - Requirements specification: contents e.g. scope, inputs, outputs, processes, costs and benefits, recommendations, alternative solutions.
Learning Outcome 3: - Design: input and output requirements (appropriate and detailed design documentation for the input and output of the proposed system) including: visuals, e.g. screen layouts, storyboards, alternative layout for different platforms and devices, data entry forms, including layout and structure, proposed fields, data entry methods, report forms, hardware and software requirements.

Indicative Content: Systems Analysis

- Data and processes within a system (the data requirements of and use within a proposed system) including: modelling data, e.g. entity relationship diagrams, data flow diagrams, data dictionaries, e.g. data stores, entities, data structures, validation, process modelling using a variety of tools, e.g. flow charts, decision tables, activity diagrams.

- Testing and maintenance methodologies (a plan for testing and maintenance of the proposed system) including: • testing methods, e.g. volume testing, scalability, multiplatform, developing test plans, identifying test data, e.g. normal, extreme, abnormal, choosing test users, proposed test schedule, proposed maintenance and update schedule.

Web Development

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	H/618/5186
Unit Aim:	Learners will develop an understanding of web technologies and use Hypertext Markup Language (HTML), Cascading Style Sheets (CSS) and JavaScript to design and develop a website.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand web architecture and components.	1.1 Describe web components and architecture. 1.2 Explain the role of the TCP/IP protocol including IPv6. 1.3 Explain the role of internet service providers (ISPs), web hosting services and domain name registrars. 1.4 Describe available types of web functionality.
2 Understand the technologies that can be used to build and support a website.	2.1 Explain the use of web markup and scripting languages. 2.2 Explain the use and functionality of web runtime environments and web application programming languages. 2.3 Explain the role of databases in building websites and web applications. 2.4 Explain typical product stack combinations that can be used for web development.
3 Be able to design, develop and test a website to meet requirements.	3.1 Produce a website development project proposal for a given need. 3.2 Identify the web components required to develop a website. 3.3 Use appropriate tools and techniques to design and develop a website with accurately presented and effectively structured content. 3.4 Test and review a website.

Indicative Content: Web Development
Learning Outcome 1: Components: hardware e.g. web, mail and proxy servers, routers, software e.g. browser, email. Protocols: transport and addressing e.g. TCP/IP, IPv6, application layer e.g. HTTP, HTTPS, SMTP. Web architecture: Internet Service Providers (ISP), web hosting services, domain structure, domain name registrars, worldwide web. Web functionality: Web 1.0, Web 2.0, blogs, online applications, cloud computing.
Learning Outcome 2: Languages: markup languages e.g. HTML, TeX, XML, web languages e.g. Expression Web, Dreamweaver, Flash, scripting languages e.g. JavaScript, VBScript, use and functionality of languages. Building websites: web runtime environments e.g. Windows, MAC, role of databases, product stack combinations e.g. Oracle, IBM WebSphere.
Learning Outcome 3: Proposal document: nature of interactivity required e.g. online transactions, static versus dynamic, client needs and user needs e.g. image, level of security, support, maintenance contracts, costs, visibility on search engines, end user need e.g. appropriateness of graphics, complexity of site, delivery of content, implementation plan e.g. development timescales, dependencies (critical path). Components: hardware, software.

Gateway Qualifications Level 3 Certificate and Diploma in Digital Engineering Design

Mandatory Unit

Project Management (Digital Engineering Design)

Unit Number:	J/650/4999
Level:	Level 3
Credit Value:	6
GLH:	42
Unit Aim:	Learners will understand project management concepts and the processes and tools used by organisations to manage digital engineering design projects. They will learn about project management methodologies and use project management software to plan a digital engineering design project, track progress, and review outcomes to determine project success.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:		ASSESSMENT CRITERIA The learner can:	
1	Understand the principles of project management and the methodologies used by organisations to manage digital engineering design projects.	1.1	Explain the stages of the project lifecycle and how they apply to digital engineering design projects.
		1.2	Describe key concepts, issues and risks when managing digital engineering design projects.
		1.3	Compare the characteristics of the different project methodologies used by organisations.
2	Be able to use project management software to plan a digital engineering design project.	2.1	Produce a project specification for a digital engineering design project in line with requirements.
		2.2	Use project management software to plan a digital engineering design project.
3	Be able to use project management software to monitor and review a digital engineering design project.	3.1	Use project management software to monitor a project plan and track progress against the plan.
		3.2	Carry out a post-project review to determine project outcomes.

Indicative Content: Project Management (Digital Engineering Design)

Learning Outcome 1:

Example digital engineering design projects could include:

- A 2D or 3D CAD project
- A 3D printing project
- A Virtual Reality (VR) project
- A Building Information Modelling (BIM) project
- A Geographic Information Systems (GIS) project

Project life cycle:
Conception and start up: project mandate, client requirements, and feasibility.
Definition of the project: set up project team, create the Project Initiation Document (PID).

Planning: timescales, costs, quality management, risk management and controls.
Launch and execution: carrying out the plan, monitoring activity, checking progress.
Closure: handover of the product, user acceptance testing, disbanding project team.
Post-project evaluation: reviewing the project against success criteria.

Concepts include the key factors, processes and stages that make up a project, such as:
Costs and timescales: project budget, setting milestones and deadlines, interim reviews.
Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project.

Quality and deliverables:
Application of current quality standards, for example: ISO/IEC 25010:2011 as a benchmark for software development, World Wide Web Consortium for website design and functionality standards.
Defining success criteria and using SMART objectives to define project outcomes.
Customer requirements in terms of functional requirements and non-functional requirements.
Product description or product breakdown structure, to describe the product to be delivered.

Issues: effects of changing external factors, monitoring progress, taking corrective actions where necessary, communications, working within relevant guidelines (internal and external) and legislation, dealing with conflict, impact of project outputs on other systems e.g. staff, organisational structures.

Benefits: saving money, maintaining or increasing profits, improving services, growing the business, increasing market share, improving productivity, expected return on investment, justification for the project, forecasting project success.

Risks: identifying typical project risks (internal/external risks), risk management cycle, identification of risks, assessing the severity of risks, accept the risk, plan contingency or avoid the risk, monitor and control the risks through the project, handling issues when a risk occurs.

Project management methodologies:
PRINCE2 – suitable for most projects.
Rapid Application Development (RAD) – suitable for short-term, large scale, big budget projects.
Waterfall – suitable for websites, database or network projects.
Agile – suitable for medium/long term projects where user requirements frequently change and outputs are required at regular intervals.

Indicative Content: Project Management (Digital Engineering Design)
Learning Outcome 2: The project must be sufficiently complex to allow planning and management to take place. It must also allow learners the opportunity to manage some resources, and the time allocated for completion. Interpreting the business case (the business case as a driver of the project): reasons for the project, options that should be considered, expected business benefits, timescale, including major milestones, budget available, risks. Project specification: identification of stakeholders, business case requirements, specific objectives or deliverables, benefits and success factors, project boundaries or scope, constraints, consideration of options, other, e.g. ethical issues, sustainable issues, understanding consequences of failure to hit deadlines or produce product, risks and risk mitigation. Project plan: purpose, content, e.g. identification of phases and activities, potential for parallel or sequential processes, resources needed for each activity, timescales, review points, e.g. milestones, checkpoints, deadlines. Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project, use of other appropriate and available software and applications, e.g. spreadsheets, graphics, databases etc
Learning Outcome 3: Monitor: routine communications with stakeholders, interim reviews, use of logbooks, routine updating of plan where necessary, others e.g. accessing additional resources where necessary, reacting to unforeseen circumstances. Tracking progress: project baseline and variance, monitoring and recording progress, checkpoint reports as a way of recording milestones achieved, monitoring risk and managing issues, recording quality management activity. Review of project success in terms of key factors, SMART objectives and views of stakeholders: review of lessons learned, review project performance against the baseline and project objectives, review of final cost, delivery date and quality of product delivered, review feedback from key stakeholders (clients, end users). Methods to obtain feedback: interviews, questionnaires, surveys, observation of resulting processes. Recommendations for future actions based on the outcome of the post-project review, communication and presenting requirements for reviews.

Specialist Units

CAD

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	K/618/5187
Unit Aim:	Learners will develop the knowledge and skills needed to use computer aided drawing (CAD) software to produce a variety of CAD drawings, from single-part 2D components to complex 3D models. They will also investigate the use of CAD and the hardware and software required.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand how CAD software is used for 2D and 3D drawings.	1.1 Compare the advantages of CAD to other drawing methods. 1.2 Describe the hardware and software required to produce CAD drawings. 1.3 Explain the commands and functions used to produce CAD drawings. 1.4 Explain how 2D and 3D CAD models can be used in the design process.
2 Be able to produce and interpret 2D CAD drawings.	2.1 Produce 2D CAD drawings. 2.2 Produce a circuit diagram. 2.3 Produce an assembly drawing, and an exploded view of an assembly or sub-assembly. 2.4 Interpret the properties of a component and circuit from a given CAD drawing.
3 Be able to use CAD software to produce 3D drawings and views.	3.1 Use a 3D environment to produce a 3D CAD drawing as a surface and solid model.

Indicative Content: CAD
Learning Outcome 1: Advantages of CAD: quality, accuracy, time, cost, electronic transfer of information, links with other software e.g. CAD/CAM, rendering software, animation software, finite element analysis (FEA) Other methods: manual drafting, model making. Software: operating systems, CAD software packages e.g. AutoCAD, AutoCAD/Inventor, MicroStation, Catia, Pro/ENGINEER, Solidworks, minimum system requirements e.g. hard disk space, memory required, processor, video card. Hardware: keyboard, mouse, other input devices e.g. light pen, digitiser, joystick, thumbwheel, monitor, printer, other output devices e.g. plotter, rapid prototyping, storage e.g. floppy disk, hard disk, memory stick, CD, network. CAD drawings: orthographic projections, circuit diagrams e.g. hydraulic, pneumatic, electronic, exploded/ assembly drawing, standards e.g. BS8888, BS3939, BS2917. Commands: absolute/relative/polar coordinates, features e.g. line types, grids, snaps, circle, text, hatching, dimensioning, layers/levels, colour, viewing e.g. zoom, pan, inserting other drawings e.g. symbols, blocks, modifying e.g. copy, rotate, move, erase, scale, chamfer, fillet.
Learning Outcome 2: **AC 2.1** 2D CAD drawings must include five components that make up an assembly or sub-assembly. **AC 2.2** The circuit diagram must contain at least five components. **AC 2.3** The assembly drawing and exploded view of an assembly or sub-assembly must contain at least five parts. **AC 2.4** Interpret: determine properties of drawn objects e.g. list, distance, area, volume.
Learning Outcome 3: 3D environment: 3D views e.g. top, front, side, isometric. 3D models: 3D techniques e.g. addition and subtraction of material, extrude, revolve, sweep, 3D coordinate entry (x, y, z), wire frame drawing, 2D to 3D (thickness, extrusion), surface models, solid models.

Digital Electronics

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	A/618/5193
Unit Aim:	Learners will develop an understanding of diodes and transistors, two of the most important building blocks in electronic circuits. They will learn about logic gates and flip-flops, both in practice and by using truth tables. Learners will also develop the skills to simulate, construct and test of variety of electronic circuits.

This unit has 5 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the function and operation of diodes, transistors and logic gates.	1.1 Explain the purpose of different types of diode, in different electronic circuits. 1.2 Explain the operation transistors in analogue and digital circuits. 1.3 Explain how truth tables are used to help show the function of a logic gate.
2 Be able to apply the principles of logic gates and circuits.	2.1 Convert truth tables into Boolean expressions. 2.2 Design logic circuits using truth tables. 2.3 Design combinational logic circuits to solve problems.
3 Be able to build and test operational amplifier-based analogue circuits.	3.1 Build and test two different types of analogue circuit using operational amplifiers.
4 Be able to build and test combinational and sequential logic circuits.	4.1 Build and test a combinational logic circuit that has three input variables. 4.2 Build and test a sequential circuit using integrated circuits.
5 Be able to use simulation software to construct and test the operation of analogue and digital circuits.	5.1 Simulate the construction and testing of an analogue circuit with three different types of components.

Indicative Content: Digital Electronics
Learning Outcome 1: Diodes: types e.g. Zener, light emitting diode (LED), PN-junction, circuit applications e.g. voltage stabiliser, indicator light, half-wave rectifier. Transistors: types e.g. NPN, PNP or field-effect transistor (FET), analogue circuit (single-stage amplifier), digital circuit e.g. comparator, transistor as a switch (automatic night light), operation e.g. analogue (voltage gain, phase inversion), digital (set-point of operation), function of components in circuits.
Learning Outcome 2: Logic gates: types of gates e.g. AND, OR, NOT, NAND, NOR XOR, gate symbols e.g. British Standards (BS), International Electrotechnical Commission (IEC), American National Standards Institute (ANSI), truth tables, Boolean expressions e.g. A+B, Ā, A, B.
Learning Outcome 3: Building analogue circuits: method of construction e.g. prototype/bread-board, printed circuit, strip-board, types of circuits e.g. oscillator, filter circuit, comparator circuit, inverting and/or non-inverting amplifier Testing analogue circuits: performance against given design requirement, recording actual input and output voltages (tabulating data, plotting graph of results), circuit measurements e.g. measurement of resonant frequency, cut-off frequency, switching point, gain at mid-frequency, bandwidth.
Learning Outcome 4: Building combinational and sequential logic circuits: types of combinational circuit e.g. at least three gates and three input variables, types of sequential circuit e.g. R-S bi-stables, JK bi-stable, 3-stage counter, 3-stage shift-register based on JK or D-type bi-stables, types of logic family e.g. transistor-transistor logic (TTL) and complementary metal oxide semiconductor (CMOS), characteristics of chips e.g. supply voltage, input and output operating voltages, input and output impedance, propagation delay, power Testing of logic circuits: records of performance against given design requirement, input and output states, use of truth tables, use of test equipment e.g. logic probe, signature analyser. Minimisation of logic circuits: e.g. use of De-Morgan's theorem, Karnaugh maps (a tool to simplify and design logic circuits).
Learning Outcome 5: Simulation of analogue circuit: types of circuits e.g. transistor amplifier, op-amp, active filter, rectifier, types of components e.g. resistor, capacitor, transistor, diode, instrument simulation e.g. voltmeter, ammeter, oscilloscope, records of performance against given design requirement e.g. screen print, input/output waveforms (with scales), gain-frequency response. Simulation of digital circuit: types of circuit e.g. three input combinational circuit, counter, shift register, types of gates/sequential circuit e.g. R-S bi-stables, JK bi-stable, 3-stage counter, 3-stage shift-register based on JK or D-type bi-stables, instrument simulation e.g. on/off indicator, logic probe, word generator, logic analyser, records of performance against given design requirement e.g. screen print, digital input/output waveforms (with scales).

Mechanical Principles

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	F/618/5194
Unit Aim:	Learners will develop an understanding of mechanical principles and the way they affect the design, operation, testing and servicing of machines and mechanisms.

This unit has 5 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand concepts and principles relating to mechanical systems.	1.1 Define parameters of static and dynamic mechanical systems. 1.2 Using a graphical method find the resultant of two concurrent coplanar forces from given data.
2 Understand the principle of moments.	2.1 Define moment of a force about a point. 2.2 Apply the principles of moments to solve related problems using formula.
3 Understand the terms velocity and acceleration.	3.1 Explain the relationship between velocity and acceleration. 3.2 Solve problems relating to speed, distance and acceleration using formula.
4 Understand the principles of motion.	4.1 Use equations of motion to solve related problems. 4.2 Use the equation F = ma to solve related problems using formula.
5 Understand the concept of work, energy and power.	5.1 Apply the concept of work, power and energy to solve related problems using formula. 5.2 Explain the difference between potential and kinetic energy. 5.3 Apply the concepts of potential and kinetic energy to solve related problems using formula.

Indicative Content: Mechanical Principles
Learning Outcome 1: Parameters: mass, Earth's gravity, weight, force, pressure, density, relative density, moment of a force, displacement, velocity, acceleration/retardation, limiting coefficient of kinetic friction, work done, power. Finding forces using graphical methods, including: concurrent coplanar forces, parallelogram of forces, resultant force, space diagram, vector diagram, triangle of forces, polygon of forces, equilibrant force, principle of moments, static equilibrium of a body. Line graphs: determining suitable scales from given data, defining and correctly labelling axes, determine the gradient, determine the intercept, prove the law of the straight line graph is $y = mx + c$.
Learning Outcome 2: Moments of a force: define and apply the principle of moments, define the meanings of the terms torque, couple. Solve problems: associated with levers and couples work, power and energy define work done in terms of force and distance moved.
Learning Outcome 3: Velocity: rate of change of position with respect to time, acceleration: rate of change of velocity. Both are vector quantities (and so also have a specified direction), but the units of velocity are meters per second while the units of acceleration are meters per second squared.
Learning Outcome 4: Motion: distance, time, speed, graphical representation of distance against time, displacement, graphical representation of displacement against time, velocity, acceleration, graphical representation of velocity against time, formulae for calculating uniform acceleration and retardation, limiting coefficient of kinetic friction, frictional resistance to motion, work done, power.
Learning Outcome 5: Work, power and energy: explain what is meant by energy; state that the unit of energy is the joule (J), the unit of power is the watt (W) and the unit of work is the joule (J); define power in terms of voltage/current and work done per second, perform calculations for work, power and energy.

Robot Technology

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	K/618/5190
Unit Aim:	Learners will develop an understanding of the principles and operations of robots. They will learn about robot control systems, the different types of sensors and their application in a robot. Learners will also develop the skills to design and develop a program to control a robot and will understand the role and importance of legislation associated with robot technology.

This unit has 4 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the operating, design and control principles of different types of robots.	1.1 Explain the operating, design and control principles of different types of robots. 1.2 Explain how different sensors and end effectors are used in robots. 1.3 Analyse the benefits and limitations of using robots for routine tasks.
2 Understand the legal and ethical issues in the development and use of robots.	2.1 Explain how legislation and roboethics influence the development and use of robots.
3 Be able to design and develop an operating program for a robot	3.1 Design an operating program for a robot to enable it to carry out a specific function. 3.2 Develop an operating program for a robot to enable it to carry out a specific function.
4 Understand hazards and health, safety and maintenance requirements associated with robots.	4.1 Explain the health and safety requirements, and maintenance procedures for the safe operation of robots.

Indicative Content: Robot Technology
Learning Outcome 1: Uses: in the home, in manufacturing industry, in medical applications, agricultural environments. Principles of operation: operational characteristics and specifications; types of controller, manipulator, end effector/tooling e.g. pneumatic suction cup, hydraulic, electrical and mechanical grippers; work space organisation e.g. feed of work, robot-to-robot work, material flow and logistics. Design principles: manipulator coordinate systems e.g. cylindrical spherical, jointed, spherical, Cartesian and Selective Compliant Assembly Robot Arm (SCARA) with associated working envelope; wrist articulations e.g. yaw, pitch and roll, degrees of freedom in terms of translations and rotations; drive mechanisms e.g. mechanical (ball screws, chain/belt, gears), pneumatic, hydraulic, electrical; speed reducers/gearheads e.g. harmonic, cycloidal, parallel shaft spur gear, planetary. Control systems: on/off and programmable-integral-derivative (PID) control; closed-loop servo controlled systems e.g. for driving one axis of a robot; input, output and feedback signals e.g. the sequence which takes place in order to perform a task; control of three axes of a robot Sensors: sensor types e.g. tactile (microswitches/piezoelectric/strain gauge/pressure), nontactile (capacitive/inductive/light/laser), vision (inspection, identification and navigation), sensor applications e.g. safety, work-cell control, component/part inspection. End effectors: grippers and tools e.g. parts handling/transfer, assembly, welding, paint spraying, testing.
Learning Outcome 2: Legal, social and moral issues relating to the development and use of robots, European Civil Law Rules in Robotics, Asimov's Laws, Zeroth Law. Roboethics: set of rules and principles that arise from the *use of robots* in our homes and workplaces, including such things as safety, privacy, and responsibility.
Learning Outcome 3: Operating program: program selection, start-up, test, alterations and operation, types of programming e.g. manual, walk through, teach pendant methods, off-line programming, planning robot efficient routes, writing programs using flowcharts, work-cell commands e.g. wait/signal/delay.
Learning Outcome 4: Health and safety requirements: relevant regulations e.g. Health and Safety at Work Act, Electricity at Work Regulations, Health and Safety Executive publications, Machine Tool Technologies Association Codes of Practice (MTA Safeguarding Codes of Practice – Industrial Robots parts 1–3), human dangers e.g. during programming, maintenance and as a result of system faults, safety barriers e.g. 'dead man's handle', hold and emergency stop buttons, pressure pads/matting surrounding robot, infra-red curtains and electromagnetic field barriers.

Indicative Content: Robot Technology
Maintenance: inspection routines e.g. mechanical condition of all parts, environmental conditions (particulate matter, temperature, ventilation, shock, vibration, electrical noise), spare parts required to sustain continuous operation, relevant maintenance tools and test equipment, set-up and maintenance schedules.

User Experience (UX) Design

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	M/618/5191
Unit Aim:	Learners will explore the principles of user experience (UX) design and how it is used to create products that provide meaningful and relevant experiences to users. They will learn about the design process to develop a UX solution to meet user requirements.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the role of user experience (UX) design in society.	1.1 Explain the developments in digital devices and how they impact on society. 1.2 Explain user experience (UX) design principles factors.
2 Be able to plan and design a user experience (UX) solution.	2.1 Plan the requirements for a user experience (UX) solution for an identified need. 2.2 Produce schematic design documentation for a user experience (UX) solution.
3 Be able to develop, test and review a (UX) solution.	3.1 Prepare content for a user experience (UX) solution for an identified need. 3.2 Develop a user experience (UX) solution to meet requirements. 3.3 Test and optimise a user experience (UX) solution in response to feedback. 3.4 Review the user experience (UX) design and development process and outcomes against requirements.

Indicative Content: User Experience (UX) Design

Learning Outcome 1:

How developments impact on the way users interact with digital devices: origins of computing, e.g. uses of early computers, types of user experience methods, command line interfaces, evolution of graphics and graphical user interfaces, command line interfaces versus graphical user interfaces, sense orientation (graphical, speech, touch).

Use of user experience (UX) in society and its impact:
Uses: e.g. self-checkout systems, domestic appliances with embedded computers, gaming.

Ways in which people interact with systems, e.g. touchscreens, mouse, voice recognition, bespoke input devices.

Impact of user experience (UX) on: usability of systems, social interaction, cultural impacts, commerce, e.g. working patterns and styles, deskilling, retraining needs, economies.

Assistive technologies, e.g. eye gaze system, braille, screen magnifiers, avatars for sign language.

Developments in user experience: screens, keyboards, pointing devices, speech recognition, virtual reality, augmented reality, artificial intelligence systems, modern gaming/gestures, 3D interfaces, thought input.

