GCE AS/A LEVEL

wjec cbac

WJEC GCE AS/A Level in DIGITAL TECHNOLOGY

APPROVED BY QUALIFICATIONS WALES

SPECIFICATION

Teaching from 2022

For AS award from 2023
For A level award from 2024

This Qualifications Wales regulated qualification is not available to centres in England.

WJEC GCE AS and A level in DIGITAL TECHNOLOGY

For teaching from 2022
For AS award from 2023
For A level award from 2024

This specification meets the requirements of the following regulatory documents published by Qualifications Wales:

- Approval Criteria for GCE AS and A level Qualifications which set out the requirements for all new or revised GCE specifications developed to be taught in Wales from September 2017.
- Approval Criteria for GCE AS and A level Digital Technology which set out the requirements for all qualifications in this subject to be taught in Wales from September 2022.

GCE AS and A LEVEL DIGITAL TECHNOLOGY (Wales)

SUMMARY OF ASSESSMENT

This specification is divided into a total of 4 units, 2 AS units and 2 A2 units. Weightings noted below are expressed in terms of the full A level qualification.

AS Units

AS Unit 1: Innovation in Digital Technology Written examination: 2 hours 20% of qualification — 80 marks: 100 UMS
An assessment (taken on-screen), comprising of a range of question types to assess specification content related to *connected digital systems and smart devices*, *the development of Artificial Intelligence*, *digital technology development life cycles*, *user experience and human computer interaction in digital systems development* and *the functions, purposes and uses of social media by individuals and organisations*. All questions are compulsory.
AS Unit 2: Creative Digital Practices Non-exam assessment (NEA): approximately 45 hours 20% of qualification — 80 marks: 100 UMS
A non-examined assessment focussing on the end to end creation of a game. Candidates will investigate, plan, design, create, test and review a game of their choice.

A level Units (the above plus a further 2 units)

A2 Unit 3: Connected Systems Written examination: 2 hours 30 minutes 30% of qualification — 100 marks: 150 UMS
An assessment (taken on-screen), comprising of a range of question types to assess specification content related to *collecting, storing, analysing and using data*, *cyber security*, and *digital technology networks.* All questions are compulsory.
A2 Unit 4: Digital Solutions Non-exam assessment (NEA): approximately 45 hours 30% of qualification — 100 marks: 150 UMS
A non-examined assessment focussing on the creation of a transactional website linked to a server-based RDBMS. Candidates will plan, design, create, develop, review, test and refine a transactional website of their choice.

This is a unitised specification which allows for an element of staged assessment. Assessment opportunities will be available in the summer assessment period each year, until the end of the life of the specification.

Unit 1 and Unit 2 will be available in 2023 (and each year thereafter) and the AS qualification will be awarded for the first time in summer 2023.

Unit 3 and Unit 4 will be available in 2024 (and each year thereafter) and the A level qualification will be awarded for the first time in summer 2024.

Qualification	Unit 1 from 2023	Unit 2 from 2023	Unit 3 from 2024	Unit 4 from 2024
AS Digital Technology	✓	✓	-	-
A level Digital Technology	✓	✓	✓	✓

Qualification Approval Numbers

Qualification Numbers listed on The Register:
AS: 610/1544/1
A Level: 610/1535/0

Qualifications Wales Approval Numbers listed on QiW:
GCE AS: C00/4451/6
GCE A level: C00/4322/1

GCE AS and A LEVEL DIGITAL TECHNOLOGY

1 INTRODUCTION

1.1 Aims and objectives

The WJEC GCE AS and A level qualification in Digital Technology advances learners' understanding of the digital technologies that are used by individuals and organisations across the world, including how they have developed and how they continue to change.

The qualification enables learners to develop a deep understanding of how innovations in digital technology, and the increasing levels of connectivity between them, impact the lives of those who use them and the wider society.

Learners will also develop practical skills in developing both creative digital products and digital solutions to problems faced by organisations, supporting their progression into employment in a career that utilises digital technologies or onto a programme of higher education involving digital technologies.