Design principles: colours, font size/style, language, amount of information, layout, user perception (colour, sound, symbols, visuals), engagement/retaining attention, difference between recognition and recall, screen design for intuitive data entry, menu selection.

Shneiderman's rules: consistency, use of shortcuts, informative feedback, design dialog to yield closure, error handling, reversal of actions, support internal locus of control, reduce short-term memory load.

Behavioural models: keystroke level model, throughput, Fitts's law, key action model, Buxton's three state model, Guiard's model.

Factors: types of user, expert users, regular users, occasional users, beginner/novice users, ergonomics, health and safety , demographics, accessibility, e.g. responding to the needs of users with restricted motor skills.

Learning Outcome 2:

Requirements for a UX solution: tasks to be performed, input required, e.g. mouse, touch screen, voice, output required, e.g. graphics, animations, audio feedback, physical feedback, user needs, e.g. accessibility considerations, purpose of system, environmental factors.

Schematic design documentation: generation of ideas, e.g. mood boards, client/designer meetings, client requirements, hardware and software requirements, visualisation/interface design, e.g. storyboarding, flow charts, technical specification, e.g. file formats required, bandwidth limitations target platform, technical designs, e.g. algorithms, example code, wiring diagrams, consideration of design rules, supporting documentation, e.g. meeting notes, research, user profiling, advantages and disadvantages of proposed solution, alternative solutions with comparison to the proposed

Indicative Content: User Experience (UX) Design
solution and advantages and disadvantages of the alternatives, methods of obtaining feedback to improve designs, e.g. user testing, client meetings.
Learning Outcome 3: Content preparation: creating unique content, e.g. sounds, images, control code ,se of content created by others (permissions, acknowledging sources, legal and ethical considerations, optimisation, e.g. file size, image size, alternate formats for screen orientation, e.g. landscape, portrait, file formats, i.e. compatibility, performance, quality, compression requirements for items such as images, possible constraints, file size and image quality. Developing a UX solution: application of UX design principles, primary interface implementation, e.g. standard icons, menus, window layout, implementing alternative interfaces, e.g. mobile version, adaptive for user needs, software integration, e.g. event handling, coding to add functionality, hardware integration, e.g. bespoke controllers, recognising keystrokes, adaptive technologies, coding to control connected hardware, supporting documentation. Testing a UX solution: identifying how and what to test, e.g. producing a test plan, choosing test data, test user identification, types of testing, e.g. effectiveness, functionality, performance, obtaining feedback from others, e.g. questionnaires, interviews, checklists, making improvements and/or refinements to solutions in response to testing and feedback from others. Reviewing the development process and outcomes: suitability for audience and purpose, ease of use, quality of the solution, e.g. reliability, usability, efficiency/performance, maintainability, portability, constraints, e.g. time, sourcing hardware components, platform, compatibility, legal and ethical considerations (accessibility requirements, copyright), impact of design and development processes, e.g. input from others, decisions made, strengths and weaknesses of the solution, evaluation of how the implemented solutions could be improved to better meet the needs of the user and fulfil the identified needs.

Web Controlled Devices

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	J/618/5620
Unit Aim:	Learners will investigate the technologies and techniques used to produce secure web applications for controlling physical devices over the internet. They will explore the principles of web server scripting and design, develop and test a web application to remotely control a physical device.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand web technology and how it is used to control physical devices over the internet.	1.1 Explain the purpose and use of web controlled devices. 1.2 Explain the different scripting languages, tools and techniques used when developing web controlled devices. 1.3 Explain how web server scripting principles are applied in web controlled devices.
2 Understand security measures used to protect web applications from malicious attacks.	2.1 Understand security measures used to protect web applications from malicious attacks. 2.2 Explain security measures used to protect web applications.
3 Be able to design, develop, test and document a web application to remotely control a physical device to meet requirements.	3.1 Produce planning and design documentation for a web application to remotely control a physical device. 3.2 Develop and test the web application to remotely control a physical device. 3.3 Create technical documentation for the support and maintenance of the web application.

Indicative Content: Web Controlled Devices

Learning Outcome 1:

Web controlled devices: building management systems – lights, curtains and environment control systems such as heating and cooling, visual devices – camera, telescope, domestic appliances – television, washing machine and baths, industrial – process monitoring, control and fault diagnosis, other – wearable technology and surgical robots, remote devices in inaccessible or dangerous locations – spacecraft, subsea planetary landers, bomb disposal, (ROVs).

Web scripting languages: PHP, ASP, Ruby on Rails, Java, ColdFusion, issues surrounding the use of scripting languages with regard to server requirements, scalability, documented support, cost, ease of use, security.

Tools and techniques: World Wide Web Consortium (W3C) standards, HyperText Markup Language (HTML), HTML5, tables, forms, text field, text area, buttons, radio buttons, check boxes, navigation, menus, hyperlinks (internal and external), anchors, interactive components – hotspots, pop-ups, buttons, menus, rollover images, Cascading Style Sheets (CSS), e.g. background colour, background images, text formatting, borders, padding, heading styles, element position.

Principles of web server scripting: usability, site layout, accessibility, spacing, navigation, client- and server-side scripting, content, database solutions – MySQLi, Oracle, hosting – shared server solutions, virtual private server (VPS), dedicated server.

Application structure and how server scripting is applied to web applications: multi-user/rank login systems, file uploading, storing data in databases – user registration details, login credentials, environment settings, error logs.

Limitations of server scripting: inability to access client-side file system, inability to read local client environment information.

Client-side scripting languages: embedding client-side scripts into web pages can allow for more interactivity and improve usability.

Client-side scripting: types of scripting languages – JavaScript, VBScript, uses of scripting languages – alerts, confirming choices, browser detection, creating rollovers, checking and validating input, handling forms, constructs – syntax, loops, decision-making functions, parameter passing, handling events, methods.

Server-side scripting: programming constructs used in a server scripting and web application development, including: logic and operators – AND, OR and NOT, variables – global, local, integer, float, string, server, sessions and cookies, functions (including passing data between), variable and function naming conventions, string manipulation – concatenation, string searching, arrays, including two-dimensional, conditional statements – if/else, switch, loops – for, while, do/while, server side – libraries, menu files, header/footer files, programming efficiency – input validation, minimising potential for user error, bypassing unnecessary subroutines, mathematical manipulation of numerical data – random number generation, modulus, sending data using POST and GET methods.

Learning Outcome 2:

Web security threats: malware, spoofing – a user masquerading as another, eavesdropping – monitoring data to uncover passwords, spamming – denial of service (DoS) attack, out of band – targeting low level system functions to gain control.

Indicative Content: Web Controlled Devices
Vulnerabilities: human error (user error), accidental deletion of software or data, leaving weaknesses – escalation of privileges, poor authentication and use of encryption, data not validated, malfunction in hardware or software leading to vulnerabilities. Security measures: data sanitisation before querying databases, predictable folder structures and their vulnerability, the use of abstraction layers when manipulating databases, encryption methods: – symmetric cryptography systems – asymmetric cryptography systems (public-key cryptography), Structured Query Language (SQL) injection prevention, impact of security protection measures on web application performance.
Learning Outcome 3: Design documentation: problem definition statement – intended user, full summary of the problem to be solved, constraints, benefits, nature of interactivity, complexity of site, research of similar web application products, initial design ideas/prototypes, diagrams, illustrations, wireframe, site maps, realistic representations, alternative design ideas/prototypes, including compatibility with mobile/tablet devices, original scripting design tools and techniques – pseudo code, flow charts, test plan with test data, to test functionality , technical and design constraints (browser or device compatibility).

Gateway Qualifications Level 3 Certificate and Diploma in Digital Product Design

Mandatory Unit

Project Management (Digital Product Design)

Unit Number:	K/650/5005
Level:	Level 3
Credit Value:	6
GLH:	42
Unit Aim:	Learners will understand project management concepts and the processes and tools used by organisations to manage digital product design projects. They will learn about project management methodologies and use project management software to plan a digital product design project, track progress, and review outcomes to determine project success.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:		ASSESSMENT CRITERIA The learner can:	
1	Understand the principles of project management and the methodologies used by organisations to manage digital product design projects.	1.1	Explain the stages of the project lifecycle and how they apply to digital product design projects.
		1.2	Describe key concepts, issues and risks when managing digital product design projects.
		1.3	Compare the characteristics of different project management methodologies used by organisations.
2	Be able to use project management software to plan a digital product design project.	2.1	Produce a project specification for a digital product design project in line with requirements.
		2.2	Use project management software to plan digital product design project.
3	Be able to use project management software to monitor and review a digital product design project.	3.1	Use project management software to monitor a project plan and track progress against the plan.
		3.2	Carry out a post-project review to determine project outcomes.

Indicative Content: Project Management (Digital Product Design)

Learning Outcome 1:

Example digital product design projects could include:

- The UI (user interface) and UX (user experience) of an app, website, system or platform
- Wearable technology

Project life cycle:
Conception and start up: project mandate, client requirements, and feasibility.
Definition of the project: set up project team, create the Project Initiation Document (PID).
Planning: timescales, costs, quality management, risk management and controls.
Launch and execution: carrying out the plan, monitoring activity, checking progress.
Closure: handover of the product, user acceptance testing, disbanding project team.
Post-project evaluation: reviewing the project against success criteria.

Concepts include the key factors, processes and stages that make up a project, such as:
Costs and timescales: project budget, setting milestones and deadlines, interim reviews.
Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project.

Quality and deliverables:
Application of current quality standards, for example: ISO/IEC 25010:2011 as a benchmark for software development, World Wide Web Consortium for website design and functionality standards.
Defining success criteria and using SMART objectives to define project outcomes.
Customer requirements in terms of functional requirements and non-functional requirements.
Product description or product breakdown structure, to describe the product to be delivered.

Issues: effects of changing external factors, monitoring progress, taking corrective actions where necessary, communications, working within relevant guidelines (internal and external) and legislation, dealing with conflict, impact of project outputs on other systems, e.g. staff, organisational structures.

Benefits: saving money, maintaining or increasing profits, improving services, growing the business, increasing market share, improving productivity, expected return on investment, justification for the project, forecasting project success.

Risks: identifying typical project risks (internal/external risks), risk management cycle, identification of risks, assessing the severity of risks, accept the risk, plan contingency or avoid the risk, monitor and control the risks through the project, handling issues when a risk occurs.

Project management methodologies:
PRINCE2 – suitable for most projects.
Rapid Application Development (RAD) – suitable for short-term, large scale, big budget projects.
Waterfall – suitable for websites, database or network projects.
Agile – suitable for medium/long term projects where user requirements frequently change, and outputs are required at regular intervals.

Learning Outcome 2:

Indicative Content: Project Management (Digital Product Design)
The project must be sufficiently complex to allow planning and management to take place. It must also allow learners the opportunity to manage some resources and the time allocated for completion. Interpreting the business case (the business case as a driver of the project): reasons for the project, options that should be considered, expected business benefits, timescale, including major milestones, budget available, risks. Project specification: identification of stakeholders, business case requirements, specific objectives or deliverables, benefits and success factors, project boundaries or scope, constraints, consideration of options, other, e.g. ethical issues, sustainable issues, understanding consequences of failure to hit deadlines or produce product, risks and risk mitigation. Project plan: purpose, content, e.g. identification of phases and activities, potential for parallel or sequential processes, resources needed for each activity, timescales, review points, e.g. milestones, checkpoints, deadlines. Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project, use of other appropriate and available software and applications, e.g. spreadsheets, graphics, databases etc.
Learning Outcome 3: Monitor: routine communications with stakeholders, interim reviews, use of logbooks, routine updating of plan where necessary, others, e.g. accessing additional resources where necessary, reacting to unforeseen circumstances. Tracking progress: project baseline and variance, monitoring and recording progress, checkpoint reports as a way of recording milestones achieved, monitoring risk and managing issues, recording quality management activity. Review of project success in terms of key factors, SMART objectives and views of stakeholders: review of lessons learned, review project performance against the baseline and project objectives, review of final cost, delivery date and quality of product delivered, review feedback from key stakeholders (clients, end users). Methods to obtain feedback: interviews, questionnaires, surveys, observation of resulting processes. Recommendations for future actions based on the outcome of the post-project review, communication and presenting requirements for reviews.

Specialist Units

CAD

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	K/618/5187
Unit Aim:	Learners will develop the knowledge and skills needed to use computer aided drawing (CAD) software to produce a variety of CAD drawings, from single-part 2D components to complex 3D models. They will also investigate the use of CAD and the hardware and software required.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand how CAD software is used for 2D and 3D drawings.	1.1 Compare the advantages of CAD to other drawing methods. 1.2 Describe the hardware and software required to produce CAD drawings. 1.3 Explain the commands and functions used to produce CAD drawings. 1.4 Explain how 2D and 3D CAD models can be used in the design process.
2 Be able to produce and interpret 2D CAD drawings.	2.1 Produce 2D CAD drawings. 2.2 Produce a circuit diagram. 2.3 Produce an assembly drawing, and an exploded view of an assembly or sub-assembly. 2.4 Interpret the properties of a component and circuit from a given CAD drawing.
3 Be able to use CAD software to produce 3D drawings and views.	3.1 Use a 3D environment to produce a 3D CAD drawing as a surface and solid model.

Indicative Content: CAD
Learning Outcome 1: Advantages of CAD: quality, accuracy, time, cost, electronic transfer of information, links with other software e.g. CAD/CAM, rendering software, animation software, finite element analysis (FEA) Other methods: manual drafting, model making. Software: operating systems, CAD software packages e.g. AutoCAD, AutoCAD/Inventor, MicroStation, Catia, Pro/ENGINEER, Solidworks, minimum system requirements e.g. hard disk space, memory required, processor, video card. Hardware: keyboard, mouse, other input devices e.g. light pen, digitiser, joystick, thumbwheel, monitor, printer, other output devices e.g. plotter, rapid prototyping, storage e.g. floppy disk, hard disk, memory stick, CD, network. CAD drawings: orthographic projections, circuit diagrams e.g. hydraulic, pneumatic, electronic, exploded/ assembly drawing, standards e.g. BS8888, BS3939, BS2917. Commands: absolute/relative/polar coordinates, features e.g. line types, grids, snaps, circle, text, hatching, dimensioning, layers/levels, colour, viewing e.g. zoom, pan, inserting other drawings e.g. symbols, blocks, modifying e.g. copy, rotate, move, erase, scale, chamfer, fillet.
Learning Outcome 2: **AC 2.1** 2D CAD drawings must include five components that make up an assembly or sub-assembly. **AC 2.2** The circuit diagram must contain at least five components. **AC 2.3** The assembly drawing and exploded view of an assembly or sub-assembly must contain at least five parts. **AC 2.4** Interpret: determine properties of drawn objects e.g. list, distance, area, volume.
Learning Outcome 3: 3D environment: 3D views e.g. top, front, side, isometric. 3D models: 3D techniques e.g. addition and subtraction of material, extrude, revolve, sweep, 3D coordinate entry (x, y, z), wire frame drawing, 2D to 3D (thickness, extrusion), surface models, solid models.

Digital Product Design and Development

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	M/618/5188
Unit Aim:	Learners will explore the features and uses of a variety of digital products to discover the key principles of navigation and user interaction. They will plan, design and develop a digital product for a particular purpose and target audience by applying visual communication skills such as colour, typography and grids.

This unit has 4 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand processes and techniques when developing assets and designs for digital products.	1.1 Explain types of digital products and their use for different purposes. 1.2 Explain the characteristics and the visual communication used in the design and development of digital products.
2 Be able to design and create assets, navigation and interactivity for a digital product to meet requirements.	2.1 Generate design ideas for a digital product. 2.2 Create assets and user interfaces for a digital product.
3 Be able to implement processes and techniques to develop a digital product	3.1 Develop a digital product in line with requirements. 3.2 Document processes and techniques used during development.
4 Be able to review and reflect on the design and development of a digital product.	4.1 Evaluate a digital product and reflect on own performance in developing it.

Indicative Content: Digital Product Design and Development
Learning Outcome 1: Purposes: e.g. interactive communication, information retrieval, performing of specific tasks, educational, entertainment. Uses: e.g. social communication, news, navigation and mapping, entertainment, education, moving image and audio. Characteristics: e.g. touch, connectivity, mobility, offline working, convenience, ease of access, personalisation. User requirements, e.g. interaction, functionality, accessibility, legibility, intuitiveness, content driven design, efficiency. Devices: compatibility across platforms, e.g. smartphones and tablets and operating systems. Restrictions, e.g. storage, compatibility, supported fonts, screen size, screen resolution, screen orientation, canvas size. Standards and terms used in app development, e.g. user experience (UX), user interface (UI), graphical user interface (GUI), post-WIMP (windows, icons, menus, pointer), information architecture (IA), iterative design, prototyping. Characteristics/visual communication: Interaction and navigation: interface elements, including visual, written and interactive content, grid and typography. Navigational elements: buttons, menus. Informational elements, e.g. icons, controls: sliders, steppers. Touch-based interactive gestures, e.g. tap, press, swipe. Navigation movements, e.g. horizontal, vertical, back, master, detail and navigation transitions: slide, expand. Assets, e.g. moving image, audio, sound, text, graphics.
Learning Outcome 2: Generating ideas: brainstorming, primary and secondary research, photography, drawings, scripts, interviews, user personas, user journeys, genre such as sports, fantasy, political, adventure, music, mood and atmosphere such as urban, traditional, cutting edge, heritage. Assets and user interfaces: structure and interactive development, e.g. wireframes, prototyping, workflows, information architecture, storyboard.

Indicative Content: Digital Product Design and Development
Learning Outcome 3: Development of digital product through layout and grids, images and icons, typefaces and typographic hierarchy, etc. Development of assets through visual communication, e.g. form colour, shape, texture or, for sound and motion, pace, tone, speed. Carry out and respond to user testing and user feedback on individual assets and user interface. Technical development of assets through software whilst considering restrictions such as platform, file formats, resolution, size. Interactive flow and functionality development through paper to digital prototyping software. Processes and techniques: project management, organising and following conventions of folders, files formats, naming, application of basic commands, apply assets, elements and features to create an app, dry run and final testing on target device for navigation, consistency, interactivity, usability, intentions, efficiency. Document processes and techniques: design brief, wireframes, navigation flow between screens, visual communication experiments, user-testing feedback, software notes and screenshots.
Learning Outcome 4: Evaluation and reflection: feedback (teachers, peers, target audience, social media), review of app against original brief, usability, consistency, navigation, legibility and accessibility, review against appropriate industry standards and software, self-review of own performance with identification of areas for development, e.g. strengths and weaknesses, challenges and opportunities, justifications for key decisions.

Robot Technology

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	K/618/5190
Unit Aim:	Learners will develop an understanding of the principles and operations of robots. They will learn about robot control systems, the different types of sensors and their application in a robot. Learners will also develop the skills to design and develop a program to control a robot and will understand the role and importance of legislation associated with robot technology.

This unit has 4 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the operating, design and control principles of different types of robots.	1.1 Explain the operating, design and control principles of different types of robots. 1.2 Explain how different sensors and end effectors are used in robots. 1.3 Analyse the benefits and limitations of using robots for routine tasks.
2 Understand the legal and ethical issues in the development and use of robots.	2.1 Explain how legislation and roboethics influence the development and use of robots.
3 Be able to design and develop an operating program for a robot	3.1 Design an operating program for a robot to enable it to carry out a specific function. 3.2 Develop an operating program for a robot to enable it to carry out a specific function.
4 Understand hazards and health, safety and maintenance requirements associated with robots.	4.1 Explain the health and safety requirements, and maintenance procedures for the safe operation of robots.

Indicative Content: Robot Technology
Learning Outcome 1: Uses: in the home, in manufacturing industry, in medical applications, agricultural environments. Principles of operation: operational characteristics and specifications; types of controller, manipulator, end effector/tooling e.g. pneumatic suction cup, hydraulic, electrical and mechanical grippers; work space organisation e.g. feed of work, robot-to-robot work, material flow and logistics. Design principles: manipulator coordinate systems e.g. cylindrical spherical, jointed, spherical, Cartesian and Selective Compliant Assembly Robot Arm (SCARA) with associated working envelope; wrist articulations e.g. yaw, pitch and roll, degrees of freedom in terms of translations and rotations; drive mechanisms e.g. mechanical (ball screws, chain/belt, gears), pneumatic, hydraulic, electrical; speed reducers/gearheads e.g. harmonic, cycloidal, parallel shaft spur gear, planetary. Control systems: on/off and programmable-integral-derivative (PID) control; closed-loop servo controlled systems e.g. for driving one axis of a robot; input, output and feedback signals e.g. the sequence which takes place in order to perform a task; control of three axes of a robot Sensors: sensor types e.g. tactile (microswitches/piezoelectric/strain gauge/pressure), nontactile (capacitive/inductive/light/laser), vision (inspection, identification and navigation), sensor applications e.g. safety, work-cell control, component/part inspection. End effectors: grippers and tools e.g. parts handling/transfer, assembly, welding, paint spraying, testing.
Learning Outcome 2: Legal, social and moral issues relating to the development and use of robots, European Civil Law Rules in Robotics, Asimov's Laws, Zeroth Law. Roboethics: set of rules and principles that arise from the *use of robots* in our homes and workplaces, including such things as safety, privacy, and responsibility.
Learning Outcome 3: Operating program: program selection, start-up, test, alterations and operation, types of programming e.g. manual, walk through, teach pendant methods, off-line programming, planning robot efficient routes, writing programs using flowcharts, work-cell commands e.g. wait/signal/delay.
Learning Outcome 4: Health and safety requirements: relevant regulations e.g. Health and Safety at Work Act, Electricity at Work Regulations, Health and Safety Executive publications, Machine Tool Technologies Association Codes of Practice (MTA Safeguarding Codes of Practice – Industrial Robots parts 1–3), human dangers e.g. during programming, maintenance and as a result of system faults, safety barriers e.g. 'dead man's handle', hold and emergency stop buttons, pressure pads/matting surrounding robot, infra-red curtains and electromagnetic field barriers.

Indicative Content: Robot Technology
Maintenance: inspection routines e.g. mechanical condition of all parts, environmental conditions (particulate matter, temperature, ventilation, shock, vibration, electrical noise), spare parts required to sustain continuous operation, relevant maintenance tools and test equipment, set-up and maintenance schedules.

User Experience (UX) Design

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	M/618/5191
Unit Aim:	Learners will explore the principles of user experience (UX) design and how it is used to create products that provide meaningful and relevant experiences to users. They will learn about the design process to develop a UX solution to meet user requirements.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the role of user experience (UX) design in society.	1.1 Explain the developments in digital devices and how they impact on society. 1.2 Explain user experience (UX) design principles factors.
2 Be able to plan and design a user experience (UX) solution.	2.1 Plan the requirements for a user experience (UX) solution for an identified need. 2.2 Produce schematic design documentation for a user experience (UX) solution.
3 Be able to develop, test and review a (UX) solution.	3.1 Prepare content for a user experience (UX) solution for an identified need. 3.2 Develop a user experience (UX) solution to meet requirements. 3.3 Test and optimise a user experience (UX) solution in response to feedback. 3.4 Review the user experience (UX) design and development process and outcomes against requirements.

Indicative Content: User Experience (UX) Design
Learning Outcome 1: How developments impact on the way users interact with digital devices: origins of computing, e.g. uses of early computers, types of user experience methods, command line interfaces, evolution of graphics and graphical user interfaces, command line interfaces versus graphical user interfaces, sense orientation (graphical, speech, touch). Use of user experience (UX) in society and its impact: Uses: e.g. self-checkout systems, domestic appliances with embedded computers, gaming. Ways in which people interact with systems, e.g. touchscreens, mouse, voice recognition, bespoke input devices. Impact of user experience (UX) on: usability of systems, social interaction, cultural impacts, commerce, e.g. working patterns and styles, deskilling, retraining needs, economies. Assistive technologies, e.g. eye gaze system, braille, screen magnifiers, avatars for sign language. Developments in user experience: screens, keyboards, pointing devices, speech recognition, virtual reality, augmented reality, artificial intelligence systems, modern gaming/gestures, 3D interfaces, thought input. Design principles: colours, font size/style, language, amount of information, layout, user perception (colour, sound, symbols, visuals), engagement/retaining attention, difference between recognition and recall, screen design for intuitive data entry, menu selection. Shneiderman's rules: consistency, use of shortcuts, informative feedback, design dialog to yield closure, error handling, reversal of actions, support internal locus of control, reduce short-term memory load. Behavioural models: keystroke level model, throughput, Fitts's law, key action model, Buxton's three state model, Guiard's model. Factors: types of user, expert users, regular users, occasional users, beginner/novice users, ergonomics, health and safety , demographics, accessibility, e.g. responding to the needs of users with restricted motor skills.
Learning Outcome 2: Requirements for a UX solution: tasks to be performed, input required, e.g. mouse, touch screen, voice, output required, e.g. graphics, animations, audio feedback, physical feedback, user needs, e.g. accessibility considerations, purpose of system, environmental factors. Schematic design documentation: generation of ideas, e.g. mood boards, client/designer meetings, client requirements, hardware and software requirements, visualisation/interface design, e.g. storyboarding, flow charts, technical specification, e.g. file formats required, bandwidth limitations target platform, technical designs, e.g. algorithms, example code, wiring diagrams, consideration of design rules, supporting documentation, e.g. meeting notes, research, user profiling, advantages and disadvantages of proposed solution, alternative solutions with comparison to the proposed

Indicative Content: User Experience (UX) Design
solution and advantages and disadvantages of the alternatives, methods of obtaining feedback to improve designs, e.g. user testing, client meetings.
Learning Outcome 3: Content preparation: creating unique content, e.g. sounds, images, control code ,se of content created by others (permissions, acknowledging sources, legal and ethical considerations, optimisation, e.g. file size, image size, alternate formats for screen orientation, e.g. landscape, portrait, file formats, i.e. compatibility, performance, quality, compression requirements for items such as images, possible constraints, file size and image quality. Developing a UX solution: application of UX design principles, primary interface implementation, e.g. standard icons, menus, window layout, implementing alternative interfaces, e.g. mobile version, adaptive for user needs, software integration, e.g. event handling, coding to add functionality, hardware integration, e.g. bespoke controllers, recognising keystrokes, adaptive technologies, coding to control connected hardware, supporting documentation. Testing a UX solution: identifying how and what to test, e.g. producing a test plan, choosing test data, test user identification, types of testing, e.g. effectiveness, functionality, performance, obtaining feedback from others, e.g. questionnaires, interviews, checklists, making improvements and/or refinements to solutions in response to testing and feedback from others. Reviewing the development process and outcomes: suitability for audience and purpose, ease of use, quality of the solution, e.g. reliability, usability, efficiency/performance, maintainability, portability, constraints, e.g. time, sourcing hardware components, platform, compatibility, legal and ethical considerations (accessibility requirements, copyright), impact of design and development processes, e.g. input from others, decisions made, strengths and weaknesses of the solution, evaluation of how the implemented solutions could be improved to better meet the needs of the user and fulfil the identified needs.

Web Controlled Devices

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	J/618/5620
Unit Aim:	Learners will investigate the technologies and techniques used to produce secure web applications for controlling physical devices over the internet. They will explore the principles of web server scripting and design, develop and test a web application to remotely control a physical device.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand web technology and how it is used to control physical devices over the internet.	1.1 Explain the purpose and use of web controlled devices. 1.2 Explain the different scripting languages, tools and techniques used when developing web controlled devices. 1.3 Explain how web server scripting principles are applied in web controlled devices.
2 Understand security measures used to protect web applications from malicious attacks.	2.1 Understand security measures used to protect web applications from malicious attacks. 2.2 Explain security measures used to protect web applications.
3 Be able to design, develop, test and document a web application to remotely control a physical device to meet requirements.	3.1 Produce planning and design documentation for a web application to remotely control a physical device. 3.2 Develop and test the web application to remotely control a physical device. 3.3 Create technical documentation for the support and maintenance of the web application.

Indicative Content: Web Controlled Devices

Learning Outcome 1:

Web controlled devices: building management systems – lights, curtains and environment control systems such as heating and cooling, visual devices – camera, telescope, domestic appliances – television, washing machine and baths, industrial – process monitoring, control and fault diagnosis, other – wearable technology and surgical robots, remote devices in inaccessible or dangerous locations – spacecraft, subsea planetary landers, bomb disposal, (ROVs).

Web scripting languages: PHP, ASP, Ruby on Rails, Java, ColdFusion, issues surrounding the use of scripting languages with regard to server requirements, scalability, documented support, cost, ease of use, security.

Tools and techniques: World Wide Web Consortium (W3C) standards, HyperText Markup Language (HTML), HTML5, tables, forms, text field, text area, buttons, radio buttons, check boxes, navigation, menus, hyperlinks (internal and external), anchors, interactive components – hotspots, pop-ups, buttons, menus, rollover images, Cascading Style Sheets (CSS), e.g. background colour, background images, text formatting, borders, padding, heading styles, element position.

Principles of web server scripting: usability, site layout, accessibility, spacing, navigation, client- and server-side scripting, content, database solutions – MySQLi, Oracle, hosting – shared server solutions, virtual private server (VPS), dedicated server.

Application structure and how server scripting is applied to web applications: multi-user/rank login systems, file uploading, storing data in databases – user registration details, login credentials, environment settings, error logs.

Limitations of server scripting: inability to access client-side file system, inability to read local client environment information.

Client-side scripting languages: embedding client-side scripts into web pages can allow for more interactivity and improve usability.

Client-side scripting: types of scripting languages – JavaScript, VBScript, uses of scripting languages – alerts, confirming choices, browser detection, creating rollovers, checking and validating input, handling forms, constructs – syntax, loops, decision-making functions, parameter passing, handling events, methods.

Server-side scripting: programming constructs used in a server scripting and web application development, including: logic and operators – AND, OR and NOT, variables – global, local, integer, float, string, server, sessions and cookies, functions (including passing data between), variable and function naming conventions, string manipulation – concatenation, string searching, arrays, including two-dimensional, conditional statements – if/else, switch, loops – for, while, do/while, server side – libraries, menu files, header/footer files, programming efficiency – input validation, minimising potential for user error, bypassing unnecessary subroutines, mathematical manipulation of numerical data – random number generation, modulus, sending data using POST and GET methods.

Learning Outcome 2:

Web security threats: malware, spoofing – a user masquerading as another, eavesdropping – monitoring data to uncover passwords, spamming – denial of service (DoS) attack, out of band – targeting low level system functions to gain control.

Indicative Content: Web Controlled Devices
Vulnerabilities: human error (user error), accidental deletion of software or data, leaving weaknesses – escalation of privileges, poor authentication and use of encryption, data not validated, malfunction in hardware or software leading to vulnerabilities. Security measures: data sanitisation before querying databases, predictable folder structures and their vulnerability, the use of abstraction layers when manipulating databases, encryption methods: – symmetric cryptography systems – asymmetric cryptography systems (public-key cryptography), Structured Query Language (SQL) injection prevention, impact of security protection measures on web application performance.
Learning Outcome 3: Design documentation: problem definition statement – intended user, full summary of the problem to be solved, constraints, benefits, nature of interactivity, complexity of site, research of similar web application products, initial design ideas/prototypes, diagrams, illustrations, wireframe, site maps, realistic representations, alternative design ideas/prototypes, including compatibility with mobile/tablet devices, original scripting design tools and techniques – pseudo code, flow charts, test plan with test data, to test functionality , technical and design constraints (browser or device compatibility).

Web Development

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	H/618/5186
Unit Aim:	Learners will develop an understanding of web technologies and use Hypertext Markup Language (HTML), Cascading Style Sheets (CSS) and JavaScript to design and develop a website.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand web architecture and components.	1.1 Describe web components and architecture. 1.2 Explain the role of the TCP/IP protocol including IPv6. 1.3 Explain the role of internet service providers (ISPs), web hosting services and domain name registrars. 1.4 Describe available types of web functionality.
2 Understand the technologies that can be used to build and support a website	2.1 Explain the use of web markup and scripting languages. 2.2 Explain the use and functionality of web runtime environments and web application programming languages. 2.3 Explain the role of databases in building websites and web applications. 2.4 Explain typical product stack combinations that can be used for web development.
3 Be able to design, develop and test a website to meet requirements.	3.1 Produce a website development project proposal for a given need. 3.2 Identify the web components required to develop a website. 3.3 Use appropriate tools and techniques to design and develop a website with accurately presented and effectively structured content 3.4 Test and review a website.

Indicative Content: Web Development
Learning Outcome 1: Components: hardware e.g. web, mail and proxy servers, routers, software e.g. browser, email. Protocols: transport and addressing e.g. TCP/IP, IPv6, application layer e.g. HTTP, HTTPS, SMTP. Web architecture: Internet Service Providers (ISP), web hosting services, domain structure, domain name registrars, worldwide web. Web functionality: Web 1.0, Web 2.0, blogs, online applications, cloud computing.
Learning Outcome 2: Languages: markup languages e.g. HTML, TeX, XML, web languages e.g. Expression Web, Dreamweaver, Flash, scripting languages e.g. JavaScript, VBScript, use and functionality of languages Building websites: web runtime environments e.g. Windows, MAC, role of databases, product stack combinations e.g. Oracle, IBM WebSphere.
Learning Outcome 3: Proposal document: nature of interactivity required e.g. online transactions, static versus dynamic, client needs and user needs e.g. image, level of security, support, maintenance contracts, costs, visibility on search engines, end user need e.g. appropriateness of graphics, complexity of site, delivery of content, implementation plan e.g. development timescales, dependencies (critical path). Components: hardware, software.

Gateway Qualifications Level 3 Certificate and Diploma in Games Technologies

Mandatory Unit

Project Management (Games Technologies)

Unit Number:	R/650/5008
Level:	Level 3
Credit Value:	6
GLH:	42
Unit Aim:	Learners will understand project management concepts and the processes and tools used by organisations to manage games technology projects. They will learn about project management methodologies and use project management software to plan a games technology project, track progress, and review outcomes to determine project success.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:		ASSESSMENT CRITERIA The learner can:	
1	Understand the principles of project management and the methodologies used by organisations to manage games technology projects.	1.1	Explain the stages of the project lifecycle and how they apply to games technology projects.
		1.2	Describe key concepts, issues and risks when managing games technology projects.
		1.3	Compare the characteristics of different project management methodologies used by organisations.
2	Be able to use project management software to plan a games technology project.	2.1	Produce a project specification for a games technology project in line with requirements.
		2.2	Use a project management software to plan a games technology project.
3	Be able to use project management software to monitor and review a games technology project.	3.1	Use project management software to monitor a project plan and track progress against the plan.
		3.2	Carry out a post-review to determine project outcomes.

Indicative Content: Project Management (Games Technologies)

Learning Outcome 1:

Example games technology projects could include:

- Gaming app
- Cross-platform online game
- Augmented Reality (AR) project

Project life cycle:
Conception and start up: project mandate, client requirements, and feasibility.
Definition of the project: set up project team, create the Project Initiation Document (PID).
Planning: timescales, costs, quality management, risk management and controls.
Launch and execution: carrying out the plan, monitoring activity, checking progress.
Closure: handover of the product, user acceptance testing, disbanding project team.
Post-project evaluation: reviewing the project against success criteria.

Concepts include the key factors, processes and stages that make up a project, such as:
Costs and timescales: project budget, setting milestones and deadlines, interim reviews.
Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project.

Quality and deliverables:
Application of current quality standards, for example: ISO/IEC 25010:2011 as a benchmark for software development, World Wide Web Consortium for website design and functionality standards.
Defining success criteria and using SMART objectives to define project outcomes.
Customer requirements in terms of functional requirements and non-functional requirements.
Product description or product breakdown structure, to describe the product to be delivered.

Issues: effects of changing external factors, monitoring progress, taking corrective actions where necessary, communications, working within relevant guidelines (internal and external) and legislation, dealing with conflict, impact of project outputs on other systems e.g. staff, organisational structures.

Benefits: saving money, maintaining or increasing profits, improving services, growing the business, increasing market share, improving productivity, expected return on investment, justification for the project, forecasting project success.

Risks: identifying typical project risks (internal/external risks), risk management cycle, identification of risks, assessing the severity of risks, accept the risk, plan contingency or avoid the risk, monitor and control the risks through the project, handling issues when a risk occurs.

Project management methodologies:
PRINCE2 – suitable for most projects.
Rapid Application Development (RAD) – suitable for short-term, large scale, big budget projects.
Waterfall – suitable for websites, database or network projects.
Agile – suitable for medium/long term projects where user requirements frequently change and outputs are required at regular intervals.

Learning Outcome 2:

Indicative Content: Project Management (Games Technologies)
The project must be sufficiently complex to allow planning and management to take place. It must also allow learners the opportunity to manage some resources, and the time allocated for completion. Interpreting the business case (the business case as a driver of the project): reasons for the project, options that should be considered, expected business benefits, timescale, including major milestones, budget available, risks. Project specification: identification of stakeholders, business case requirements, specific objectives or deliverables, benefits and success factors, project boundaries or scope, constraints, consideration of options, other, e.g. ethical issues, sustainable issues, understanding consequences of failure to hit deadlines or produce product, risks and risk mitigation. Project plan: purpose, content, e.g. identification of phases and activities, potential for parallel or sequential processes, resources needed for each activity, timescales, review points, e.g. milestones, checkpoints, deadlines. Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project, use of other appropriate and available software and applications, e.g. spreadsheets, graphics, databases etc.
Learning Outcome 3: Monitor: routine communications with stakeholders, interim reviews, use of logbooks, routine updating of plan where necessary, others e.g. accessing additional resources where necessary, reacting to unforeseen circumstances. Tracking progress: project baseline and variance, monitoring and recording progress, checkpoint reports as a way of recording milestones achieved, monitoring risk and managing issues, recording quality management activity. Review of project success in terms of key factors, SMART objectives and views of stakeholders: review of lessons learned, review project performance against the baseline and project objectives, review of final cost, delivery date and quality of product delivered, review feedback from key stakeholders (clients, end users). Methods to obtain feedback: interviews, questionnaires, surveys, observation of resulting processes. Recommendations for future actions based on the outcome of the post-project review, communication and presenting requirements for reviews.

Specialist Units

3D Game Models

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	J/618/5195
Unit Aim:	Learners will develop skills in 3D modelling and be able to use modelling software to create 3D characters and vehicles for a game.

This unit has 2 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Be able to create 3D character models for a game.	1.1 Use 3D modelling tools to create a bipedal character and show the stages of development. 1.2 Apply colours and texture maps to the bipedal character model. 1.3 Use 3D modelling tools to create a quadruped character and show the stages of development. 1.4 Apply colours and texture maps to the quadruped character model. 1.5 Produce an output of the bipedal and quadruped character models in a suitable format.
2 Be able to create a 3D vehicle model for a game.	2.1 Use 3D modelling tools to create a vehicle and show the stages of development. 2.2 Apply colours and texture maps to the vehicle model and show the stages of development. 2.3 Produce an output of the vehicle model in a suitable format.

Indicative Content: 3D Game Models

Learning Outcome 1:

Stimulus for 3D bipedal, quadruped and vehicle model: client brief, own brief, from market research.

Ideas: brainstorming, sketches, pre-visualisation (concept drawings, storyboards, level diagrams, 2D and 3D drawings)

Legal and ethical considerations: legal, copyright, ethical, confidentiality, decency, representation, race, gender, religion, sexuality.

Specification: target audience, key visual themes, storyboards, constraints, polygon count, image resolution, output size, file type, file size.

Software interface: files, loading, properties, merging, replacing, importing, saving, viewports, configuring viewports, viewport controls, command panels, keyboard shortcuts, floating palettes, customising the interface, floating toolbars, drawing units, drawing aids (layers, grids, snap), object naming conventions.

Geometric models and text: models, box, tube, plane, sphere, disc, cone, cylinder, pyramid, 3D text.

Mesh building and editing: vertices (adding, editing, deleting), polygons, planar, non-planar.

Modelling: layers, modify (move, rotate, stretch, deform), extend (bevel, extrude, lathe), combine (Boolean, Patch), duplicate (mirror, array, clone), organic modelling, sub-division surfaces, weight maps, level of detail, nurbs, relational modelling, curves, control vertices, UV coordinates, surfaces, extrudes, sweeps, skinning, trims, fillets, surface approximation.

Virtual camera: concepts, lens length, field of vision (FOV), focus and aperture, depth of field, cameras, creating a camera, creating a camera view, camera parameters, camera type, target, free, conversion from real world equivalents (especially in light of digital photography and use of smaller sensors).

Lighting: light types (ambient, distant, area, spot, point, linear, photometric, raytraced), lighting controls and effects, projector, attenuation, colour, shadows, atmospheric, e.g. clouds, smoke, fire, volumetric, fog, mist.

Texturing: creating textures, loading, applying textures to objects, material editor, mapping materials, material modifiers, material types, bitmap, procedural.

Rendering: scene rendering, rendering controls, rendering options, output size and aspect ratio, safeframe, file type, file size, image resolution, image formats, compression.

Learning Outcome 2:

Stimulus for 3D bipedal, quadruped and vehicle model: client brief, own brief, from market research.

Ideas: brainstorming, sketches, pre-visualisation (concept drawings, storyboards, level diagrams, 2D and 3D drawings)

Indicative Content: 3D Game Models

Legal and ethical considerations: legal, copyright, ethical, confidentiality, decency, representation, race, gender, religion, sexuality.

Specification: target audience, key visual themes, storyboards, constraints, polygon count, image resolution, output size, file type, file size.

Software interface: files, loading, properties, merging, replacing, importing, saving, viewports, configuring viewports, viewport controls, command panels, keyboard shortcuts, floating palettes, customising the interface, floating toolbars, drawing units, drawing aids (layers, grids, snap), object naming conventions.

Geometric models and text: models, box, tube, plane, sphere, disc, cone, cylinder, pyramid, 3D text.

Mesh building and editing: vertices (adding, editing, deleting), polygons, planar, non-planar.

Modelling: layers, modify (move, rotate, stretch, deform), extend (bevel, extrude, lathe), combine (Boolean, Patch), duplicate (mirror, array, clone), organic modelling, sub-division surfaces, weight maps, level of detail, nurbs, relational modelling, curves, control vertices, UV coordinates, surfaces, extrudes, sweeps, skinning, trims, fillets, surface approximation.

Virtual camera: concepts, lens length, field of vision (FOV), focus and aperture, depth of field, cameras, creating a camera, creating a camera view, camera parameters, camera type, target, free, conversion from real world equivalents (especially in light of digital photography and use of smaller sensors).

Lighting: light types (ambient, distant, area, spot, point, linear, photometric, raytraced), lighting controls and effects, projector, attenuation, colour, shadows, atmospheric, e.g. clouds, smoke, fire, volumetric, fog, mist.

Texturing: creating textures, loading, applying textures to objects, material editor, mapping materials, material modifiers, material types, bitmap, procedural.

Rendering: scene rendering, rendering controls, rendering options, output size and aspect ratio, safeframe, file type, file size, image resolution, image formats, compression.

Concept Art and Digital: Graphics for Games

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	L/618/5196
Unit Aim:	Learners will develop practical skills in drawing game concept art. They will understand how concept art is used within games and will use a variety of drawing media to develop skills in observational drawing. Learners will also develop skills in using digital graphics software to be able to convert and digitise concept art for use in games.

This unit has 4 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the types of digital graphics file formats used in games.	1.1 Explain bitmap and vector graphics and their use within computer games. 1.2 Explain a range of graphics file formats and their different characteristics. 1.3 Explain the impact of file formats, compression techniques, image resolution and colour depth on file size and image quality.
2 Be able to draw concept art for games.	2.1 Research ideas in response to client brief. 2.2 Draw preliminary designs using appropriate drawing techniques and styles. 2.3 Apply shading and colour to preliminary designs.
3 Be able to digitise concept art into game graphics.	3.1 Create digitised versions of concept art using appropriate technologies. 3.2 Apply industry tools and techniques to develop digital variance for both bitmap and vector concept art. 3.3 Export final digital graphics using appropriate technologies.
4 Be able to evaluate and refine digital game graphics.	4.1 Present digital game graphics to client and peers. 4.2 Refine digital game graphics in response to feedback. 4.3 Explain the legal implications of using, creating and editing digital graphics for games.

Indicative Content: Concept Art and Digital Graphics for Games
Learning Outcome 1: Pixel: picture element, image resolution, intensity. Raster images: compression (lossy, lossless), file extensions (bmp, png, gif, tiff, jpg psd). Vector images: points, lines, curves, polygons, file extensions (e.g. eps, ai). Bit depth: sampling, bits per pixel (BPP), monochrome, 256, highcolour, truecolour. Colour space: greyscale, RGB (red, green, blue), YUV (luminance and chrominance), HSV (hue, saturation, value). Image capture: scanners, digital cameras, resolution (pixels per inch), storage (memory, file size, asset management). Optimising: target destination, bit depth, resolution, dimensions, intended image output.
Learning Outcome 2: Stimulus: client brief, own brief, from market research. Ideas: brainstorming, moodboards, thumbnail sketching Legal and ethical considerations: copyright, ethical issues, e.g. confidentiality, representation (race, gender, religion, sexuality), decency, libel, intellectual property. Graphics specification: client brief, audience, thumbnail sketching, visual style, e.g. colour, style, composition, typography, technical considerations, e.g. file format, file size, optimisation, intended output. Constraints: client brief, target audience, legal issues e.g. original intellectual property (IP), franchised IP, ethical issues e.g. decency, representation e.g. race, gender, religion, sexuality. Sources of ideas: e.g. direct observation, narrative, photographic, cinematic, explorative research. Drawing styles: direct observation, stylised form e.g. cartoon, manga. Anatomy concept art: anatomy e.g. characters, creatures, development study drawings, final piece. Environment concept art: environment e.g. plants, buildings, terrain, development study drawings, final piece. Object concept art: objects, machines, vehicles, weapons, development study drawings, final piece.
Learning Outcome 3: Image capture: scanner, digital camera.