The qualification may be taken by those who have previously studied WJEC GCSE Digital Technology or those who are interested in developing new skills in this subject area. The qualification will be of particular value to those with an interest in working in digital technology or continuing their studies in this subject area in higher education. It is, nonetheless, designed to appeal to a broad range of learners with different interests and may complement the study of a wide range of other subjects, including computer science, mathematics, physics, geography, design and technology, economics, business studies, art and design, history and geology.

This WJEC GCE specification in Digital Technology will enable learners to develop:

- an understanding of significant past, current and emerging digital technologies
- an understanding of the integrated and connected nature of digital technologies used by individuals and organisations
- skills in researching and exploring issues before finding and implementing effective solutions to them
- skills in planning, designing and creating innovative web-based and multimedia content that meets the needs of specific audiences
- an understanding of legal, social, ethical and professional and environmental impacts of digital technologies on individuals and wider society
- a knowledge of the systems development life cycle and its iterative and cyclical nature.

1.2 Prior learning and progression

This specification builds on the knowledge, understanding and skills established at GCSE. Some learners may have already gained knowledge, understanding and skills through their study of Digital Technology at GCSE. However, there are no prior learning requirements for this specification. Any requirements set for entry to a course following this specification are at the discretion of centres.

It is reasonable to assume that many learners will have achieved qualifications equivalent to Level 2 at KS4. Skills in Numeracy/Mathematics, Literacy/English and Digital Technology will provide good basis for progression to this Level 3 qualification, as will knowledge and understanding gained through the study of Level 2 sector/subject related qualifications.

This specification provides a suitable foundation for the study of Digital Technology or a related area through a range of higher education courses, progression to the next level of vocational qualifications or employment. In addition, the specification provides a coherent, satisfying and worthwhile course of study for learners who do not progress to further study in this subject.

This specification is not age specific and, as such, provides opportunities for learners to extend their life-long learning.

1.3 Equality and fair access

This specification may be followed by any learner, irrespective of gender, ethnic, religious or cultural background. It has been designed to avoid, where possible, features that could, without justification, make it more difficult for a learner to achieve because they have a particular protected characteristic.

The protected characteristics under the Equality Act 2010 are age, disability, gender reassignment, pregnancy and maternity, race, religion or belief, sex and sexual orientation, marriage and civil partnership.

The specification has been discussed with groups who represent the interests of a diverse range of learners, and the specification will be kept under review.

Reasonable adjustments are made for certain learners in order to enable them to access the assessments (for example, candidates are allowed access to a Sign Language Interpreter, using British Sign Language). Information on reasonable adjustments is found in the following document from the Joint Council for Qualifications (JCQ): *Access Arrangements and Reasonable Adjustments: General and Vocational Qualifications.*

This document is available on the JCQ website (www.jcq.org.uk). As a consequence of provision for reasonable adjustments, very few learners will have a complete barrier to any part of the assessment.

1.4 Welsh Baccalaureate

In following this specification, learners should be given opportunities, where appropriate, to develop the skills that are being assessed through the Skills Challenge Certificate within the Welsh Baccalaureate:

- Literacy
- Numeracy
- Digital literacy
- Critical thinking and problem solving
- Planning and organisation
- Creativity and innovation
- Personal effectiveness.

1.5 Welsh perspective

In following this specification, learners must consider a Welsh perspective if the opportunity arises naturally from the subject matter and if its inclusion would enrich learners' understanding of the world around them as citizens of Wales as well as the UK and the world. There are opportunities with the NEA units for learners to work within a Welsh context.

2 SUBJECT CONTENT

The subject content and assessment requirements are designed to ensure learners develop an appropriate breadth and depth of knowledge, understanding and skills in digital technology.

The subject content is presented in four units, each sub-divided into clear and distinct topic areas. Within each topic area the knowledge, understanding and skills are set out with an initial overview and then in two columns. The left hand column identifies the content to be studied. The right hand column provides amplification of the knowledge, understanding and skills that learners should develop in this area.

The amplification is designed to be exhaustive and clarify the breadth and depth of study required. *'Such as…'* or *'for example…*' are used only where it is helpful to place an aspect of the amplification in context. *'Including…'* is used to help clarify the breadth of an aspect of amplification or topic. Learners may choose to study the topic in greater breadth (i.e. beyond the scope of exemplification included in the amplification), as all relevant information may gain credit in the assessments. However, the focus of questions will always be on the amplification provided within the specification. Together, the content and the amplification columns give the full content of the specification.