Indicative Content: Concept Art and Digital Graphics for Games
Workflow: e.g. slicing images, optimising (bit depth, resolution, dimensions) Menus: open, save, new, import, export, edit, view, help Image settings: size, resolution, width, height, colour mode, background, transparency, aspect ratio, file name. Drawing tools: tool options, brush, pencil, duplicate, clone, fill, text, line, stroke, shape, zoom, guides and rulers, grid, snap, palettes, e.g. colour, gradients, layers, object, brushes, history, actions, size, resolution, layers, e.g. copying, saving, arranging, flattening, colour selection, e.g. foreground, background, colour swatch, eyedropper. Editing tools: selection, e.g. marquee, lasso, magic wand, magnetic lasso, deselect, transform, e.g. scale, rotate, skew, flip, cut, copy, paste, crop, trim, erase, undo, fill. Advanced tools: effects, e.g. layer effects, filters, channels, image adjustments, e.g. brightness and contrast, hue and saturation, colour balance, gradients, transparency, invert, masks, paths, e.g. vector paths, converting text to paths, image slicing
Learning Outcome 4: Present: to suit purpose, layout e.g. symmetry, format. Annotation to drawings: purpose, idea sources, reflective comment (compared with original intentions, fitness for purpose, aesthetic qualities). Poster montage: development studies, final piece, annotations. Legal and ethical considerations: copyright, ethical issues, e.g. confidentiality, representation (race, gender, religion, sexuality), decency, libel, intellectual property rights.

Games Engines

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	D/618/5199
Unit Aim:	Learners will develop an understanding of games engines and how they are used as a tool to produce games. They will investigate different game engines and explore their purpose and main components. Leaners will also learn how to use a 2D and 3D games engine to design and produce game worlds.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the types and purpose of game engines and their use in the games industry.	1.1 Compare different types of game engines. 1.2 Explain the purposes and functions of game engines. 1.3 Analyse the use of different types of games engines.
2 Be able to create a prototype game level using a 2D game engine.	2.1 Design a prototype for a 2D game level. 2.2 Source and create assets. 2.3 Create a 2D game prototype.
3 Be able to create a prototype game level using a 3D game engine.	3.1 Design a prototype for a 3D game level. 3.2 Source and create assets. 3.3 Create a 3D game prototype.

Indicative Content: Games Engines
Learning Outcome 1: Types of game engine: 2D engines, 3D engines, mobile engines, game mods, off-the-shelf and bespoke games engines, uses of games engines in large games companies vs. indie games companies. Purpose: graphic rendering, collision detection, artificial intelligence (AI), sound, physics. Functions: Graphic rendering: culling methods (binary space partitioning (BSP), portal based, backface, view frustum, occlusion, contribution), rendering techniques (radiosity, ray tracing), lighting, textures, fogging, shadowing, depth testing, anti-aliasing, vertex and pixel shaders, level of detail. Animation systems: path-based, inverse kinematics, forward kinematics, particle systems. Systems: physics, effects, sound, networking. Artificial intelligence: AI agents (bots, non-player characters), world navigation (pathfinding, obstacle avoidance), behaviours, neural nets and fuzzy logic. Middleware: off-the-shelf components e.g. rendering, physics, AI, animation, modelling, texturing, sound.
Learning Outcome 2: Design: interpreting creative brief, storyboarding, asset management, level design maps, platforms, genre, interaction mode, hardware, market trends, constraints legal and ethical, design goals, use of audio visual, game mechanics/mechanisms, game play mechanisms, narrative considerations, premise, back story, plot, characters. Assets: graphical (textures, meshes, models), events (triggers, actions, objects, scripts), sound e.g. effects, music, ambience, dialogue, file types. Production: assets, events, lighting, animation, game world, testing (alpha, beta, user testing). Prototype: core mechanics, game mechanisms, game play dynamics, game play aesthetics. Publishing: output, executable.

Mobile Games Development

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	Y/618/5203
Unit Aim:	Learners will understand mobile games and the technologies, platforms and interfaces used to develop them. Learners will also develop the skills to design, develop and test a 2D mobile game using industry standard techniques.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand mobile technologies, platforms and interfaces.	1.1 Explain the characteristics of mobile games and mobile devices. 1.2 Compare the different types of hardware and software used in mobile games development. 1.3 Explain how current and emerging mobile technologies impact on the development of mobile games.
2 Be able to design a 2D mobile game using industry standard techniques.	2.1 Produce design documentation for a 2D mobile game. 2.2 Review the designs with others to identify and inform refinements.
3 Be able to develop and test a 2D mobile game using industry standard techniques.	3.1 Develop a 2D mobile game. 3.2 Select and use appropriate data types and show how they are declared. 3.3 Select and use appropriate selection and iteration methods. 3.4 Test and refine a 2D mobile game to ensure effective gameplay.

Indicative Content: Mobile Games Development
Learning Outcome 1: Characteristics: native gaming apps (those that are programmed for, and installed on, a specific mobile platform), web gaming apps (remote apps not required to be installed on the device) hybrid gaming apps (cross-platform compatible scripting that can be installed on a device). Mobile devices: tablets, smartphones, user interface, e.g. small screen, touch screen, operating system (Android, iOS), device capabilities, such as connectivity, screen size, memory storage or programming language.
Learning Outcome 2: Gaming app design: description game and gameplay, target platform(s), screen layouts and navigation, algorithms, e.g. pseudocode, activity diagrams, control structures, data validation, integration of device capabilities, i.e. how, when and where device capabilities will be utilised, details of resources and assets to be used: predefined code, video, graphical, audio (e.g. sprites, sounds, images, movies, animations and buttons that will be integrated into mobile game). Test schedule: testing the inputs and expected outputs, constraints, limitation of platform, legal and ethical considerations e.g. privacy, security, use of content created by others.
Learning Outcome 3: Preparing content: gather pre-defined programs, snippets and/or subroutines, and readymade and original assets, edit (using appropriate editing software) and optimise assets for a mobile platform (e.g. sacrificing quality for smaller file size), use file formats that are appropriate for the intended platform. Develop and refine: game development environment, integrate ready-made assets, code snippets etc. Annotate code to allow effective repair/debugging of the mobile game. Test plans and test data: is mobile game fit for purpose? review the quality of the mobile game in terms of efficiency/performance, maintainability, portability and usability, gather feedback from others, document any changes to the design, including changes to the source table for pre-defined programs/snippets and ready-made assets. Lessons learned: evaluate the effectiveness of the mobile game with reference to: The extent to which the solution met the identified requirements Issues arising during testing and refinement How the mobile game could be improved to better meet the needs of the user and fulfil the identified client requirements. Alternative solutions that could be implemented if the task were to be repeated.

The Games Industry

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	H/618/5205
Unit Aim:	Learners will develop an understanding of the games industry and how it operates. They will explore different organisations, job roles, technologies and trends and learn about contractual, legal and ethical obligations in the games industry.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the games industry.	1.1 Describe different organisational structures and job roles in the games industry. 1.2 Compare the main styles of games developed in the games industry. 1.3 Compare genres, visual styles and audiences for different games.
2 Understand the role of emerging technologies in gaming.	2.1 Analyse the role of Virtual Reality and Augmented Reality technologies in gaming. 2.2 Analyse trends that are likely to define the future of gaming.
3 Understand regulation within the games industry.	3.1 Describe contractual, legal and ethical obligations in the games industry. 3.2 Explain the importance of intellectual properties and gaming franchises in games development.

Indicative Content: The Games Industry
Learning Outcome 1: Organisational structure: type of company (indie, AAA), development studios, publishing houses, independent studios; departments (design, production, programming, quality assurance (QA), marketing, distribution, legal). Job roles: 3D modeller, animator, artist, audio engineer, designer, scriptwriter, level designer, localisation technician, producer, programmer, quality assurance tester. Levels of responsibility: team member, lead, producer, management, working patterns (office hours, irregular hours, hot-seating, freelance, fixed-term contract, staff). Indie vs AAA games: cheaper, shorter, smaller, stylised art designs, developed by individuals or small teams, limited finances (crowd funding or personal investment). Genre: action, adventure, role-play, simulation, strategy etc. Visual style: game appearance, four types (cell shaded, photorealistic, exaggerated and abstract). Audiences: segmented by genre, platform and type of gameplay, types of players (achievers, explorers, socialiser, killers).
Learning Outcome 2: AR/VR: creates an immersive experience for users, personal interaction with digital environment. Gaming trends: gaming demo graphics, consoles ownership, mobile gaming, cloud gaming, game streaming, remastering games/remakes, cross-play options, increasing inclusivity, gaming-as-a-service.
Learning Outcome 3: Contractual: types of contract; format holders (licensors, naming conventions, look and feel); negotiating contracts; commissioning processes; costing; scheduling; time management; risk management; subcontracting; outsourcing; working to a brief. Legal: regulatory requirements; compliance; copyright; trademarks; intellectual property rights; Pan European Game Information (PEGI); British Board of Film Classification (BBFC); implications of franchising; licensors; health and safety policy. Ethical: policies and procedures; ethical requirements; emerging social concerns and expectations Professional bodies: The Entertainment and Leisure Software Publishers' Association (ELSPA); The Independent Games Developers Association (IGDA); Women in Games; British Academy of Film and Television Arts (BAFTA); The Mobile Entertainment Forum (MEF).

Virtual and Augmented Reality

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	T/618/5208
Unit Aim:	Learners will learn about virtual and augmented reality and how they are used in industry. They will research both technologies and design a virtual or augmented reality prototype.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the use of virtual (VR) and augmented reality (AR).	1.1 Explain the role of VR and AR technology. 1.2 Evaluate future uses of VR and AR technology and its current and potential impact on society.
2 Understand the features, functions and components of VR and AR.	2.1 Explain the hardware components required for VR and AR. 2.2 Describe the software used for the development of VR and AR. 2.3 Analyse the technological functions of VR and AR.
3 Be able to design, develop and evaluate a VR or AR prototype.	3.1 Design a VR or AR prototype. 3.2 Develop a VR or AR prototype and show the stages of development. 3.3 Test, refine and evaluate a VR or AR prototype.

Indicative Content: Virtual and Augmented Reality
Learning Outcome 1: Areas of use: entertainment, leisure and the media (tourism, games, museums), architecture, business (marketing, service and planned maintenance), education (e.g. textbooks, skills development, remote collaboration), health care and surgery (training, simulations), military (training, simulations), sport (live streaming of scores and other statistics, sponsorship images). Potential impacts: visualisation of designs, simulations, training, demonstrations of concepts, virtual tours. Future uses: possible developments of virtual and augmented reality and how these may impact on society (e.g. gaming, advances in treating injuries or disease, leisure activities, the environment, the home and education).
Learning Outcome 2: Technologies: hardware, processor, display (e.g. handheld device, head mounted display, eyeglasses, head up display), sound (e.g. speakers, headphones), sensors (e.g. optical, accelerometer, GPS, compass, RFID), input devices (e.g. camera, microphone). Software, range of products available, features of the software, image registration, Augmented Reality Mark-up Language.
Learning Outcome 3: Design: aims of the product (e.g. intended outcome, success criteria, information to be delivered, where the product is to be used), financial plan, quality plan, target audience (e.g. age, gender, income), nature of the product (e.g. single user product, multiuser product), content including resource plan, design tools (e.g. storyboarding, mind mapping, mood boards), trigger image(s) and the stage(s) that follow on from the trigger being accessed, hardware and software requirements. Develop: create the trigger point of interest, create the layer(s)/overlay(s). Testing: create a test plan, testing during development, end user testing, review against original success criteria. Evaluation: identified suitable success criteria, has the project deviated from the original scope, deviated from the budget as defined in the financial plan, has the project delivered business benefits identified in the business case, achieved the objectives in the terms of reference, deviated from forecast resource levels as per the resource plan, conformed to the management process as per the execution phase, identify potential improvements.

Gateway Qualifications Level 3 Certificate and Diploma in Networking and Cybersecurity

Mandatory Unit

Project Management (Networking and Cyber Security)

Unit Number:	T/650/5009
Level:	Level 3
Credit Value:	6
GLH:	43
Unit Aim:	Learners will understand project management concepts and the processes and tools used by organisations to manage networking and cybersecurity projects. They will learn about project management methodologies and use project management software to plan a networking and cybersecurity project, track progress, and review outcomes to determine project success.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:		ASSESSMENT CRITERIA The learner can:
1	Understand the principles of project management and the methodologies used by organisations to manage networking and cybersecurity projects.	1.1 Explain the stages of the project lifecycle and how they apply to networking and cybersecurity projects. 1.2 Describe key concepts, issues and risks when managing networking and cybersecurity projects. 1.3 Compare the characteristics of different project management methodologies used by organisations.
2	Be able to use project management software to plan networking and cybersecurity project.	2.1 Produce a project specification for a networking and cybersecurity project in line with requirements. 2.2 Use project management software to plan a networking and cybersecurity project.
3	Be able to use project management software to monitor and review a networking and cybersecurity project.	3.1 Use project management software to monitor a project plan and track progress against the plan. 3.2 Carry out a post-project review to determine project outcomes.

Indicative Content: Project Management (Networking and Cybersecurity)

Learning Outcome 1:

Example networking and cybersecurity projects could include:

- The design and implementation of a LAN/MAN/WAN
- A cloud-based storage solution for an SME
- Security solutions, including protection against malware attacks, phishing, spam, ransomware.
- Packet sniffing project
- Key logger/ surveillance software
- Caesar cipher app decoder

Project life cycle:
Conception and start up: project mandate, client requirements, and feasibility.
Definition of the project: set up project team, create the Project Initiation Document (PID).
Planning: timescales, costs, quality management, risk management and controls.
Launch and execution: carrying out the plan, monitoring activity, checking progress.
Closure: handover of the product, user acceptance testing, disbanding project team.
Post-project evaluation: reviewing the project against success criteria.

Concepts include the key factors, processes and stages that make up a project, such as:
Costs and timescales: project budget, setting milestones and deadlines, interim reviews.
Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project.

Quality and deliverables:
Application of current quality standards, for example: ISO/IEC 25010:2011 as a benchmark for software development, World Wide Web Consortium for website design and functionality standards.
Defining success criteria and using SMART objectives to define project outcomes.
Customer requirements in terms of functional requirements and non-functional requirements.
Product description or product breakdown structure, to describe the product to be delivered.

Issues: effects of changing external factors, monitoring progress, taking corrective actions where necessary, communications, working within relevant guidelines (internal and external) and legislation, dealing with conflict, impact of project outputs on other systems, e.g. staff, organisational structures.

Benefits: saving money, maintaining or increasing profits, improving services, growing the business, increasing market share, improving productivity, expected return on investment, justification for the project, forecasting project success.

Risks: identifying typical project risks (internal/external risks), risk management cycle, identification of risks, assessing the severity of risks, accept the risk, plan contingency or avoid the risk, monitor and control the risks through the project, handling issues when a risk occurs.

Project management methodologies:
PRINCE2 – suitable for most projects.
Rapid Application Development (RAD) – suitable for short-term, large scale, big budget projects.
Waterfall – suitable for websites, database or network projects.

Indicative Content: Project Management (Networking and Cybersecurity)
Agile – suitable for medium/long term projects where user requirements frequently change and outputs are required at regular intervals.
Learning Outcome 2: The project must be sufficiently complex to allow planning and management to take place. It must also allow learners the opportunity to manage some resources, and the time allocated for completion. Interpreting the business case (the business case as a driver of the project): reasons for the project, options that should be considered, expected business benefits, timescale, including major milestones, budget available, risks. Project specification: identification of stakeholders, business case requirements, specific objectives or deliverables, benefits and success factors, project boundaries or scope, constraints, consideration of options, other, e.g. ethical issues, sustainable issues, understanding consequences of failure to hit deadlines or produce product, risks and risk mitigation. Project plan: purpose, content, e.g. identification of phases and activities, potential for parallel or sequential processes, resources needed for each activity, timescales, review points, e.g. milestones, checkpoints, deadlines. Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project, use of other appropriate and available software and applications, e.g. spreadsheets, graphics, databases etc.
Learning Outcome 3: Monitor: routine communications with stakeholders, interim reviews, use of logbooks, routine updating of plan where necessary, others, e.g. accessing additional resources where necessary, reacting to unforeseen circumstances. Tracking progress: project baseline and variance, monitoring and recording progress, checkpoint reports as a way of recording milestones achieved, monitoring risk and managing issues, recording quality management activity. Review of project success in terms of key factors, SMART objectives and views of stakeholders: review of lessons learned, review project performance against the baseline and project objectives, review of final cost, delivery date and quality of product delivered, review feedback from key stakeholders (clients, end users). Methods to obtain feedback: interviews, questionnaires, surveys, observation of resulting processes. Recommendations for future actions based on the outcome of the post-project review, communication and presenting requirements for reviews.

Specialist Units

Access Control

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	M/618/5210
Unit Aim:	Learners will understand the purpose and methods of controlling access to systems. They will learn about the concepts of identity, authentication and authorisation, and explore how they are used to manage access control in organisations.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the purpose and concepts of access control.	1.1 Explain the role of access control in organisations and the primary categories used to define access to data. 1.2 Explain the different types of access control from a physical, logical and administrative perspective. 1.3 Evaluate different access control techniques used in organisations. 1.4 Compare different methods of identity management and authentication.
2 Be able to apply methods of controlling access.	2.1 Implement authentication to increase effectiveness and usability. 2.2 Define a series of password policies and configure password authentication for multiple user IDs.
3 Understand the limits of access control.	3.1 Explain the balance between restricting and enabling access for legitimate users. 3.2 Assess the organisational and behavioural threats to and vulnerabilities of access control.

Indicative Content: Access Control

Learning Outcome 1:

Purpose of access control, for example: confidentiality, integrity and availability, limiting access to systems (physical and logical aspects), limiting access to data, providing 'defence in depth', identifying and classifying data assets.

Primary categories of access control, for example: directive (codes of conduct, security policies and procedures), deterrent (disciplinary procedures, monitoring, reporting), preventative (physically restricting access), compensating (additional guards during periods of heightened threat), detective (intrusion detection systems), corrective (software patches, firewall reconfiguration), recovery (updating of security policies to reflect changes in business).

Types of access control, for example:
Physical: perimeter fences, gates/doorways, security guards/patrols, badge locks/key locks, biometric scanners (retina, palm, finger print scanner).
Logical: firewalls, anti-virus, encryption, user IDs and passwords, passphrases, security tokens, one-time passwords, Remote Access Server (RADIUS).

Administrative: policies and procedures, security clearances, identity validation, staff training, support/helpdesk.

Access control techniques, for example: discretionary controls (DAC), delegated control to the user level (Windows, Unix, Linux), user/group centric, permissions (read/write/execute), Access Control Lists (ACLs).

Mandatory controls (MAC), organisation centric (classification levels and clearances), security labelling for data objects (classification and categories), specially developed operating systems (SELinux).

Non-Discretionary Controls, organisation centric, administrator assigns permissions, role based.

Identity management and authentication methods, for example: ID badges, user Ids, PINs, account numbers, digital certificates, RFID.

Authentication factors: something you know (passwords, passphrases, challenge-response), something you have (Smartcard, fobs and time code devices), something you are (biometrics), somewhere you are (proximity to a scanner, inside a firewall).

Concept of a 'credential set' as being the combination of a form of identification and a form of authorisation.

Learning Outcome 2:

Implementing authentication to increase the effectiveness and usability, for example: accessibility for authentication, CAPTCHA audio, SweetCaptcha, ReCaptcha.
Password management and policies: complexity (length and non-alpha characters), avoidance of dictionary words, ageing/expiration policy, re-use policy, maximum retry policy, retry delay, single-sign on, password management applications.

Multi-factor authentication: one-time passwords, mobile phone time codes, question/response.

Indicative Content: Access Control
Define and document an authentication policy covering a range of methods: configure password policies for user IDs, test the password policies, specify access permissions for a range of files to enable read/write, read only, read/execute, no access, test user ID authorisation to access the files.
Learning Outcome 3: Limits of access control, for example: dichotomy of organisational needs (government vs business), top-down organisational centric vs bottom-up user centric, cost effectiveness (cost of control vs value of the assets), violation of MAC principles (trusted computing base), lack of effective control in DAC based systems, complexity of administration, biometric accuracy (False Reject Rate, False Accept Rate). Threats and vulnerabilities to access control: Internal threats: organisational culture (complacency, lack of effective control), organisational climate, disgruntled employees, industrial espionage, misplaced trust. Internal vulnerabilities: poor or absent security policies/procedures, lack of adherence to security policy, lack of education and training, lack of adherence to security procedures (poor administration, deliberate avoidance), poor or inadequate vetting of employees and contractors. External threats: tailgating/piggybacking, social engineering (phishing, baiting/Quid Pro Quo), identity theft, shoulder surfing, spoofing.

Data Communications

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	T/618/5211
Unit Aim:	This unit explores data communication, transmission methods and protocols that enable connectivity and transmission of data, including signal theory. Learners will learn why particular transmission methods are chosen for particular situations and be able to compare the effectiveness of these different methods. Learners will also be able to apply knowledge and understanding by connecting communication devices between users.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the principles of data communications.	1.1 Explain the use and features of different types of communication devices. 1.2 Explain how networks communicate. 1.3 Explain how different communication protocols are used to govern and control data transmission.
2 Understand the features of data communications systems.	2.1 Describe the main elements of data communication systems. 2.2 Explain the principles of signal theory. 2.3 Compare the effectiveness of different transmission methods.
3 Be able to implement different forms of network communications.	3.1 Create direct network communication between two users. 3.2 Set up interconnection devices for direct communication.

Indicative Content: Data Communications
Learning Outcome 1: Communication devices: wired devices e.g. data terminal equipment (DTE), data circuit-terminating equipment (DCE), wireless devices, GPRS, mobile phones, laptops, netbooks, tablets. Computer networks: types e.g. LAN, WAN, wireless, network topologies e.g. star, mesh, bus, tree (or hierarchical), ring, network services e.g. packet switched, ISDN, multiplexed, ATM, WAP, broadband, network software e.g. network operating system, network connection software, access methods e.g. CSMA/CD, CSMA/CA, token passing. Network components: servers, workstation, network cards e.g. Ethernet, wireless, token ring Interconnection devices: e.g. switches, routers, bridges, wireless access points, mobile base stations Models: e.g. open system interconnection (OSI) model, TCP/IP model Protocols: e.g. Bluetooth, Wi-Fi, IrDa, cellular radio, GSM/UMTS, WAP, WML, 802.11 standards, TCP/IP, wireless security protocols.
Learning Outcome 2: Elements: communication devices, data elements, electronic communication methods, transmission media and methods. Signal theory: digital signalling methods, representing data electronically (bits, bytes, packet structures), synchronous transmission, asynchronous transmission, error detection, error correction, bandwidth limitation, bandwidth noise, channel types e.g. telephone, high frequency (HF) radio, microwave, satellite, other issues e.g. bandwidth, data compression. Data elements: checksum e.g. cyclic redundancy check (CRC), encapsulation e.g. frames, packets, datagrams, addresses, sequence numbers. Electronic communication: methods e.g. simplex, duplex, half-duplex communication, parallel, universal serial bus, serial, infra-red, Bluetooth, WiFi, 3G, 4G, 5G etc. Transmission: methods e.g. coaxial, optical fibre, unshielded twisted pair (UTP), shielded twisted pair (STP), infrared, radio, microwave, satellite.
Learning Outcome 3: Internet communication: terminology e.g. HTTP, HTTPS, FTP, SMTP, uniform resource locator, worldwide web, other e.g. blogs, wikis, video conferencing, vlogs, social networking. System requirements: wired or mobile systems, communication services e.g. email, video, internet, software, configuration. Direct communication: e.g. instant messaging, video communication, email, web phone, social networking, web conferencing, desktop sharing. Interconnection devices: e.g. switches, routers, bridges, wireless access points, mobile base stations

Ethical Hacking

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	F/618/5213
Unit Aim:	Learners will understand the role of ethical hacking in testing the security of networks, using techniques such as penetration testing and social engineering. Learners will also explore some of the tools and techniques used to identity vulnerabilities and the countermeasures that can minimise cyber-attacks.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the role of ethical hacking.	1.1 Explain the role of ethical hacking and the activities that an ethical hacker can perform for an organisation. 1.2 Explain the processes used to vet ethical hackers for employment.
2 Understand a range of ethical hacking tools and techniques.	2.1 Compare different ethical hacking tools and techniques used to identify weaknesses in a system from a physical, logical and social perspective.
3 Be able to plan, execute and report on the process of ethical hacking.	3.1 Develop an ethical hacking plan to identify and test weaknesses. 3.2 Execute a series of ethical hacking attacks based upon the plan. 3.3 Report on the results of the attacks.

Indicative Content: Ethical Hacking
Learning Outcome 1: Role of ethical hacking: identification of vulnerabilities networks and systems, testing system and data security using penetration testing (PT), evasion of intrusion detection systems (IDS), evasion of intrusion prevention systems (IPS), evasion of Honeypots, social engineering, breaking encryption, valuating/reporting. Vetting process: interviews, references, background checks (e.g., qualifications, employment, residence), professional memberships/code of conduct, professional qualification (e.g., Certified Ethical Hacker, CREST, SANS, CLAS) , security vetting code of practice, government vetting, baseline Personnel Security Standard (BPSS), security clearance , counter terrorism check, Disbarring and Vetting Service (formerly CRB Check).
Learning Outcome 2: Tools (hardware and software) and techniques: Physical: (i.e. environment, building, IT infrastructure): public records, satellite images, cameras, binoculars, specialised hardware (e.g., Pwn Phone, Plugbot), wireless sniffers (War Driving), VOIP (War Dialing), Bluetooth scanners , dumpster diving, RF scanners, drones. Logical: (i.e., operating system, software and configuration): port Scanners (NMAP, Angry IP Scanner, NetScanTools), Sniffers (Snort), password crackers (Cain & Abel, THC Hydra, John the Ripper) , vulnerability scanners (Nessus, Nikto), wireless networks (Kismet, KisMac, NetStumbler), website (BurpSuite), generalist (Metasploit, Wapiti), forensic analysis. Social: identify theft/spoofing (Piggybacking), shoulder surfing, pretexting, baiting, human intelligence gathering, deception.
Learning Outcome 3: Ethical hacking plan: identify the system(s) to be tested, risks involved, timeline, knowledge of the system(s), action to be taken, deliverables (e.g., written / oral report), the plan should include physical, logical and human exploits. Execute the plan and evaluate results: reconnaissance, scanning, gaining access, maintaining access, covering tracks. The NIST 800-42 Method: planning, discovery, attack, report. OCTAVE Allegro: develop risk measurement criteria, profile critical information assets, identify threats for each information asset, identify risks for each threat relating to an information asset. INFOSEC PTES: pre-engagement interactions, intelligence gathering, threat modelling, vulnerability analysis, exploitation, post-exploitation, reporting. Learners should record the results of their attacks whether successful or not, and include any vulnerabilities they identify and successful exploitations they were able to perform (i.e. successful penetrations).

Network Management

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	Y/618/5217
Unit Aim:	Learners will understand network management functions and the tools and technologies required to manage networks. They will develop skills in interrogating a network to identity network assets and configure and carry out routine network management activities.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand network management tools and technologies.	1.1 Explain network technologies and tools. 1.2 Evaluate the impact of emerging network technologies.
2 Understand network management functions.	2.1 Explain the functions of network management. 2.2 Explain routine network performance management activities.
3 Be able to carry out network management activities.	3.1 Interrogate a network to identify the network assets and their configuration. 3.2 Carry out routine network management activities to meet requirements. 3.3 Keep accurate records of network management tasks. 3.4 Design a network security policy for a small organisation.

Indicative Content: Network Management
Learning Outcome 1: Network technologies: operating systems, protocols, layout, devices. Networking operating systems: examples e.g. Windows, Linux. Networking protocols: e.g. SNMPv3, ICMP. Layout: cabling, topologies, wireless. Network devices: servers, workstations, interconnection devices, network cards, vendor specific hardware. Networking tools: purpose e.g. fault management, performance management, specific examples of tools e.g. HP Openview, Cisco Works, Wireshark, using system software e.g. to find network assets. Emerging technologies: e.g. more automated networks, AI and machine learning (autonomous networks), optical networking, cognitive radio, 5G, Wi-Fi 6 (802.11ax), SD-WAN standard. Impact of emerging technologies: enhanced capabilities e.g. faster, greater storage capacity, improved control, new work methods e.g. mobile working, home working, web centric applications, ease of use.
Learning Outcome 2: Network management functions: configuration, fault management, account management, performance variables e.g. network throughput, user response times, line utilisation. Other activities: planning, designing, installing, network operations e.g. security, data logging, checking performance and traffic, reporting.
Learning Outcome 3: Regular maintenance activities: e.g. backup and restore files, user account creation and deletion, design and develop login scripts, virus scans, file cleanup. Tools: to manage performance or fault finding e.g. SNMP, HP Openview. Documentation: work logs, log resources used, system testing. Configuration options: user accounts location, choosing server and setting rights, drive mappings, virus scanning options. Security features: VPN access, firewall management, access control lists, device hardening, continuous policy review, forensic analysis, user rights. Security policies and procedures: periodically review user access and rights, penetration testing, security audits, review firewall and access control list policies.

Network Threats and Vulnerabilities

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	D/618/5218
Unit Aim:	Learners will learn about types and sources of network attacks and develop the skills and understanding needed to plan and protect a network. They will also learn how to configure devices and software to improve network security.

This unit has 4 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand network threats and vulnerabilities.	1.1 Explain types and sources of network attacks. 1.2 Explain the motives behind network attacks.
2 Understand network security practices.	2.1 Explain how hardware and software can be used to minimise network security threats.
3 Understand organisational aspects of network security.	3.1 Explain the range of actions an organisation should take to minimise network security threats. 3.2 Plan procedures to secure a network in line with organisational requirements.
4 Be able to apply network security.	4.1 Configure a device or software to improve network security.

Indicative Content: Network Threats and Vulnerabilities
Learning Outcome 1: Attacks: denial of service, back door, spoofing, mathematical, brute force, software exploitation, viruses, rootkits, worms, Trojans, spyware, adware. Sources of attacks: internal; external via internet connections or through unsecured wireless access point, viruses introduced by email.
Learning Outcome 2: Email systems: security features e.g. secure MIME, spam, hoaxing, relay agents. Wireless systems: security features e.g. site surveys, MAC association, WEP/WPA keys, TKIP Networked devices: security features e.g. router, switch, wireless access point. Transmission media: issues e.g. use of shielding. Personal access control: devices e.g. biometrics, passwords, usernames, permissions, digital signatures. Security control at device level: access control e.g. protocols, log in, certificates. Encryption: e.g. encrypting files for confidentiality, encryption with application-specific tools, recovering encrypted data Intrusion detection systems: devices e.g. firewalls, virus protection, spyware protection, file monitoring, folder monitoring, use of honeypots, alarms
Learning Outcome 3: Policies and procedures: monitoring; education and training; backup and recovery schemes; configuring and upgrading software; setting up file and folder permissions. User responsibilities: adherence to specific guidelines e.g. strength of password, installation of new software. Education and training: maintenance of skills; knowledge of exploits; application of updates and patches. Physical security of system: lock and key; logging of entry; secure room environments; authentication of individual. Risk assessment and reduction: potential risks; penetration testing; security audits.
Learning Outcome 4: Administration: procedures e.g. implementing password policy, locking down user accounts, securing administrator's permissions, protecting against viruses, restricting access to critical services, installing or updating security software. Algorithms: types (private/public key encryption), DES, 3DES, RSA, hashing. Transport: methods e.g. IPSEC, GRE, VPN. Application: e.g. certificates, trust memberships. Filtering: e.g. firewalls, access control lists. Test: test for functionality; test for performance e.g. does security measure slow down system functions.

Networking

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	H/618/5219
Unit Aim:	Learners will understand the key components of networks and will also learn about the protocols and the services provided by networks. They will explore the technologies and devices used in networking and be able to design and maintain a secure network.

This unit has 5 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand networks and their components.	1.1 Explain different types of networks. 1.2 Describe networking components and technologies. 1.3 Explain why different network standards and protocols are necessary.
2 Be able to apply numerical skills for network addressing.	2.1 Identify the characteristics of common (IP) addresses. 2.2 Apply binary conversion and arithmetic. 2.3 Apply subnetting to different IP addresses.
3 Understand network connectivity.	3.1 Explain the purpose and characteristics of different types of cable. 3.2 Explain the purpose and characteristics of wireless systems, antennas and devices. 3.3 Explain how test equipment for wired and wireless networks is used.
4 Understand how to configure and maintain a secure network.	4.1 Design a network to meet specified requirements. 4.2 Explain how to support and maintain network security.
5 Understand networking maintenance practices and processes.	5.1 Explain how different tools are used in network maintenance and performance monitoring. 5.2 Describe methods for managing local storage.

Indicative Content: Networking
Learning Outcome 1: Types of network: local area network (LAN), wide area network (WAN), internet, WAN technologies e.g. frame relay, MPLS, ATM, Personal Area Network (PAN), logical and physical topologies e.g. star, bus, ring, mesh, tree, network access methods e.g. CSMA, Token passing, network models e.g. OSI 7 layer, TCP/IP. Components: workstations, servers, domain controllers, firewalls, routers, switches, wireless access point, wireless routers, interconnection devices, connectors and cabling, software, commercial systems. Networking technologies: Active Directory (AD), Lightweight Directory Access Protocol (LDAP), Dynamic Host Configuration Protocol (DHCP), Domain Name System (DNS), Network address translation (NAT), Access control (rights and permissions). Common networking ports: HTTP (80), HTTPS (443), POP3 (110), FTP (21), IMAP (143), DHCP (67/68), SMTP (25), DNS (53). Network protocols and standards: types e.g. TCP/IP, AppleTalk, UDP, 802.2, 802.3, FDDI, 802.5, wireless technologies e.g. 802.11, infrared, Bluetooth, 3G, factors affecting range and speed of wireless technologies. Application layer protocols: types e.g. DNS, DHCP, HTTP, FTP, SMTP.
Learning Outcome 2: Characteristics of common (IP) addresses: IP version 4 addressing principles: dotted decimal format, classes (A-D), public and private addresses, address categories (default gateway, loopback address, broadcast address). IP version 6 address representation (full and abbreviated representations), format (prefix, subnet ID, interface ID). Apply binary conversion and arithmetic, binary to decimal, decimal to binary conversion (up to eight bits). Apply subnetting to different IP addresses: subnet masks, subnets (number of hosts, number of networks, starting and ending IP addresses).
Learning Outcome 3: Cable characteristics (transmission speed, segment length) and connectors, coaxial, F-type connector, twisted pair (shielded/unshielded), cat 1-6 cables, RJ 45 connector (straight-through cable, crossover cables, rollover cables), fibre optic (multi-mode, single mode), standards (10BaseT, 100BaseT, 1000BaseT). Characteristics of wireless systems, antennas and devices, directional, omnidirectional, multiple-input multiple-output (MIMO), point-to-point, point-to-multi point, wireless access points, routers and endpoint device, Bluetooth connectivity, standards (802.11 a, 802.11 b, 802.11 g, 802.11 n, 802.11 AC), speed, security, coverage. Test equipment used for wired and wireless networks: cable tester, loopback, continuity tester, tone probe, wire map tester, wireless locator/Wi-Fi analyser, wireless heat map,

Indicative Content: Networking
optical time-domain reflexometer (OTDR).
Learning Outcome 4: Network design should show the purpose and characteristics of networking devices and technologies. Support and maintain network security: access control (rights and permissions), password policies, encryption, virtual private network (VPN), virtual local area network (VLAN), configuring security devices and software.
Learning Outcome 5: Tools for network maintenance and performance monitoring: Software utilities: ping (loopback address, default gateway, local hosts), tracert, ipconfig (/renew, /release, /all), netstat, nslookup), Command-line interface (CLI), system logs, system monitor, network monitor. Maintenance records (help desk records, job sheets, fault logs, CRM). Knowledge base: updates (automatic, manual, server updates services), remote assistant, remote desktop. Methods of managing local storage: disk quotas, mapping drives, disk cleanup, redundant array of independent disks (RAID 0, RAID 1, RAID 5, RAID 10), rights and permissions.

Gateway Qualifications Level 3 Certificate and Diploma in Social Media for E-Commerce

Mandatory Unit

Project Management (Social Media for Ecommerce)

Unit Number:	D/650/5010
Level:	Level 3
Credit Value:	6
GLH:	42
Unit Aim:	Learners will understand project management concepts and the processes and tools used by organisations to manage social media for ecommerce projects. They will learn about project management methodologies and use project management software to plan a social media for ecommerce project, track progress, and review outcomes to determine project success.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:		ASSESSMENT CRITERIA The learner can:	
1	Understand the principles of project management and the methodologies used by organisations to manage social media for ecommerce projects.	1.1	Explain the stages of the project lifecycle and how they apply to social media for ecommerce projects
		1.2	Describe key concepts, issues and risks when managing social media for ecommerce projects.
		1.3	Compare the characteristics of different project management methodologies used by organisations.
2	Be able to use project management software to plan a social media for ecommerce project.	2.1	Produce a project specification for a social media for ecommerce project.
		2.2	Use project management software to plan a social media for ecommerce project.
3	Be able to use project management software to monitor and review a social media for ecommerce project.	3.1	Use project management software to monitor a project plan and track progress against the plan.
		3.2	Carry out a post-project review to determine project outcomes.

Indicative Content: Project Management (Social Media for Ecommerce)

Learning Outcome 1:

Example social media for ecommerce projects could include:
- Design/develop an ecommerce website
- Tools to build brand awareness, drive traffic website, increase sales, etc.
- Social media strategy
- Search Engine Optimisation (SEO) strategy
- The creation of an online community

Project life cycle:
Conception and start up: project mandate, client requirements, and feasibility.
Definition of the project: set up project team, create the Project Initiation Document (PID).
Planning: timescales, costs, quality management, risk management and controls.
Launch and execution: carrying out the plan, monitoring activity, checking progress.
Closure: handover of the product, user acceptance testing, disbanding project team.
Post-project evaluation: reviewing the project against success criteria.

Concepts include the key factors, processes and stages that make up a project, such as:
Costs and timescales: project budget, setting milestones and deadlines, interim reviews.
Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project.

Quality and deliverables:
Application of current quality standards, for example: ISO/IEC 25010:2011 as a benchmark for software development, World Wide Web Consortium for website design and functionality standards.
Defining success criteria and using SMART objectives to define project outcomes.
Customer requirements in terms of functional requirements and non-functional requirements.
Product description or product breakdown structure, to describe the product to be delivered.

Issues: effects of changing external factors, monitoring progress, taking corrective actions where necessary, communications, working within relevant guidelines (internal and external) and legislation, dealing with conflict, impact of project outputs on other systems e.g. staff, organisational structures.

Benefits: saving money, maintaining or increasing profits, improving services, growing the business, increasing market share, improving productivity, expected return on investment, justification for the project, forecasting project success.

Risks: identifying typical project risks (internal/external risks), risk management cycle, identification of risks, assessing the severity of risks, accept the risk, plan contingency or avoid the risk, monitor and control the risks through the project, handling issues when a risk occurs.

Project management methodologies:
PRINCE2 – suitable for most projects.
Rapid Application Development (RAD) – suitable for short-term, large scale, big budget projects.
Waterfall – suitable for websites, database or network projects.
Agile – suitable for medium/long term projects where user requirements frequently change and outputs are required at regular intervals.

Indicative Content: Project Management (Social Media for Ecommerce)
Learning Outcome 2: The project must be sufficiently complex to allow planning and management to take place. It must also allow learners the opportunity to manage some resources, and the time allocated for completion. Interpreting the business case (the business case as a driver of the project): reasons for the project, options that should be considered, expected business benefits, timescale, including major milestones, budget available, risks. Project specification: identification of stakeholders, business case requirements, specific objectives or deliverables, benefits and success factors, project boundaries or scope, constraints, consideration of options, other e.g. ethical issues, sustainable issues, understanding consequences of failure to hit deadlines or produce product, risks and risk mitigation. Project plan: purpose, content e.g. identification of phases and activities, potential for parallel or sequential processes, resources needed for each activity, timescales, review points e.g. milestones, checkpoints, deadlines. Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project, use of other appropriate and available software and applications e.g. spreadsheets, graphics, databases etc.
Learning Outcome 3: Monitor: routine communications with stakeholders, interim reviews, use of logbooks, routine updating of plan where necessary, others, e.g. accessing additional resources where necessary, reacting to unforeseen circumstances. Tracking progress: project baseline and variance, monitoring and recording progress, checkpoint reports as a way of recording milestones achieved, monitoring risk and managing issues, recording quality management activity. Review of project success in terms of key factors, SMART objectives and views of stakeholders: review of lessons learned, review project performance against the baseline and project objectives, review of final cost, delivery date and quality of product delivered, review feedback from key stakeholders (clients, end users). Methods to obtain feedback: interviews, questionnaires, surveys, observation of resulting processes. Recommendations for future actions based on the outcome of the post-project review, communication and presenting requirements for reviews.

Specialist Units

Content Management Systems

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	Y/618/5220
Unit Aim:	This unit will introduce learners to Content Management System (CMS) software and how it is used to manage the creation and modification of digital content. Learners will develop a website using CMS Software and be able to measure return on investment (ROI). They will also understand the importance of website accessibility and the legislation and guideline that must be followed when creating and managing digital content.

This unit has 5 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand how organisations use Content Management Systems (CMS).	1.1 Explain the purpose of CMS in organisations. 1.2 Explain the features and functions of CMS software. 1.3 Compare different CMS software and hosting options.
2 Understand website accessibility.	2.1 Explain the importance of web accessibility legislation and guidelines when creating and managing digital content. 2.2 Explain how to modify a website to make it accessible.
3 Be able to plan the components of a CMS website to meet requirements.	3.1 Plan the content and layout for a CMS website.
4 Be able to use CMS software to create an accessible website to meet requirements.	4.1 Customise a website template and insert planned content. 4.2 Use tools and techniques to add features. 4.3 Test the website and use findings to improve accessibility.
5 Be able to measure and improve the return on investment (ROI) of a website.	5.1 Explain the importance of measuring website traffic and the impact of 'bounce rate'. 5.2 Compare methods of measuring the return on investment (ROI) of a website

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
	5.3 Use analytic tools to monitor website traffic. 5.4 Use analytical data to identify improvements to a website.

Indicative Content: Content Management Systems
Learning Outcome 1: Features: server side, SEO friendly, content hierarchy. Functions: integrated file manager, intuitive interface, templates. Advantages and disadvantages: cost, ownership of content, flexibility, customisation, SEO, static vs. dynamic pages, analytics. Hosting options: self-hosted, hosted third-party. Laws, guidelines and constraints: copyright law, acknowledgement of sources, avoiding plagiarism, provisions for data protection, accessibility standards, IPR. File types: text (e.g. rtf, docx, pdf), images (jpeg, tif, gif), sound (e.g. wav, mp3), video (e.g. mp4, avi). CMS software: e.g. WordPress, Blogger, Weebly.
Learning Outcome 2: Accessibility guidelines: use of cascading style sheets (CSS), colours that do not cause problems for colour blindness, use ALT tags and titles on images, tabulated structures need captions and headings, sound files need accessible player or transcript to be made available, video files need accessible player and closed captioning, tabbed navigation, audio CAPTCHA on forms.
Learning Outcome 3: The CMS website created could be for a business, charity, sports club, personal, enterprise, event etc. The unit can be completed with free hosting or paid for hosting and it is a requirement that CMS software is used. Content and layout: web page content and layout will vary according to the needs of the website but should include text (e.g. body, headings), images (photographs, images), moving images (animation, videos, live streaming), social networking links, blog, etc. Plan should include: keywords and/or keyword phrases to be used in website meta-tags, the template for a website, types of content, different file types for content, blog, buttons to share content, links to social media, etc.
Learning Outcome 4: Website templates: may be customised according to requirements of CMS and website design, should have header/footer and layout of pages (side bars, menu structure). Tools and techniques: methods will vary but may include use of plugins, widgets, creating and changing code using programming language, snippets, creating internal and external links, adding multimedia content to pages. Website meta-tags: title, description, URL, Alt-tags, H1, H2, keyword, tagging.

Indicative Content: Content Management Systems
Testing methods: methods will vary but should include: viewing pages using different browser software', checking links, testing multi-media and interactive elements.
Learning Outcome 5: Methods of measuring: number of hits to a website page, number of downloads, emails sent to an address, calls to a phone number, number of shares of content, number of visits to a blog. Information to analyse: e.g. bounce rate, hits, unique visitors, search terms, referral sites.

Content Marketing

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	D/618/5221
Unit Aim:	Learners will investigate the goals, benefits, methods, factors and technologies of content marketing. They will also develop skills to create, implement and evaluate the success of a content marketing campaign.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the role of content marketing in business.	1.1 Describe content marketing methods. 1.2 Explain how content marketing is used in business. 1.3 Develop content marketing ideas for use in a campaign. 1.4 Explain the factors to consider when creating content for different marketing purposes. 1.5 Summarise the legal and ethical issues when creating content for marketing.
2 Understand technology used in content marketing.	2.1 Explain how technology impacts on the choice of content, platform and channel. 2.2 Explain how search engine optimisation (SEO) is achieved for content marketing. 2.3 Evaluate different types of data that can be used to measure success.
3 Be able to run a content marketing campaign.	3.1 Generate content and create for a website content marketing campaign in line with requirements. 3.2 Apply SEO to improve website traffic. 3.3 Use reporting tools to measure the success of a content marketing campaign. 3.4 Evaluate the success of a content marketing campaign against requirements.