There is no hierarchy implied by the order in which the content is presented. However, as Units 1 and 2 are at AS level and Units 3 and 4 are at A2 level, it is recommended that Units 1 and 2 are covered before Units 3 and 4.

Whilst the assessment for each unit focuses on the content specific to that unit, candidates may make relevant reference to content from other units.

Learners may apply knowledge, skills and understanding gained from Units 1 and 2 in their study of Units 3 and 4. Thus they are provided with the opportunity to make connections between, and demonstrate their knowledge and understanding of, elements from across the full course of study.

2.1	**Unit 1:** AS & A level **Innovation in Digital Technology**
2.1.1	Connected digital systems and smart devices
2.1.2	The development of Artificial Intelligence
2.1.3	Digital technology development life cycles
2.1.4	User-centred design, user experience and human-computer interaction in digital systems development
2.1.5	Functions, purposes and uses of social media by individuals and organisations
Integrated within relevant aspects of content in this unit, learners will explore a range of legal, social, ethical and professional dimensions.	

2.2	**Unit 2:** AS & A level **Creative Digital Practices**
2.2.1	Investigating games
2.2.2	Planning games
2.2.3	Making informed design decisions
2.2.4	Creating games
2.2.5	Testing and developing games
2.2.6	Refining and reviewing games
2.2.7	Presenting outcomes

2.3	**Unit 3:** A level **Connected Systems**
2.3.1	Contemporary practices involved in collecting, storing, analysing and using data
2.3.2	Cyber security
2.3.3	Digital technology networks
Integrated within relevant aspects of content in this unit, learners will explore a range of legal, social, ethical and professional dimensions.	

2.4	**Unit 4:** A level **Digital Solutions**
2.4.1	Investigating transactional websites
2.4.2	The design of transactional websites
2.4.3	The capture, storage and processing of data
2.4.4	The use of RDBMS database systems, scripting languages and SQL
2.4.5	Developing and reviewing transactional websites
2.4.6	Testing, refining and evaluating transactional websites
2.4.7	Presenting outcomes

2.1 AS Unit 1

Innovation in Digital Technology

On-screen examination 2 hours
50% of AS qualification
20% of A level qualification
80 marks

The examination must be conducted in accordance with *Instructions for Conducting Examinations*, available at www.jcq.org.uk.

Overview of unit

In this unit learners will develop knowledge, skills and understanding in:

- how connected digital systems operate
- the development and impact of Artificial Intelligence
- the life cycle of digital technologies
- how systems are designed to promote positive experiences and interactions and to be user-centric
- the types of social media and their impact.

Areas of content

Learners should be given the opportunity to develop their knowledge and understanding of the five areas of content set out on pages 10 to 19.

2.1.1	Connected digital systems and smart devices
2.1.2	The development of Artificial Intelligence
2.1.3	Digital technology development life cycles
2.1.4	User-centred design, user experience and human-computer interaction in digital systems development
2.1.5	Functions, purposes and uses of social media by individuals and organisations
Integrated within relevant aspects of content in this unit, learners will explore a range of legal, social, ethical and professional dimensions.	

2.1.1 Connected digital systems and smart devices

In this section learners will gain knowledge and understanding of the following:

- how digital systems connect
- the Internet of Things (IoT)
- use of smart devices in domestic settings, the built environment and manufacturing
- impacts of the IoT.

Content		Amplification

(a)	How digital systems connect	Learners should understand:
		• the main components of network communication hardware and be able to explain their role in the transmission of data
		• protocols and standards
		• protocols and platforms that are commonly used by digital systems.
		
		Learners should be able to explain how the following function:
		• Ethernet
		• Wi-Fi
		• Bluetooth
		• TCP/IP
		• 2G(GSM)/2.5G(GPRS)/3G/4G/5G
		• common types of transmission media:
		  • wired (CAT5, CAT6, CAT6a)
		  • fibre (FTTC and FTTP)
		  • wireless (radio, microwave, satellite, infrared).
		