Indicative Content: Content Marketing
Learning Outcome 1: Content marketing methods: the learner should be able to describe a range of methods across a range of technologies and platforms with examples. Factors to consider: aims and objectives, target audience, available skills and resources, cost, time, accessibility, legal, copyright, relevance of context, ethical. Content marketing ideas: paid media, paid search advertisements (ads), social media ads, sponsorships, display/banner ads. Legal requirements: copyright, product/trades descriptions, trademarks, patents, data protection, advertising unfair/deceptive advertising, spam. Ethical issues: opt-in/opt-out procedures, permissions, appropriateness of digital communications, tracking customer behaviour.
Learning Outcome 2: Impact: device (computers, tablets, smartphones), file types, file size, data rates, cross platform compatibility, end-user hardware, network speed, etc Content types: text, videos, images, info-graphics, audio, games, apps, eBooks and ePubs, news feeds, webinars, blogs, web forms, forums, social media platforms. Different types of data: page stats, impressions, viewed, opened, click through rate, reports, statistics, metrics, hit rate/visits (total), unique visitors, bounce rate.
Learning Outcome 3: SEO: add meta data, keywords and /or key phrases, etc. Reporting tools: metrics, analytics, dashboards, aggregators.

Digital Graphics and Animation

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	H/618/5608
Unit Aim:	Learners will understand how digital graphics and animations are used and their characteristics. They will also learn how to design and use digital formats to create graphics and animations for different audiences and purposes.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the uses and characteristics of digital graphics and animation.	1.1 Evaluate the uses and applications of digital graphics and animation for different purposes. 1.2 Explain the processes and techniques used to produce, store and represent graphics and animation in digital format.
2 Be able to design and refine digital graphics and animation.	2.1 Generate ideas for digital graphics and animation, taking into account legal and ethical guidelines. 2.2 Create design documentation for digital graphics and animation to meet requirements. 2.3 Refine designs in response to feedback.
3 Be able to develop and review digital graphics and animation.	3.1 Develop digital graphics and animation in line with guidelines and requirements. 3.2 Document digital graphics and animation processes and techniques used during development. 3.3 Review the quality of digital graphics and animation against requirements.

Indicative Content: Digital Graphics and Animation
Learning Outcome 1: Uses and applications of digital graphics and animation: education, entertainment, advertisement, marketing, scientific visualisation, creative arts, gaming, simulations. Content and format characteristics: target audience, purpose, e.g. education, entertainment, illustration, target platform, target medium (print/digital). Raster images: compression (lossy, lossless), file formats, 2D arrays, dimensions, sampling, colour modes, bit depth, resolution, compression (lossy, lossless). Vector images: points, lines, curves, polygons, file formats, geometrical primitives (points, lines, curves, polygons), paths, nodes, voxel. Bit depth: sampling, bits per pixel (BPP), monochrome, 256, highcolour, truecolour. Colour space: greyscale, RGB (red, green, blue), YUV (luminance and chrominance), HSV (hue, saturation, value) Image capture: scanners, digital cameras, resolution (pixels per inch), storage (memory, file size, asset management). Optimising: target destination, bit depth, resolution, dimensions, intended image output (print/digital). 2D and 3D digital animation techniques: key frames, tweening, motion capture, wire framing, coordinate systems (2D and 3D), environmental physics, behavioural animation.
Learning Outcome 2: Ideas: brainstorming, moodboards, thumbnail sketching, concept art. Techniques and processes to consider: digital processing and editing techniques, compression formats and techniques, quality characteristics, e.g. image quality, compatibility, user experience, usability. Legal and ethical guidelines to consider: copyright, ethical issues, e.g. representation (race, gender, religion, sexuality), decency, libel, intellectual property rights, privacy, security, use of content by others. Design documentation t include: requirements of the brief, including audience, purpose and requirements, research, file naming and storage/backup location, sources of images, product designs. Intended platform/media for delivery: Hardware requirements: specification of target platform, input, processing and output requirements, specialist input devices, e.g. motion capture, virtual reality, laser scanning, CT scanner, specialist output devices, e.g. virtual reality, e-paper, holographic, locater devices, e.g. absolute or relative, direct or indirect, discrete or continuous. Software requirements: tools required, file formats, types and sizes, compatibility, codecs. Technical constraints: file types, software licensing. Reviewing and refine designs: improve the quality, effectiveness and appropriateness of designs, gathering feedback from client/uses, showing evidence of communications with client, e.g. email, verbal communication, scheduling and documenting meetings, agreeing

Indicative Content: Digital Graphics and Animation
and adjusting timescales, refining ideas and solutions, updating design specification documentation.
Learning Outcome 3: Digital graphics and animation processing tools and techniques. Graphic tools: freehand, grouping, colour balance, filters, selection, hue and saturation, masking, layering, retouching, opacity/transparency, editing and combining paths. Animation tools: frame rates, onion skinning, tweening, transitions, camera angles, movement, picture duration, rendering. Storing digital graphics and animation: file formats, compression, target device/platform, user requirements, quality characteristics, storing and using other digital assets, e.g. audio, video, hardware and software requirements. Graphic processing and editing techniques: translation, scaling, rotation, composite transformations, 3D viewing, file size, e.g. quality of image, frame disposal, aut crop. Compression formats and techniques. User experience: quality, compatibility, usability, hardware requirements, software requirements. Review digital graphics and animation: quality, suitability for audience and purpose, suitability against the original requirements, technical constraints, strengths and potential improvements, optimising digital graphics and animations, e.g. paltering frame rates, exporting to different file formats, updating/replacing assets, applying different tools or effects, using different compression methods. Quality of digital graphics and animation (measured against requirements): image quality, sound quality, special and visual effects, accuracy, compatibility, usability, stability, functionality, costs.

Marketing Digital

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	L/618/5232
Unit Aim:	Learners will develop an understanding of digital marketing and how it helps an organisation to achieve its goals. They will learn about the digital marketing mix and how trends impact on digital marketing activities and techniques. Learners will also explore the role of digital information, media and channels in digital marketing.

This unit has 4 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the role of digital marketing and how it helps an organisation to achieve its goals.	1.1 Explain different business markets and the characteristics of digital marketing. 1.2 Compare digital marketing strategies and the factors that affect them. 1.3 Explain trends that impact on digital marketing. 1.4 Explain marketing objectives and how they help an organisation to achieve its goals.
2 Understand the role of digital information, media and channels in digital marketing.	2.1 Explain different sources of digital information and how it can be used by organisations to inform decision making. 2.2 Compare the benefits and limitations of different types of digital media. 2.3 Compare different digital marketing channels and the factors to consider when deciding on an appropriate channel.
3 Understand how the marketing mix can be used for digital marketing activities.	3.1 Explain how the marketing mix applies to digital marketing. 3.2 Explain the benefits and limitations of push and pull marketing techniques.
4 Understand the measurement of outcomes from digital marketing activities.	4.1 Explain how and why organisations measure outcomes of digital marketing activities and the metrics and performance indicators they use.

Indicative Content: Digital Marketing

Learning Outcome 1:

Market types: Business-to-Consumer (B2C), Business-to-Business (B2B), physical/non-physical, virtual/online.

Market reach: mass markets, niche markets.

Characteristics of digital marketing: uses digital platforms – a set of tools built on cloud technology that makes the development of applications easy, uses software to automate marketing processes, triggers emails/social media posts, uses algorithms to personalise advertising, adds dynamic content based on user profiles, gathers purchasing data, takes place in real-time, fast-paced, inexpensive, geographically independent.

Digital marketing strategies: SEM (Search Engine Marketing), SEO (Search Engine Optimisation), PPC (Pay-Per-Click), SMM (Social Media Marketing), Content Marketing, Email Marketing, Influencer/Affiliate Marketing, Viral Marketing, Radio Advertising, Television Advertising, Mobile Advertising.

Factors affecting digital marketing strategies: target market, budget, product, in-house resources, technology, time.

Trends: social factors, technological developments, technological growth, access and usage of the internet, number of users, demand for information, technology-enabled services, use of mobile technologies, devices and applications (apps), smartphones and smartwatches, laptops, tablets and netbooks computers, computers, gaming devices, smart TVs.

Marketing objectives: sales revenue growth, brand awareness, market entry, product differentiation, product development, attract new customers, encourage digital engagement, increase website traffic, develop relationships with existing customers.

Learning Outcome 2:

Sources of digital information: customer reviews, social media, following conversations, interactions with social media, comparison websites (aggregators), company websites, statistics sites, e-journals, web crawlers, quality scores.

Organisational use: identification of gaps in markets, identification of changes in consumer habits, tastes and behaviours, updating of web content, targeted marketing, planning campaigns.

Types of digital media:

- Paid media (organisations pay to deliver content to an audience): paid search advertisements (ads), social media ads, sponsorships, display/banner ads.
- Earned media (organisations try to earn coverage and exposure from reporters and influencers: viral marketing, social media conversations, blog/vlogs, user-generated reviews.
- Owned media (under the direct control of the organisation): websites/mobile sites, newsletters, catalogues, blogs, email lists, applications (apps) and software.

Channels:
Website: Search Engine Optimisation (SEO), influencers, chatbots, Rich Site Summary (RSS) feeds, trusted feeds, podcasts, widgets.

Indicative Content: Digital Marketing

Search Engine Marketing (SEM), Search Engine Optimisation (SEO), organic search marketing, paid search advertising, pay-per-click (PPC), banner adverts.

Social media: Online Public Relations (OPR), photo, video and slide-sharing sites, viral marketing, blogs and vlogs, brand blogging, influencer marketing, social media advertising, social media endorsements.

Email for attracting and retaining customers: opt-in email, cold email, co-branded email, conversion emails, e-newsletters, event triggered/behavioural emails, email sequencing.

Factors to consider when deciding on appropriate channels: reaching target market, accessibility of information, speed of communication, communication with the customer, cost to the organisation, choice for customer, competitors' activities, brand image and development.

Learning Outcome 3:

Marketing Mix: Product, Price, Promotion, Place (4Ps)

- Product: offering digital information or transaction services, to existing customers, targeting new customer segments by repackaging information and content, bundling of physical and digital products, pay-per-view/download, digital only products.
- Price: price comparison aggregators, differentiation of digital and store price, search order of products according to price, dynamic pricing, price testing, digital auctions, subscriptions.
- Promotion: advertising, selling, sales promotion, public relations, sponsorship, direct marketing, location based marketing, exhibitions, merchandising, word of mouth, guerrilla marketing.
- Place: global reach, intermediation (marketing through third parties), disintermediation (marketing direct to the customer), payment place, localisation of information (language, specific cultural requirements), virtual organisations.

Push and pull marketing techniques:

- Push techniques to generate sales by providing information directly to a target audience via advertising, promotional campaigns, promotional discounts
- Pull (techniques to raise awareness and engagement by creating information that is attractive to the target audience via blogs/vlogs, SEO, online events.

Learning Outcome 4:

Reasons for measuring outcomes: refinement and adaptation of marketing activities, budget allocation.

Tools for monitoring: dashboards, aggregators, web analytics.

Key metrics: hit rate/visits (total), unique visitors, bounce rate, exit rate, dwell time (stickiness), click-through rate, download rates, visitor origin (country/region), time of day, top page views, Pages Per Visit (PPV), Daily Active Users (DAU), Monthly Active Users (MAU).

Key Performance Indicators (KPIs): Return on Investment (ROI), customer satisfaction and engagement, customer trends, Cost per acquisition (CPA), sales, retention rates, win back, engagement, re-engagement, perception, customer satisfaction, brand awareness, average revenue per user.

Digital Marketing Metrics and Analytics

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	Y/618/5234
Unit Aim:	This unit will develop learners' understanding of the sales funnel and the customer experience, and the types of data generated during the customer journey. They will learn how and why organisations measure digital marketing activities and the key metrics and performance indicators they use to determine the success of digital marketing campaigns.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the sales funnel in digital marketing.	1.1 Explain the stages of the sales funnel. 1.2 Explain the different factors that impact on sales funnel conversion rates.
2 Understand how digital marketing metrics are generated.	2.1 Explain the customer experience during different stages of the sales journey and the types of data generated. 2.2 Explain the types of data required to evaluate success in relation to Key Performance Indicators (KPIs). 2.3 Compare software tools for tracking and viewing data. 2.4 Explain the key features of analytics software.
3 Understand how to use analytics software to optimise a digital marketing campaign.	3.1 Analyse digital marketing campaign data for insights and trends. 3.2 Suggest and justify methods to optimise a digital marketing campaign.

Indicative Content: Digital Marketing Metrics and Analytics
Learning Outcome 1: Stages of the sales funnel/customer experience: awareness, education, repertoire, consideration, purchase. Factors: customer life cycle, quality of marketing activity, quantity of marketing activity.
Learning Outcome 2: Reasons for measuring data: refinement and adaptation of marketing activities, budget allocation. Types of data: page impression, unique visits, click through rates (CTR), average number of page views per visit, average duration, sales, bounce rates, validity, reliability, sample size, usefulness. Key Performance Indicators (KPIs): Return on Investment (ROI), customer satisfaction and engagement, customer trends, Cost per acquisition (CPA), sales, retention rates, win back, engagement, re-engagement, perception, customer satisfaction, brand awareness, average revenue per user. Key metrics: hit rate/visits (total), unique visitors, bounce rate, exit rate, dwell time (stickiness), click-through rate, download rates, visitor origin (country/region), time of day, top page views, Pages Per Visit (PPV), Daily Active Users (DAU), Monthly Active Users (MAU). Tools for tracking data: tracking codes, pixel tracking, first party and third party cookies. Tools for viewing data: analytic reports, dashboards, aggregators. Key features of analytics software: big data processing (involve the collection and organisation of raw data to produce meaning), intuitive user interface, flexible, user friendly, predictive applications, identity management, analytics, filtering/sorting, reporting features, security, support, version control.
Learning Outcome 3: Reasons for measuring data: refinement and adaptation of marketing activities, budget allocation. Types of data: page impression, unique visits, click through rates (CTR), average number of page views per visit, average duration, sales, bounce rates, validity, reliability, sample size, usefulness. Key Performance Indicators (KPIs): Return on Investment (ROI), customer satisfaction and engagement, customer trends, Cost per acquisition (CPA), sales, retention rates, win back, engagement, re-engagement, perception, customer satisfaction, brand awareness, average revenue per user. Key metrics: hit rate/visits (total), unique visitors, bounce rate, exit rate, dwell time (stickiness), click-through rate, download rates, visitor origin (country/region), time of day, top page views, Pages Per Visit (PPV), Daily Active Users (DAU), Monthly Active Users (MAU).

Indicative Content: Digital Marketing Metrics and Analytics
Tools for tracking data: tracking codes, pixel tracking, first party and third party cookies. Tools for viewing data: analytic reports, dashboards, aggregators. Key features of analytics software: big data processing (involve the collection and organisation of raw data to produce meaning), intuitive user interface, flexible, user friendly, predictive applications, identity management, analytics, filtering/sorting, reporting features, security, support, version control.

Social Media Marketing (SMM)

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	D/618/5235
Unit Aim:	In this unit learners will develop an understanding of how social media is used in digital marketing and will plan, create and measure a social media marketing campaign to meet organisational goals.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the role of social media in digital marketing.	1.1 Explain the use of social media in digital marketing campaigns. 1.2 Explain the factors to consider when creating social media marketing campaigns. 1.3 Explain the importance of identifying and measuring outcomes from marketing campaigns. 1.4 Explain tools for monitoring and measuring social media marketing campaigns.
2 Be able to implement and measure a social media marketing campaign.	2.1 Plan a social media marketing campaign to meet organisational goals in line with requirements. 2.2 Select and justify appropriate channels and digital media for a social media marketing campaign. 2.3 Create and implement a social media marketing campaign. 2.4 Add tracking tools to measure the success of a social media marking campaign. 2.5 Select data to determine the success a social media marketing campaign and provide recommendations for improvement.
3 Understand the challenges, legal and ethical issues and how they impact on social media marketing.	3.1 Explain the challenges in digital marketing and how they impact on social media marketing activities. 3.2 Explain legal and ethical issues relating to social media marketing campaigns.

Indicative Content: Social Media Marketing (SMM)

Learning Outcome 1:

Uses: raise awareness, acquisition, retention, increased click through to website, perception change, promote brand awareness, etc.

Factors: targeted to audience, appropriate social networking site, appropriate call to action, time constraint, design, content, budget, multi- channel campaign targeting and analytics.

Reasons for measuring outcomes: refinement and adaptation of marketing activities, budget allocation.

Tools for monitoring: dashboards, aggregators, web analytics.

Key metrics: hit rate/visits (total), unique visitors, bounce rate, exit rate, dwell time (stickiness), click-through rate, download rates, visitor origin (country/region), time of day, top page views, Pages Per Visit (PPV), Daily Active Users (DAU), Monthly Active Users (MAU).

Key Performance Indicators (KPIs): Return on Investment (ROI), customer satisfaction and engagement, customer trends, Cost per acquisition (CPA), sales, retention rates, win back, engagement, re-engagement, perception, customer satisfaction, brand awareness, average revenue per user.

Learning Outcome 2:

Types of digital media:

- Paid media (organisations pay to deliver content to an audience): paid search advertisements (ads), social media ads, sponsorships, display/banner ads.
- Earned media (organisations try to earn coverage and exposure from reporters and influencers: viral marketing, social media conversations, blog/vlogs, user-generated reviews.
- Owned media (under the direct control of the organisation): websites/mobile sites, newsletters, catalogues, blogs, email lists, applications (apps) and software.

Channels:
Website: Search Engine Optimisation (SEO), influencers, chatbots, Rich Site Summary (RSS) feeds, trusted feeds, podcasts, widgets.

Search Engine Marketing (SEM), Search Engine Optimisation (SEO), organic search marketing, paid search advertising, pay-per-click (PPC), banner adverts.

Social media: Online Public Relations (OPR), photo, video and slide-sharing sites, viral marketing, blogs and vlogs, brand blogging, influencer marketing, social media advertising, social media endorsements.

Email for attracting and retaining customers: opt-in email, cold email, co-branded email, conversion emails, e-newsletters, event triggered/behavioural emails, email sequencing.

Factors to consider when deciding on appropriate channels: reaching target market, accessibility of information, speed of communication, communication with the customer, cost to the organisation, choice for customer, competitors' activities, brand image and development.

Indicative Content: Social Media Marketing (SMM)
Tools: tracking codes, pixel tracking, first party and third party cookies.
Learning Outcome 3: Challenges: changes in SEO algorithms, digital platforms becoming obsolete, new digital platforms being introduced, cross-platform compatibility, increase in digital channels, big data (handling large data volumes), cyber security. Legal issues: Data protection: privacy and data collection, security and storage of customer information. Intellectual property: trademarks, copyright. Advertising: unfair/deceptive advertising, spam. Ethical issues: opt-in/opt-out procedures, permissions, tracking customer behaviour, marketing to minors, alcohol, religion, decency, discrimination, regional variations.

Gateway Qualifications Level 3 Certificate and Diploma in Software Development

Mandatory Unit

Project Management

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	F/618/5180
Unit Aim:	Learners will understand project management concepts and the processes and tools used by organisations to manage IT projects. They will learn about project management methodologies and use project management software to plan an IT project, track progress, and review the outcomes to determine project success.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the principles of project management and the methodologies used by organisations to manage IT projects.	1.1 Explain the stages of the project lifecycle as they apply to a given IT project. 1.2 Describe key concepts, issues and risks when managing IT projects. 1.3 Compare the characteristics of different project management methodologies used by organisations.
2 Be able to use project management software to plan an IT project.	2.1 Produce a project specification for an IT project in line with requirements. 2.2 Use project management software to plan an IT project.
3 Be able to use project management software to monitor and review an IT project.	3.1 Use project management software to monitor a project plan and track progress against the plan. 3.2 Carry out a post-project review to determine project outcomes.

Indicative Content: Project Management

Learning Outcome 1:

IT projects: software application development, installing IT systems and networks, information collection and analysis, digital marketing campaign, etc.

Project life cycle:
Conception and start up: project mandate, client requirements, and feasibility.
Definition of the project: set up project team, create the Project Initiation Document (PID).

Planning: timescales, costs, quality management, risk management and controls.

Launch and execution: carrying out the plan, monitoring activity, checking progress.
Closure: handover of the product, user acceptance testing, disbanding project team.

Post-project evaluation: reviewing the project against success criteria.
Concepts include the key factors, processes and stages that make up a project, such as:
Costs and timescales: project budget, setting milestones and deadlines, interim reviews.

Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project.

Quality and deliverables:
Application of current quality standards, for example: ISO/IEC 25010:2011 as a benchmark for software development, World Wide Web Consortium for website design and functionality standards.

Defining success criteria and using SMART objectives to define project outcomes.
Customer requirements in terms of functional requirements and non-functional requirements.
Product description or product breakdown structure, to describe the product to be delivered.

Issues: effects of changing external factors, monitoring progress, taking corrective actions where necessary, communications, working within relevant guidelines (internal and external) and legislation, dealing with conflict, impact of project outputs on other systems e.g. staff, organisational structures.

Benefits: saving money, maintaining or increasing profits, improving services, growing the business, increasing market share, improving productivity, expected return on investment, justification for the project, forecasting project success.

Risks: identifying typical project risks (internal/external risks), risk management cycle, identification of risks, assessing the severity of risks, accept the risk, plan contingency or avoid the risk, monitor and control the risks through the project, handling issues when a risk occurs.

Project management methodologies:
PRINCE2 – suitable for most projects.
Rapid Application Development (RAD) – suitable for short-term, large scale, big budget projects.
Waterfall – suitable for websites, database or network projects.
Agile – suitable for medium/long term projects where user requirements frequently change and outputs are require at regular intervals.