		Learners should understand:
		• comparative capacity of wired, fibre and wireless media
		• that networks may be wired or wireless, Local Area Networks (LANs/WLANs) or Wide Area Networks (WANs)
		• common uses of such network types and differences in transmission speeds between LANs and WANs.

Content		Amplification

(b)	The Internet of Things (IoT)	Learners should understand:
		• the four phases in the evolution of the Internet:
		  • connectivity
		  • networked economy
		  • collaborative experiences
		  • Internet of Everything (IoE)
		• the Internet of Things (IoT) in terms of a network of physical objects, with a unique identifier, combined with an embedded system of sensors, software and communication technologies
		• the definition of 'things' in terms of physical objects, machines, interactive devices and assistive devices
		• the need for IPv6 (due to the limitations of IPv4) to implement the IoT
		• the four pillars of the IoE:
		  • people
		  • process
		  • data
		  • things
		• the three main interactions within the IoE:
		  • People to People (P2P)
		  • Machine to People (M2P)
		  • Machine to Machine (M2M).

(c)	Use of smart devices in domestic settings, the built environment and manufacturing	Learners should understand:
		• the contexts smart devices are typically used within:
		  • the home (e.g. smart speakers, TVs, fridges, watches)
		  • the built environment (e.g. heating, lighting, parking)
		  • manufacturing (e.g. Industry 4.0, scanners, smart glasses)
		• the underlying technologies, including:
		  • sensors
		  • software and communication technologies
		  • how the device(s) controls the required process(es)
		• the positive and negative impacts of the underlying technologies
		• the social, legal, ethical and professional impact of the use of smart devices in the home and workplace
		• the environmental impacts of the proliferation of devices in terms of their manufacture, use and disposal, as well as the consumption of finite resources such as electricity.

(d)	Impacts of the IoT	Learners should understand the positive and negative impacts of the IoT.

2.1.2 The development of Artificial Intelligence

In this section learners will gain knowledge and understanding of the following:

- Artificial Intelligence (AI)
- Machine Learning (ML)
- robotics
- applications, functions and potential uses of AI systems
- impacts of AI.

Content		Amplification

(a)	Artificial Intelligence (AI)	Learners should understand:
		• the term Artificial Intelligence (AI) in terms of the simulation of intelligent behaviour by a computer which enables a machine to make decisions without human intervention
		• the theoretical concepts of Artificial General Intelligence (AGI) Artificial Narrow Intelligence (Specialist AI/ANI) and the differences between them
		Learners should be able to describe the following tests used to confirm human-level AGI and how they are applied:
		  • The Turing test
		  • Wozniak/Goertzel's Coffee Test
		  • Nilsson's Employment Test
		  • Goertzel's Robot College Student Test
		Learners should understand:
		• the three enablers of AI and how these have impacted AI's proliferation:
		  • the exponential growth in the speed of computers
		  • Huang's Law
		  • cloud computing.
		• the ethical constraints and social implications of AI.

(b)	Machine Learning (ML)	Learners should understand:
		• Machine Learning (ML) is a subset of Artificial Intelligence (AI) in terms of algorithms that can adapt without following explicit instructions
		• the difference between traditional algorithms and ML algorithms used in AI in terms of:
		  • the results of ML algorithms returning probabilities not certainties
		  • the instructions not being pre-set in advance but learned from 'training data'
		• the difference between supervised, semi-supervised and unsupervised learning within ML.

Content		Amplification
(c)	Robotics	Learners should understand: • the term robot • the main components of a contemporary robotic system and the role of these components • the following types of programming used for robots: Online: • Teach Pendant Programming (Drive Through) • Teach by Example (Lead Through) Offline: • Graphical-offline programming (simulation) • the uses of different types of robots in a variety of scenarios (e.g. the home, education, manufacturing) • the relative advantages and disadvantages of using robots in a variety of scenarios, (e.g. greater consistency, reduced labour costs, high initial costs, impacts on employment) • the concerns that individuals may have with the development of autonomous robots (e.g. crisis decision making, fear of replacement, social isolation) • the potential unintended consequences of the development of autonomous robots (e.g. removal of unskilled jobs, lack of accountability, dehumanisation) • how developers can protect against such unintended consequences (e.g. Asimov's rules, conformance to a legal and ethical framework) • the social and ethical implications associated with the increased use of robotics.

Content		Amplification

(d)	Applications, functions and potential uses of AI systems	Learners should understand:
		• underpinning technologies of AI, including:
		  • conditional probability
		  • suggestion engines
		  • pattern recognition and prediction rules
		  • neural networks as equations using:
		  • massive models
		  • massive data
		  • trial and error
		  • Deep Learning
		• types of problems that AI can solve, including:
		  • Simultaneous Location and Mapping (SLAM)
		  • language recognition
		  • machine translation
		  • anomaly detection
		  • image recognition
		
		Learners should be aware of:
		• common uses of AI, including:
		  • translation engines
		  • healthcare
		  • cyber security
		  • transport
		  • entertainment
		  • education (to detect plagiarism)
		  • voice command (voice to text/smart data)
		  • social networking (auto tagging)
		  • shopping (search/recommendation)
		  • finance (fraud/credit)
		  • communication (filtering).

(e)	Impacts of AI	Learners should understand: • the possible anxieties caused by the proliferation of AI • ways to protect against the unintended consequences of using AI, including regulation.

2.1.3 Digital technology development life cycles

In this section learners will gain knowledge and understanding of the following:

- the stages of the digital technology development life cycle
- how digital technologies are designed
- relevant approaches and methodologies
- changeover
- maintenance.

Content		Amplification

(a)	The stages of the digital technology development life cycle	Learners should understand:
		• the four stages within the S-curve model:
		  • research and development
		  • ascent
		  • maturity
		  • decline
		• the S-curve model in terms of economic benefits
		• the classification of users that take up new technologies.

(b)	How digital technologies are designed	Learners should understand:
		• the phases within the development of digital technologies:
		  • feasibility study
		  • requirements analysis
		  • design
		  • software development
		  • testing
		  • release
		• the role(s) of individuals within a development team in each of these phases.

(c)	Relevant approaches and methodologies	Learners should understand:
		• types of development methodologies, including:
		  • Waterfall
		  • Rapid Application Development (RAD)
		  • Agile
		  • Big Bang
		  • Spiral
		• the advantages and disadvantages of these methodologies and justification of their use in different scenarios (e.g. in program development or project management).

(d)	Changeover	Learners should understand:
		• methods of changeover:
		  • parallel
		  • phased
		  • pilot
		  • direct
		• the advantages and disadvantages of each method and justification of their use in different scenarios (e.g. system implementation in assembly line changeover or website development).

Content		Amplification

(e)	Maintenance	Learners should understand:
		• the need for maintenance of digital technologies following release
		• the types of maintenance that may be required, including:
		  • preventive
		  • corrective
		  • adaptive
		  • perfective
		• examples of maintenance that can apply to data, software and hardware
		• the advantages and disadvantages of these types of maintenance and justification of their use in different contexts (e.g. software development within embedded devices or applications).

2.1.4 User-centred design, user experience and human-computer interaction in digital systems development

In this section learners will gain knowledge and understanding of the following:
- human-computer interaction
- User-Centred Design (UCD)
- Digital user experience (DUX).

Content		Amplification

(a)	Human-computer interaction	Learners should understand:
		• human-computer interaction as a study of the User Interface (UI) between people and computers
		• interfaces and input methods
		• types and comparison of input method and user interface, and justification for their use in different circumstances
		• social and health issues related to human-computer interaction and their impact when using the following:
		  • mobile devices
		  • desktop and laptop devices
		  • peripheral devices
		  • augmented reality and virtual reality devices
		  • software applications
		• methods of mitigating these issues.

Content		Amplification

(b)	User-Centred Design (UCD)	Learners should understand:
		• user-centred design (UCD) in terms of an iterative process where designers focus on the users and their needs in each phase of the design process
		• the purpose of UCD in terms of the product being designed to the needs of the user rather than the user having to adapt to the product
		• the five principles within UCD:
		  • a clear understanding of user and task requirements
		  • incorporation of user feedback
		  • active involvement of the user to evaluate the design of a product
		  • integrating UCD with other development activities
		  • an iterative design process
		• the four phases within the UCD process:
		  • specifying the context of use
		  • specifying requirements
		  • creating design solutions
		  • evaluating designs
		• how requirements are noted and refined through:
		  • ethnographic study
		  • continual feedback
		  • contextual enquiry
		  • prototype and usability testing
		• the use of tools used in UCD, including:
		  • personas
		  • scenarios
		  • use cases
		• the main considerations of UCD:
		  • visibility
		  • accessibility
		  • legibility
		  • language.