Indicative Content: Project Management
Learning Outcome 2: The IT project must be sufficiently complex to allow planning and management to take place. It must also allow learners the opportunity to manage some resources, and the time allocated for completion. Interpreting the business case (the business case as a driver of the project): reasons for the project, options that should be considered, expected business benefits, timescale, including major milestones, budget available, risks. Project specification: identification of stakeholders, business case requirements, specific objectives or deliverables, benefits and success factors, project boundaries or scope, constraints, consideration of options, other e.g. ethical issues, sustainable issues, understanding consequences of failure to hit deadlines or produce product, risks and risk mitigation. Project plan: purpose, content e.g. identification of phases and activities, potential for parallel or sequential processes, resources needed for each activity, timescales, review points e.g. milestones, checkpoints, deadlines. Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project, use of other appropriate and available software and applications e.g. spreadsheets, graphics, databases etc.
Learning Outcome 3: Monitor: routine communications with stakeholders, interim reviews, use of logbooks, routine updating of plan where necessary, others e.g. accessing additional resources where necessary, reacting to unforeseen circumstances. Tracking progress: project baseline and variance, monitoring and recording progress, checkpoint reports as a way of recording milestones achieved, monitoring risk and managing issues, recording quality management activity. Review of project success in terms of key factors, SMART objectives and views of stakeholders: review of lessons learned, review project performance against the baseline and project objectives, review of final cost, delivery date and quality of product delivered, review feedback from key stakeholders (clients, end users). Methods to obtain feedback: interviews, questionnaires, surveys, observation of resulting processes. Recommendations for future actions based on the outcome of the post-project review, communication and presenting requirements for reviews.

Specialist Units

JavaScript

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	K/618/5237
Unit Aim:	Learners will develop an understanding of JavaScript as a text-based programming language to create interactive elements on web pages.

This unit has 2 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the use of JavaScript in web development.	1.1 Explain how JavaScript is used as a web programming language.
2 Be able to use JavaScript in web pages.	2.1 Use JavaScript to prompt and validate inputs in web pages. 2.2 Use document. Write to display messages in web pages. 2.3 Alter, show, hide and move objects in web pages. 2.4 Use JavaScript to include special effects in web pages. 2.5 Use functions and variables to customise web pages. 2.6 Use functions and variables for functional web pages. 2.7 Use event handlers to trigger JavaScript code.

Indicative Content: JavaScript
Learning Outcome 1: JavaScript is a programming language that powers the dynamic behaviour on most websites. Alongside HTML and CSS, it is a core technology that makes the web run, flexible; can be used for both front-end and back-end.
Learning Outcome 2: W3Schools Resource Title: JavaScript Tutorial: http://www.w3schools.com/js/ JavaScript cheatsheet: https://www.codecademy.com/learn/introduction-to-javascript/modules/learn-javascript-introduction/cheatsheet Client-side form validation, Constraint validation API. Document.write()method writes a string of text to a document stream opened by document.open(). jQuery to respond to user actions; *alter*, *show*, *hide* and *move objects*, show/hide div. Visual effects: layout techniques, text animation, transition effects etc. Event handlers: onSelect, onSubmit, onClick, onMouseOver, onLoad, onUnload.

Maths for Computing

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	M/618/5238
Unit Aim:	Learners will develop maths skills for computing, including matrices, series and probability. Learners will also apply number systems, including binary and hexadecimal, and interpret data gathered for a defined purpose.

This unit has 4 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Be able to apply matrix methods.	1.1 Show how matrices can be used to represent ordered data. 1.2 Perform add, subtract and scalar multiplication operations on a matrix. 1.3 Multiply two matrices. 1.4 Find the inverse and transpose of a matrix. 1.5 Apply matrix techniques to solve simultaneous linear equations.
2 Be able to apply sequences and series, probability and recursion.	2.1 Apply sequence and series techniques to solve problems. 2.2 Apply probability and recursion techniques to solve problems.
3 Be able to apply number systems.	3.1 Explain how number systems are used in computing. 3.2 Perform basic operations on number systems. 3.3 Perform conversion operations between number systems.
4 Be able to interpret data.	4.1 Gather data for a defined purpose. 4.2 Interpret trends and patterns in data.

Indicative Content: Maths for Computing
Learning Outcome 1: Matrices: method of representing ordered data, relationship with computer program variable arrays, index notation. Operations: add, subtract, scalar multiplication, multiply two matrices, inverse, transpose. Techniques: solving simultaneous linear equations, vector transformation and rotation, maps and graphs.
Learning Outcome 2: Sequences and series: nth term of a sequence, generation of recurrence relationship, arithmetic and geometric sequences and series, sum to n terms of an arithmetic and geometric series, sum to infinity of a geometric series, Σ notation. Probability: events e.g. union, intersection, complementary, mutually exclusive, independent, space diagrams e.g. sum of scores when two dice are thrown, visualising events using Venn diagrams, tree diagrams. Recursion: series e.g. Fibonacci, factorial, natural numbers, termination condition, recursive algorithms e.g. factorial, quicksort, binary search
Learning Outcome 3: Number systems: binary, octal, denary and hexadecimal, conversion between number systems, basic operations e.g. addition, division, multiplication, subtraction on number systems. Uses in computing: ASCII code (binary), MIME (hex), file permissions in Unix (octal), IP addressing, subnet addressing, subnet masking, class addressing, domain routing, etc.
Learning Outcome 4: Gathering data: methods of gathering quantity data e.g. measurements, questionnaires, surveys, extraction of required information from raw data, limitations of data gathered. Representing data: comparing data sets using back-to-back stem and leaf diagrams e.g. pulse rates of students before and after exercise, mean, median, mode, interquartile ranges, histograms, variance, standard deviation. Interpreting data: e.g. analysing summary data, proving hypotheses, identifying trends and patterns.

Object Oriented Programming

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	T/618/5239
Unit Aim:	Learners will become familiar with the underpinning concepts of object oriented programming to develop skills in an object oriented language. They will look at the features, tools and techniques of object oriented programming and use a structured approach to the design and development of a program, ensuring it is documented and tested against user requirements.

This unit has 4 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the features of object oriented programming.	1.1 Explain the key features of object oriented programming. 1.2 Explain the importance of encapsulation, inheritance and polymorphism in object oriented programming.
2 Be able to use tools and techniques of an object oriented programming language.	2.1 Demonstrate use of object oriented tools and techniques.
3 Be able to design and develop an object oriented program to meet requirements.	3.1 Design an object oriented program. 3.2 Develop an object oriented program.
4 Be able to test and document an object oriented program.	4.1 Test an object oriented program. 4.2 Document appropriate action to correct errors. 4.3 Create technical documentation for the support and maintenance of the program.

Indicative Content: Object Oriented Programming
Learning Outcome 1: Key features: discrete, reusable units of programming logic, identification of objects, data abstraction, modularity, classification, inheritance, polymorphism, encapsulation, classes, methods, message passing. Encapsulation: bundles data and methods that work on that data within one unit. Inheritance: reusability enables new objects to take on the properties of existing objects. Polymorphism: the ability of a variable, function or object to take on multiple forms. Programming languages: e.g. Visual Basic.NET (VB.NET), C++, C#, Java, Python.
Learning Outcome 2: Tools: e.g. predefined functions, screen templates. Techniques: using integrated development environment (IDE). Variables: global, local, static, overloaded results, instance.
Learning Outcome 3: Classes: class diagram, dependencies and inheritances, identification attributes, methods, the control of scope of attributes and methods, inheritance, aggregation, association, polymorphism, pre-defined classes e.g. class library, downloaded, imported. Objects: e.g. constructors, destructors, building a program with reusable objects, defining relationships between objects, implementing message passing between objects. Creation of program: use of development environment, debugging, data validation, error handling and reporting. Programming language syntax: e.g. selecting, declaring and initialising variable and data structure types and sizes. Constructs: selection e.g. if … then … else, CASE, iteration e.g. while … do, repeat … until. Programming standards: e.g. use of comments, code layout, indentation.
Learning Outcome 4: Testing: test strategy, test plan structure e.g. test, date, expected result, actual result, corrective action, error messages, specialist software tools e.g. debug. Review: against specifications requirements, interim reviews. Documentation: user guide, technical support.

Programming Implementation

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	K/618/5240
Unit Aim:	Learners will become familiar with the underpinning concepts of programming and how it is implemented.

This unit has 4 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand programming languages.	1.1 Explain the principles and concepts of programming languages.
2 Understand how programming is implemented.	2.1 Interpret variables within programming languages. 2.2 Interpret common programming control structures that are used when developing code. 2.3 Describe the use of common data structures. 2.4 Describe how algorithms are used in programming. 2.5 Describe how to test and debug programs.
3 Understand the importance of good programming practices.	3.1 Identify the elements of common coding standards. 3.2 Explain the role and importance of good coding practices.
4 Understand functional and non-functional requirements in programming.	4.1 Identify the types of functional and non-functional requirements. 4.2 Describe the tests used for functional and non-functional requirements.

Indicative Content: Programming Implementation

Learning Outcome 1:

Principles and concepts:

Procedural languages: statements (lines of code in sequence), blocks (one or more declarations or statements), procedures (independent code module that fulfils some concrete task and is referenced within a larger body of source code), modularity (splits program up into small parts or chunks, each one of these chunks contribute to the program and performs a task), tools and techniques (functions, procedures, libraries, parameters, debugging).

Programming languages: e.g. Pascal, C, Cobol, Fortran.

Object-orientated languages classes (template for creating object, a user-defined data type, which holds its own data members and member functions), objects (specific instance of a class; it contains real values instead of variables), abstraction (handles complexity by hiding unnecessary details from the user), encapsulation (bundles data and methods that work on that data within one unit), inheritance (reusability, enables new objects to take on the properties of existing objects), polymorphism (the ability of a variable, function or object to take on multiple forms), tools and techniques, predefined functions, templates, integrated development environment (IDE).

Programming languages: e.g. Visual Basic.NET (VB.NET), C++, C#, Java, Python.

Event-driven languages: vents (user actions, sensor outputs, or messages from other programs or threads), event handlers (series of subroutines or methods), event loops (main loop in a program that typically waits for the user to trigger something), time driven (code that runs on a time trigger), trigger functions (chooses which event handler needs to be run for the event that has occurred), tools and techniques (use of tool boxes and controls, selection, loops, event handlers, objects and object properties, menus).

Programming languages: e.g. Visual Basic, Visual C++ and Java.

Learning Outcome 2:

Variables: integer, float, Boolean, string, character.

Programming control structures: sequence (line-by-line execution), selection (if…then…else, ELSEIF (ELIF), nested if, case/switch)

Iteration: repeat, for, while, do-while.

Common data structures uses: linked lists, arrays, stacks, queues.

Algorithms: sorting (bubble, quick, insertion, merge), searching (serial/linear, binary).

Test and debug programs: tools used to debug programs logical next line, step into, step out, next instruction, break point).

Ordered stages of testing: black box, white box, alpha, beta.

Indicative Content: Programming Implementation
Learning Outcome 3: Common coding standards: open (free to apply own style for code), not limited for language constructs, can select any programming language. Organisational: common style guide for code, guide for language constructs, pre-determined programming language. Good programming practices: commenting, documentation (to keep a log of events), consistent indentation (shows logical structure), code grouping (grouping data so that the elements in each group share a common attribute), consistent naming (so that variables are easily identifiable), camel case, underscores, Don't Repeat Yourself (DRY) principle (to reduce the amount of work required to extend and maintain the software in the future), programming refactoring (to improve non-functional attributes of software).
Learning Outcome 4: Functional requirements: calculations, technical details, data manipulation, data processing. Non-functional requirements: accessibility, efficiency, reliability, scalability, maintainability, security, robustness. Functional testing: unit testing, smoke testing, integration testing, system testing. Non-functional testing: availability testing, compatibility testing, configuration testing, load testing.

Robot Technology

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	K/618/5190
Unit Aim:	Learners will develop an understanding of the principles and operations of robots. They will learn about robot control systems, the different types of sensors and their application in a robot. Learners will also develop the skills to design and develop a program to control a robot and will understand the role and importance of legislation associated with robot technology.

This unit has 4 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the operating, design and control principles of different types of robots.	1.1 Explain the operating, design and control principles of different types of robots. 1.2 Explain how different sensors and end effectors are used in robots. 1.3 Analyse the benefits and limitations of using robots for routine tasks.
2 Understand the legal and ethical issues in the development and use of robots.	2.1 Explain how legislation and roboethics influence the development and use of robots.
3 Be able to design and develop an operating program for a robot.	3.1 Design an operating program for a robot to enable it to carry out a specific function. 3.2 Develop an operating program for a robot to enable it to carry out a specific function.
4 Understand hazards and health, safety and maintenance requirements associated with robots.	4.1 Explain the health and safety requirements, and maintenance procedures for the safe operation of robots.

Indicative Content: Robot Technology
Learning Outcome 1: Uses: in the home, in manufacturing industry, in medical applications, agricultural environments. Principles of operation: operational characteristics and specifications; types of controller, manipulator, end effector/tooling e.g. pneumatic suction cup, hydraulic, electrical and mechanical grippers; work space organisation e.g. feed of work, robot-to-robot work, material flow and logistics. Design principles: manipulator coordinate systems e.g. cylindrical spherical, jointed, spherical, Cartesian and Selective Compliant Assembly Robot Arm (SCARA) with associated working envelope; wrist articulations e.g. yaw, pitch and roll, degrees of freedom in terms of translations and rotations; drive mechanisms e.g. mechanical (ball screws, chain/belt, gears), pneumatic, hydraulic, electrical; speed reducers/gearheads e.g. harmonic, cycloidal, parallel shaft spur gear, planetary. Control systems: on/off and programmable-integral-derivative (PID) control; closed-loop servo controlled systems e.g. for driving one axis of a robot; input, output and feedback signals e.g. the sequence which takes place in order to perform a task; control of three axes of a robot Sensors: sensor types e.g. tactile (microswitches/piezoelectric/strain gauge/pressure), nontactile (capacitive/inductive/light/laser), vision (inspection, identification and navigation), sensor applications e.g. safety, work-cell control, component/part inspection. End effectors: grippers and tools e.g. parts handling/transfer, assembly, welding, paint spraying, testing.
Learning Outcome 2: Legal, social and moral issues relating to the development and use of robots, European Civil Law Rules in Robotics, Asimov's Laws, Zeroth Law. Roboethics: set of rules and principles that arise from the *use of robots* in our homes and workplaces, including such things as safety, privacy, and responsibility.
Learning Outcome 3: Operating program: program selection, start-up, test, alterations and operation, types of programming e.g. manual, walk through, teach pendant methods, off-line programming, planning robot efficient routes, writing programs using flowcharts, work-cell commands e.g. wait/signal/delay.
Learning Outcome 4: Health and safety requirements: relevant regulations e.g. Health and Safety at Work Act, Electricity at Work Regulations, Health and Safety Executive publications, Machine Tool Technologies Association Codes of Practice (MTA Safeguarding Codes of Practice – Industrial Robots parts 1–3), human dangers e.g. during programming, maintenance and as a result of system faults, safety barriers e.g. 'dead man's handle', hold and emergency stop buttons, pressure pads/matting surrounding robot, infra-red curtains and electromagnetic field barriers.

Indicative Content: Robot Technology
Maintenance: inspection routines e.g. mechanical condition of all parts, environmental conditions (particulate matter, temperature, ventilation, shock, vibration, electrical noise), spare parts required to sustain continuous operation, relevant maintenance tools and test equipment, set-up and maintenance schedules.

Software Testing

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	M/618/5241
Unit Aim:	Learners will develop an understanding of testing strategies and techniques and the stages from planning to acceptance testing. They will also understand how automation can be applied to software testing and will implement test plans, identify appropriate test data and record results.

This unit has 2 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand software testing.	1.1 Explain the purpose and methods of software testing. 1.2 Describe the different stages and types of software testing. 1.3 Explain how automation is used in software testing. 1.4 Describe functional and structural testing.
2 Be able to develop and implement a test plan.	2.1 Design appropriate test data. 2.2 Develop a test plan in line with requirements. 2.3 Implement a test plan and record results. 2.4 Produce a test report.

Indicative Content: Software Testing
Learning Outcome 1: Purpose: to ensure software is functional, secure and meets specified business requirements. Test methods: unit testing e.g. source code testing; integration testing e.g. big bang, top down-top up; system testing e.g. usability, performance, compatibility, error handling, security; black box testing e.g. test cases based on inputs and expected outputs; white box testing e.g. data flow, branch, path testing; purpose of each; static testing e.g. walkthrough without executing code; dynamic testing e.g. from a debugger environment Test stages: e.g. planning, developing test procedures, carrying out tests, reporting (is software ready?), analysis of results, retesting; alpha e.g. white box testing; beta e.g. usability testing; acceptance e.g. black box testing; non-functional testing; performance testing; acceptance testing. Different types of testing: Alpha/beta. Unit testing: identify processes and input and output requirements, identify and isolate code into its smallest testable part, plan tests cases, identify test data, debug code. Integration testing: identify units of code that will work together, decide on approach to be used (top down, bottom up), define parameters for the way in which the units will work, use modules that have been unit tested as the input for the test. Performance testing: define performance goals, identify suitable metrics, deploy manual and automatic testing tools as required, analyse data generated by testing tools. System testing: test software as a complete package, plan destructive testing cases, plan non-destructive testing cases, compare performance with functional requirements specification. Acceptance testing: identify and engage suitable test users, deploy users to test the program in real or simulated use scenarios, gather feedback from test users, compare user feedback against functional and non-functional requirements specification. Regression testing: fix errors identified in other stages of testing o retest the identified component to check error is fixed, retest associated components to ensure no unintentional issues have arisen. Load/stress testing: agree acceptable performance parameters (data access speed, load times, number of concurrent users, system availability), identify and deploy browser-level and protocol-level testing, expose site to low, normal, high and extreme levels of traffic, analyse performance of site against agreed parameters.
Learning Outcome 2: Test data: normal, erroneous, extreme (outside limits), learners need to understand the importance of designing test data to confirm a program works correctly under normal and exceptional circumstances (valid, invalid, boundary). Test plan should include: test specification (including functional and structural techniques, setting minimum criteria for completion; functional e.g. black box testing, structural e.g.

Indicative Content: Software Testing
white box testing), test cases, test data and expected results, resources and scheduling, recording and checking of results (test log), evaluation. Test process: test specification; test cases; test data; expected results; resources required; time plan; recording documentation; evaluation of results Test cases: expected outputs from specified inputs; formal e.g. positive, negative testing; informal e.g. scenario testing. Test report should specify the presence or absence of errors, make proposals for rectifying errors found and report on the success of the test against the original specification, contents e.g. test plan, test specification, test cases, test procedure specification, test log/records, test incident report (actual v expected result) Record results: test e.g. branch test, test data, expected result, actual result, corrective action taken.

Gateway Qualifications Level 3 Certificate and Diploma in Systems Infrastructure

Mandatory Unit

Project Management (IT Systems Infrastructure)

Unit Number:	J/650/5013
Level:	Level 3
Credit Value:	6
GLH:	42
Unit Aim:	Learners will understand project management concepts and the processes and tools used by organisations to manage IT systems infrastructure projects. They will learn about project management methodologies and use project management software to plan a systems infrastructure project, track progress, and review outcomes to determine project success.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:		ASSESSMENT CRITERIA The learner can:	
1	Understand the principles of project management and the methodologies used by organisations to manage IT systems infrastructure projects.	1.1	Explain the stages of the project lifecycle and how they apply to IT systems infrastructure projects.
		1.2	Describe key concepts, issues and risks when managing IT systems infrastructure projects.
		1.3	Compare the characteristics of different project management methodologies used by organisations.
2	Be able to use project management software to plan an IT systems infrastructure project.	2.1	Produce a project specification for an IT systems infrastructure project in line with requirements.
		2.2	Use project management software to plan an IT systems infrastructure project.
3	Be able to use project management software to monitor and review an IT systems infrastructure project.	3.1	Use project management software to monitor a project plan and track progress against the plan.
		3.2	Carry out a post-project review to determine project outcomes.

Indicative Content: Project Management (IT Systems Infrastructure)

Learning Outcome 1:

Example IT systems infrastructure projects could include:

- Hardware and software replacement or upgrades in a school, college or SME
- Network equipment upgrade, including improved internet connectivity
- Business applications and services migrations
- Data storage and backup solutions

Project life cycle:
Conception and start up: project mandate, client requirements, and feasibility.
Definition of the project: set up project team, create the Project Initiation Document (PID).
Planning: timescales, costs, quality management, risk management and controls.
Launch and execution: carrying out the plan, monitoring activity, checking progress.
Closure: handover of the product, user acceptance testing, disbanding project team.
Post-project evaluation: reviewing the project against success criteria.

Concepts include the key factors, processes and stages that make up a project, such as:
Costs and timescales: project budget, setting milestones and deadlines, interim reviews.
Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project.

Quality and deliverables:
Application of current quality standards, for example: ISO/IEC 25010:2011 as a benchmark for software development, World Wide Web Consortium for website design and functionality standards.
Defining success criteria and using SMART objectives to define project outcomes.
Customer requirements in terms of functional requirements and non-functional requirements.
Product description or product breakdown structure, to describe the product to be delivered.

Issues: effects of changing external factors, monitoring progress, taking corrective actions where necessary, communications, working within relevant guidelines (internal and external) and legislation, dealing with conflict, impact of project outputs on other systems e.g. staff, organisational structures.

Benefits: saving money, maintaining or increasing profits, improving services, growing the business, increasing market share, improving productivity, expected return on investment, justification for the project, forecasting project success.

Risks: identifying typical project risks (internal/external risks), risk management cycle, identification of risks, assessing the severity of risks, accept the risk, plan contingency or avoid the risk, monitor and control the risks through the project, handling issues when a risk occurs.

Project management methodologies:
PRINCE2 – suitable for most projects.
Rapid Application Development (RAD) – suitable for short-term, large scale, big budget projects.
Waterfall – suitable for websites, database or network projects.
Agile – suitable for medium/long term projects where user requirements frequently change and outputs are required at regular intervals.

Indicative Content: Project Management (IT Systems Infrastructure)
Learning Outcome 2: The project must be sufficiently complex to allow planning and management to take place. It must also allow learners the opportunity to manage some resources, and the time allocated for completion. Interpreting the business case (the business case as a driver of the project): reasons for the project, options that should be considered, expected business benefits, timescale, including major milestones, budget available, risks. Project specification: identification of stakeholders, business case requirements, specific objectives or deliverables, benefits and success factors, project boundaries or scope, constraints, consideration of options, other, e.g. ethical issues, sustainable issues, understanding consequences of failure to hit deadlines or produce product, risks and risk mitigation. Project plan: purpose, content, e.g. identification of phases and activities, potential for parallel or sequential processes, resources needed for each activity, timescales, review points, e.g. milestones, checkpoints, deadlines. Project management tools: Gantt charts, PERT charts, critical path methods, specialised software packages such as Microsoft Project, use of other appropriate and available software and applications, e.g. spreadsheets, graphics, databases etc.
Learning Outcome 3: Monitor: routine communications with stakeholders, interim reviews, use of logbooks, routine updating of plan where necessary, others e.g. accessing additional resources where necessary, reacting to unforeseen circumstances. Tracking progress: project baseline and variance, monitoring and recording progress, checkpoint reports as a way of recording milestones achieved, monitoring risk and managing issues, recording quality management activity. Review of project success in terms of key factors, SMART objectives and views of stakeholders: review of lessons learned, review project performance against the baseline and project objectives, review of final cost, delivery date and quality of product delivered, review feedback from key stakeholders (clients, end users). Methods to obtain feedback: interviews, questionnaires, surveys, observation of resulting processes. Recommendations for future actions based on the outcome of the post-project review, communication and presenting requirements for reviews.

Specialist Units

Cloud Technologies

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	T/618/5242
Unit Aim:	This unit explores cloud technologies and services and the models used to deliver them. Learners will learn about the fundamentals of cloud services and the security protocols used to protect data in organisations. They will also setup and configure a cloud using virtual machines and understand the importance of disaster recovery plans to ensure date can be recovered.

This unit has 4 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the fundamentals of cloud services.	1.1 Identify the characteristics of cloud services. 1.2 Explain different types of cloud service delivery and deployment models and their functionality. 1.3 Evaluate the benefits and limitations of different types of cloud service delivery and deployment models. 1.4 Describe how DNS records are used in cloud services.
2 Understand cloud security.	2.1 Describe the characteristics of passwords and how they are configured and managed in cloud services. 2.2 Explain how users, groups and identities are managed in cloud services. 2.3 Discuss the security threats to cloud services and the methods available to minimise risk.
3 Apply cloud technologies to virtual environments.	3.1 Setup and configure a cloud using virtual machines. 3.2 Explain the benefits and drawbacks of virtual machines and cloud-based applications.
4 Apply cloud backup and recovery methods.	4.1 Produce a cloud backup policy and disaster recovery plan to meet organisational requirements.

Indicative Content: Cloud Technologies
Learning Outcome 1: Characteristics of cloud services: on-demand usage, ubiquitous access, multi-tenancy, resiliency, measured usage, elasticity/scalability. Types of delivery model: IaaS (infrastructure as a service), PaaS (platform as a service), SaaS (software as a service), DaaS (data as a service). Types of deployment model: public, community, private, hybrid. Types of DNS records: A record, CNAME record, TXT record, AAAA record, MXENTRY record.
Learning Outcome 2: Characteristics of passwords: changed regularly, more than eight characters long, unique for each service, not using personal data, combination of alphanumeric characters, cases and symbols. Configuration and management of passwords: multi-factor authentication, automated password reset, password policy and enforcement. Management of users and groups: create security groups, configure security groups, cloud connectivity, invite/edit/remove users, manage application access, check login statistics. Management of cloud identities: identity provisioning (on-boarding and off-boarding), identity management (across multiple organisations, services, devices). security threats: insider threats (malicious and accidental), denial-of-service (DoS) attacks, SYN flood, HTTP flood, distributed denial-of-service (DDoS) attack, insecure application programming interfaces (APIs), malware, (spyware, worms, Trojans, viruses, adware, ransomware). Minimise risk: computer usage policies, staff training, access rights/permissions, regular password resetting, malware software/malware checking, certification of APIs, collaboration of user knowledge/experience, using white/grey hat hackers, SYN cookies, collection of reverse proxies.
Learning Outcome 3: Setup and configuration of virtual machines: types of virtual machines and their characteristics, application, desktop (virtual desktop infrastructure (VDI), hardware (hypervisor), network, storage. Resource allocation (host, operating system (OS), memory, storage, CPU, network). Configuration (resource group names, network names, subnet network name, storage account name). Benefits and limitations of virtual machines: Benefits familiar interfaces, high availability, scalability, easy cloning, fast backup and recovery.

Indicative Content: Cloud Technologies
Limitations: security, potential downtime, oversubscription. Benefits of cloud-based applications: automated application updates, availability on multiple devices/platforms - increased productivity, collaboration, reduces hardware costs, version control, file compatibility, security, support, automated saving.
Learning Outcome 4: Cloud backup policy: location (onsite, offsite), types of backup (full, partial, differential, mirror, incremental), frequency. disaster recovery plan: identify personnel, assess risks and impacts on each part of the organisation, provide step-by-step protocols (where the plan is to be found, what to do in the event of a disaster and who to contact), identify new location and equipment (where staff can work if unable to open normal place of work, what technology is available, supplier for hardware and software), identify backup locations (personnel involved, backup policies and disk of restore), provide emergency communications (who to contact, how to contact and key messages) agree timescales, service-level agreement (SLA). Maintaining a disaster recovery plan: keeping information up to date, testing protocols, minimising risks.

Data Communications

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	T/618/5211
Unit Aim:	This unit explores data communication, transmission methods and protocols that enable connectivity and transmission of data, including signal theory. Learners will learn why particular transmission methods are chosen for particular situations and be able to compare the effectiveness of these different methods. Learners will also be able to apply knowledge and understanding by connecting communication devices between users.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the principles of data communications.	1.1 Explain the use and features of different types of communication devices. 1.2 Explain how networks communicate. 1.3 Explain how different communication protocols are used to govern and control data transmission.
2 Understand the features of data communications systems.	2.1 Describe the main elements of data communication systems. 2.2 Explain the principles of signal theory. 2.3 Compare the effectiveness of different transmission methods.
3 Be able to implement different forms of network communications.	3.1 Create direct network communication between two users. 3.2 Set up interconnection devices for direct communication.

Indicative Content: Data Communications
Learning Outcome 1: Communication devices: wired devices e.g. data terminal equipment (DTE), data circuit-terminating equipment (DCE), wireless devices, GPRS, mobile phones, laptops, netbooks, tablets. Computer networks: types e.g. LAN, WAN, wireless, network topologies e.g. star, mesh, bus, tree (or hierarchical), ring, network services e.g. packet switched, ISDN, multiplexed, ATM, WAP, broadband, network software e.g. network operating system, network connection software, access methods e.g. CSMA/CD, CSMA/CA, token passing. Network components: servers, workstation, network cards e.g. Ethernet, wireless, token ring Interconnection devices: e.g. switches, routers, bridges, wireless access points, mobile base stations Models: e.g. open system interconnection (OSI) model, TCP/IP model Protocols: e.g. Bluetooth, Wi-Fi, IrDa, cellular radio, GSM/UMTS, WAP, WML, 802.11 standards, TCP/IP, wireless security protocols.
Learning Outcome 2: Elements: communication devices, data elements, electronic communication methods, transmission media and methods. Signal theory: digital signalling methods, representing data electronically (bits, bytes, packet structures), synchronous transmission, asynchronous transmission, error detection, error correction, bandwidth limitation, bandwidth noise, channel types e.g. telephone, high frequency (HF) radio, microwave, satellite, other issues e.g. bandwidth, data compression. Data elements: checksum e.g. cyclic redundancy check (CRC), encapsulation e.g. frames, packets, datagrams, addresses, sequence numbers. Electronic communication: methods e.g. simplex, duplex, half-duplex communication, parallel, universal serial bus, serial, infra-red, Bluetooth, WiFi, 3G, 4G, 5G etc. Transmission: methods e.g. coaxial, optical fibre, unshielded twisted pair (UTP), shielded twisted pair (STP), infrared, radio, microwave, satellite.
Learning Outcome 3: Internet communication: terminology e.g. HTTP, HTTPS, FTP, SMTP, uniform resource locator, worldwide web, other e.g. blogs, wikis, video conferencing, vlogs, social networking. System requirements: wired or mobile systems, communication services e.g. email, video, internet, software, configuration. Direct communication: e.g. instant messaging, video communication, email, web phone, social networking, web conferencing, desktop sharing. Interconnection devices: e.g. switches, routers, bridges, wireless access points, mobile base stations.

Networking

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	H/618/5219
Unit Aim:	Learners will understand the key components of networks and will also learn about the protocols and the services provided by networks. They will explore the technologies and devices used in networking and be able to design and maintain a secure network.

This unit has 5 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand networks and their components.	1.1 Explain different types of networks. 1.2 Describe networking components and technologies. 1.3 Explain why different network standards and protocols are necessary.
2 Be able to apply numerical skills for network addressing.	2.1 Identify the characteristics of common (IP) addresses 2.2 Apply binary conversion and arithmetic. 2.3 Apply subnetting to different IP addresses.
3 Understand network connectivity.	3.1 Explain the purpose and characteristics of different types of cable. 3.2 Explain the purpose and characteristics of wireless systems, antennas and devices. 3.3 Explain how test equipment for wired and wireless networks is used.
4 Understand how to configure and maintain a secure network.	4.1 Design a network to meet specified requirements. 4.2 Explain how to support and maintain network security.
5 Understand networking maintenance practices and processes.	5.1 Explain how different tools are used in network maintenance and performance monitoring. 5.2 Describe methods for managing local storage.

Indicative Content: Networking
Learning Outcome 1: Types of network: local area network (LAN), wide area network (WAN), internet, WAN technologies e.g. frame relay, MPLS, ATM, Personal Area Network (PAN), logical and physical topologies e.g. star, bus, ring, mesh, tree, network access methods e.g. CSMA, Token passing, network models e.g. OSI 7 layer, TCP/IP. Components: workstations, servers, domain controllers, firewalls, routers, switches, wireless access point, wireless routers, interconnection devices, connectors and cabling, software, commercial systems. Networking technologies: Active Directory (AD), Lightweight Directory Access Protocol (LDAP), Dynamic Host Configuration Protocol (DHCP), Domain Name System (DNS), Network address translation (NAT), Access control (rights and permissions). Common networking ports: HTTP (80), HTTPS (443), POP3 (110), FTP (21), IMAP (143), DHCP (67/68), SMTP (25), DNS (53). Network protocols and standards: types e.g. TCP/IP, AppleTalk, UDP, 802.2, 802.3, FDDI, 802.5, wireless technologies e.g. 802.11, infrared, Bluetooth, 3G, factors affecting range and speed of wireless technologies. Application layer protocols: types e.g. DNS, DHCP, HTTP, FTP, SMTP.
Learning Outcome 2: Characteristics of common (IP) addresses: IP version 4 addressing principles: dotted decimal format, classes (A-D), public and private addresses, address categories (default gateway, loopback address, broadcast address). IP version 6 address representation (full and abbreviated representations), format (prefix, subnet ID, interface ID). Apply binary conversion and arithmetic, binary to decimal, decimal to binary conversion (up to eight bits). Apply subnetting to different IP addresses: subnet masks, subnets (number of hosts, number of networks, starting and ending IP addresses).
Learning Outcome 3: Cable characteristics (transmission speed, segment length) and connectors, coaxial, F-type connector, twisted pair (shielded/unshielded), cat 1-6 cables, RJ 45 connector (straight-through cable, crossover cables, rollover cables), fibre optic (multi-mode, single mode), standards (10BaseT, 100BaseT, 1000BaseT). Characteristics of wireless systems, antennas and devices, directional, omnidirectional, multiple-input multiple-output (MIMO), point-to-point, point-to-multi point, wireless access points, routers and endpoint device, Bluetooth connectivity, standards (802.11 a, 802.11 b, 802.11 g, 802.11 n, 802.11 AC), speed, security, coverage. Test equipment used for wired and wireless networks: cable tester, loopback, continuity tester, tone probe, wire map tester, wireless locator/Wi-Fi analyser, wireless heat map, optical time-domain reflexometer (OTDR).

Indicative Content: Networking
Learning Outcome 4: Network design should show the purpose and characteristics of networking devices and technologies. Support and maintain network security: access control (rights and permissions), password policies, encryption, virtual private network (VPN), virtual local area network (VLAN), configuring security devices and software.
Learning Outcome 5: Tools for network maintenance and performance monitoring: Software utilities: ping (loopback address, default gateway, local hosts), tracert, ipconfig (/renew, /release, /all), netstat, nslookup), Command-line interface (CLI), system logs, system monitor, network monitor. Maintenance records (help desk records, job sheets, fault logs, CRM). Knowledge base: updates (automatic, manual, server updates services), remote assistant, remote desktop. Methods of managing local storage: disk quotas, mapping drives, disk cleanup, redundant array of independent disks (RAID 0, RAID 1, RAID 5, RAID 10), rights and permissions.

System Management and Support

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	A/618/5243
Unit Aim:	Learners will study how systems are managed and supported, and the tools and activities that can be used to assist organisations and users.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand system support, management and associated tools.	1.1 Explain the different activities involved in system management and support. 1.2 Explain the tools that assist system management and support activities.
2 Be able to plan the infrastructure for a system.	2.1 Produce a plan for managing and supporting a system to meet organisational requirements. 2.2 Improve the plan in response to feedback.
3 Be able to implement and carry out system management and support activities.	3.1 Implement a system to meet organisational requirements. 3.2 Test the system to ensure it meets organisational requirements. 3.3 Carry out system management and support activities and produce user and maintenance documentation.

Indicative Content: System Management and Support

Learning Outcome 1:

Live system management: configuring systems to support users and applications and secure the system, providing technical support to users, managing users, creating accounts, allocating passwords and setting access levels, monitoring of usage and identification of misuse, fault-finding, use of fault recording database, updating solutions to faults, setting up and running backup and restore procedures.

Security procedures: antivirus scans, firewall configuration o access control, configuring security policies o managing security patches and updates, management of software, centralised software rollout and updates, license management.

Drive management: imaging, drive mapping, network management, protocol and IP (internet protocol) address management.

System maintenance and disaster recovery: contingency planning to deal with major problems, strategic long-term planning of hardware and software developments, e.g. operating system upgrades, server hardware updating or expansion, formulating and updating a network code of practice, supervision and management of network staff, advising senior management, legal and ethical considerations.

Tools: servers and virtual PCs, cloud storage, mobile devices, laptops, desktops, bring your own device (BYOD), performance monitoring and management tools, provision of user desktop computing by various means, including server virtualisation with thin client computing and web-based applications, managing user support requests.

Learning Outcome 2:

Management and support procedures: working with users to develop procedures for the management and support of systems, creating a code of practice, developing support request reporting and escalation procedures, installation and setup of support request database, agreeing a service level agreement, developing contingency plans, user support documentation, creation of security policies, access control and traffic management expectations.

User desktop interface: working with clients to develop a standard user desktop environment for installation on user PCs, including selection of operating system, applications, versions and settings to create desktop disk image, testing of the desktop image, defining user groups, user rights and security policies.

System planning: typical system requirements, taking into account client requirements and growth of the system, defining disk space requirements, quotas, drive mappings, network design, IP addressing, subnetting, backup procedures.

Indicative Content: System Management and Support

Learning Outcome 3:

Support activities: helpdesk and technical support, fault logging and management, communicating with users o routine support and repair tasks, analysis of support data to identify problem areas and trends, account management (user account creation passwords resets), setting and adjusting access and permissions, storage areas and limits.

Implementation activities: system configuration, (adjusting settings on server and client machines, usage monitoring, bandwidth, bottlenecks, storage, use of peripherals), software management, (patches, upgrades, security updates, new application rollout, software removal), device configuration (firewalls, routers, wireless access points, joining a mobile device to a network, disk configuration, creating network shared drives, creating user system disk images, setting permissions on folders, backup and restore.

System testing/optimisation: firewalls and access control rules, latest patches and known vulnerabilities, device hardening as required, management of system permissions, auditing the access rights of users.

Traffic optimisation: checking performance, under load, throughput and speed, identifying the contention (bottleneck) points and how these might be managed.

System Security and Encryption

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	R/618/5247
Unit Aim:	Learners will investigate different system security threats and the methods used to protect against them. They will learn how encryption can be used to protect data and will plan and undertake activities to protect systems from security attacks and vulnerabilities while complying with legal and organisational requirements.

This unit has 4 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand security threats and the legal requirements affecting system security.	1.1 Explain different system security threats and their potential impact on organisations. 1.2 Explain the principles of data security and the legal requirements organisations must adhere to.
2 Understand cryptographic techniques and processes used to protect data.	2.1 Explain the principles and uses of cryptography. 2.2 Assess the impact of encryption and data protection on security and legal issues. 2.3 Evaluate the effectiveness of different applications of cryptography.
3 Understand the techniques used to protect systems from security threats.	3.1 Explain how different protection techniques can help protect systems in an organisation.
4 Be able to implement strategies to protect systems from security threats.	4.1 Produce a system security plan of the protection to be applied in line with legal and organisational requirements. 4.2 Perform tasks to protect a system and review the extent and level of protection applied.

Indicative Content: System Security and Encryption
Learning Outcome 1: Current security threats and techniques (which are continually evolving), including: internal threats, external threats, physical threats, social engineering and software-driven threats, techniques used to obtain secure information (software that has a malicious intent). Network-based threats: passive threats, including wiretapping, port scanning and idle scanning. Active threats, including denial-of-service attack, spoofing, man in the middle, Address Resolution Protocol (ARP) poisoning, smurf attack, buffer overflow, heap overflow, format string attack, Structured Query Language (SQL) injection and cyber-attack. Cloud computing security risks. Data security risks: principles of confidentiality, integrity and availability of information, unauthorised access or modification of information, deliberate or accidental loss of information, the need to protect intellectual property from theft or malicious damage. Legal requirements: data protection legislation and the requirements it places on organisations to keep data about stakeholders secure. Computer misuse legislation and its definitions of illegal practices and applications. Copyright designs and patents legislation and its requirements in terms of protecting software products and digital media such as music and films. Telecommunications (Lawful Business Practice) (Interception of Communications) regulations and their requirement to allow companies to monitor employee communication using systems and other uses of the internet while at work. Fraud legislation, legal liability and contractual obligations. System security breach is likely to result in one or more of the following: operational impact on an organisation of the loss of data or service, financial impact of loss of service, such as an e-commerce website damage to reputation, legal consequences of data privacy breaches, forensics research requirements to identify data lost, stolen or copied.
Learning Outcome 2: Cryptographic principles: digital rights management (DRM), password storing and salts; obfuscation and steganography; secure transactions, multi-factor authentication; file, folder, disk encryption; encryption of communication data. Cryptography methods: shift ciphers, one-time pads, hash functions (e.g. MD4, MD5, SHA-2 SHA-3), block ciphers, stream ciphers, cryptographic primitives, e.g. pseudo random functions, one-way functions, cryptographic salts and their use in storing passwords, encryption algorithms, e.g. RSA, DES, 3DES, mathematical principles, integer factorisation, prediction of prime numbers. Applications of cryptography: symmetric key encryption, public key encryption, key exchanges (Diffe-Hellman), digital certificates (including certificate authorities), HTTPS protocol, virtual private networks (VPNs), Generic Routing Encapsulation (GRE) tunnel, encryption of data on Wi-Fi networks.

Indicative Content: System Security and Encryption
Learning Outcome 3: Physical security: door locks, card key entry, closed circuit television (CCTV), voice control and biometric scans, DNA identification technology, servers, routers, switches kept in a secure location with controlled access, backing up data, e.g. full back-up, differential and incremental backups, use of a fire safe and off-site data storage, disaster recovery plans for use when an organisation's systems become unavailable. Organisational policies and their application, including internet and email use policies, security and password procedures, staff responsibilities, training of staff on IT security issues, disciplinary procedures, security audits and their application to check compliance of policies and procedures. Software based protection: anti-virus software and detection techniques, software and hardware firewalls and filtering techniques, domain management, user authentication, access controls and the methods they use to restrict authorised/unauthorised users access to resources.
Learning Outcome 4: Protection strategies: organisational policies, anti-malware protection, firewall configuration, wireless security, access control, testing and reviewing protection applied.

Systems Analysis

Level:	Level 3
Credit Value:	6
GLH:	42
Unit Number:	D/618/5185
Unit Aim:	Learners will investigate the principles of systems analysis and learn to use systems analysis methods to examine an organisation and its current systems. They will also develop the skills needed to design a system solution to meet organisational requirements.

This unit has 3 learning outcomes.

LEARNING OUTCOMES The learner will:	ASSESSMENT CRITERIA The learner can:
1 Understand the principles of systems analysis.	1.1 Illustrate the stages of the systems lifecycle. 1.2 Compare different software development models used by industry. 1.3 Assess the suitability of different systems analysis tools and techniques for modelling business processes.
2 Be able to investigate IT requirements to meet business needs.	2.1 Produce a system requirements specification for an identified organisation.
3 Be able to develop a design for an IT system to meet business needs.	3.1 Produce a design for a system, justifying decisions. 3.2 Obtain feedback to refine the design.

Indicative Content: Systems Analysis
Learning Outcome 1: - Systems life cycle stages: definition, investigation and analysis, design, implementation, testing, documentation, evaluation, maintenance. - Development lifecycle models: Waterfall, other e.g. Spiral, Rapid Applications Development (RAD), agile methodologies, e.g. Scrum, dynamic systems development method (DSDM), adaptive software development (ASD), prototyping, benefits, stages e.g. initiation and feasibility, investigation, requirements analysis and specification, design (logical and physical), build systems, testing, implementation, maintenance. - Systems analysis tools and techniques: any contemporary methodology for systems analysis and design, typical e.g. activity diagrams, dataflow diagrams, computer-aided software engineering tools (CASE). - Structured systems analysis and design method (SSADM), Unified Modelling Language (UML), structure (static) diagrams, e.g. class diagram, component diagram, behaviour (dynamic) diagrams, e.g. activity diagram, use case diagram, interaction diagrams, suitability of methods for different programming paradigms, e.g. object-oriented, event-driven, procedural, business process reengineering (BPR). - Key drivers: business need, e.g. need for growth, company acquisition, need to increase productivity, legal requirements.
Learning Outcome 2: - Business needs of an identified organisation: the aims and requirements of an organisation, and how IT is used to support: the services an organisation provides, aims and goals of an organisation, customers – needs, expectations, how product/service is delivered, staff – needs, working styles and patterns, location – staff, customers, premises, market/service delivery point. - Investigation: techniques e.g. interview, questionnaire, meeting, observation, document analysis, data analysis, sensitivity in collecting information and observing individuals at work. - Analysis: as related to the chosen methodology, cost-benefit analysis. - Threats - factors affecting the success and failure of a current system: risks, e.g. completing tasks, budget, missed deadline(s), stakeholder support, staff involvement, constraints, e.g. costs, scope, time, provision of appropriate resources, e.g. people, time, budgets, maintenance system, change management, user involvement in the development process. - Requirements specification: contents e.g. scope, inputs, outputs, processes, costs and benefits, recommendations, alternative solutions.
Learning Outcome 3: - Design: input and output requirements (appropriate and detailed design documentation for the input and output of the proposed system) including: visuals, e.g. screen layouts, storyboards, alternative layout for different platforms and devices, data entry forms, including layout and structure, proposed fields, data entry methods, report forms, hardware and software requirements.

Indicative Content: Systems Analysis
- Data and processes within a system (the data requirements of and use within a proposed system) including: modelling data, e.g. entity relationship diagrams, data flow diagrams, data dictionaries, e.g. data stores, entities, data structures, validation, process modelling using a variety of tools, e.g. flow charts, decision tables, activity diagrams. - Testing and maintenance methodologies (a plan for testing and maintenance of the proposed system) including: • testing methods, e.g. volume testing, scalability, multiplatform, developing test plans, identifying test data, e.g. normal, extreme, abnormal, choosing test users, proposed test schedule, proposed maintenance and update schedule.

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