Content		Amplification

(c)	Digital User Experience (DUX)	Learners should understand:
		• Digital User Experience (DUX) in terms of:
		  • design
		  • navigability
		  • performance
		  • efficiency
		  • cross-platform compatibility
		• the scope of DUX from traditional online environments and apps, to more recent environments, such as:
		  • wearables
		  • virtual or augmented reality
		• the elements used when considering and evaluating DUX, including:
		  • aesthetics of design
		  • information architecture
		  • accessibility
		  • human computer interaction
		  • ergonomics
		  • utility
		  • performance
		• metrics used to test and evaluate the above elements, including:
		  • task success rate
		  • task completion time
		  • retention rate
		  • conversion rate
		  • error rate
		  • satisfaction
		  • heuristic evaluation.

2.1.5 Functions, purposes and uses of social media by individuals and organisations

In this section learners will gain knowledge and understanding of the following:

- types of social media
- functions of social media
- purpose and uses of social media
- impacts of social media use.

Content		Amplification

(a)	Types of social media	Learners should understand social media in terms of digital platforms that permit the creation or sharing information via virtual communities.
		
		Learners should be aware of:
		• different types of social media, including:
		  • social networking sites
		  • media sharing networks
		  • discussion networks
		  • bookmarking and content curation
		  • consumer review networks
		  • blogging networks
		  • social shopping networks
		  • interest based social networks
		  • anonymous social networks
		  • merged social media and gaming
		• the main features and functionalities of these types of social media.

(b)	Functions of social media	Learners should be aware of the functions of different types of social media, including: • profile setting • status/wall posts • uploading media • messaging • notifications • newsfeeds • comments/reactions • sharing • saving/bookmarking • privacy and security settings • integration with other social media platforms.
(c)	Purpose and uses of social media	Learners should understand the purpose, and legal, ethical and professional implications of the different uses of social media by: • individuals • organisations.
(d)	Impacts of social media use	Learners should understand the positive and negative impacts of the use of social media by individuals and organisations.

2.2 AS Unit 2

Creative Digital Practices

Non-exam assessment (NEA): approximately 45 hours
50% of AS qualification
20% of A level qualification
80 marks

Overview of unit

In this unit learners will develop knowledge, skills and understanding in creative digital practices, including:

- researching, planning, designing, developing, testing, refining and documenting.

This non-exam assessment (NEA) gives candidates the opportunity to choose a context for their task, and to develop a game of their choice.

NEA formats

The NEA must be presented in the following ways:

- word processed A4 or A3 documents in PDF format
- an executable game
- supporting evidence presented in a format compatible with GameMaker to include:
  - all annotated and marked up source code
  - all raw sprite and game artwork in a format compatible with the Adobe suite of applications
  - all iterations of the development of the final game
- a narrated or annotated 5-10 minute gameplay movie or screen capture in MP4 format to demonstrate the features and functionality of the game.
- supporting evidence should be viewable in any web browser.

Centres must remind candidates to keep their own work secure at all times and not share completed or partially completed work on-line, on social media or through any other means.

Investigating games

Candidates should research game genres and their sub-genres for three games in order to identify their similarities and differences. Candidates should also understand the differences between the hardware platforms associated with gaming.

Candidates should produce a summary of their research that identifies characteristics of the games researched including consideration of the impact that certain aspects of games have on individuals as well as the positive and adverse effect that games may have on individuals.

Candidates are required to use their research findings to create a game of their own choice.

Planning games

Candidates should use suitable project management tools to produce an action plan showing overall timescale for the development, activities at each stage of development, and timings for the activities.

Candidates are required to set up and use procedures for storing and protecting project information, tracking and monitoring progress. They must be able to define a project in terms of:

- analysis
- design
- prototyping
- testing
- producing documentation
- releasing

Candidates are required to identify the activities that will be carried out in each stage and recognise the relationships between these activities.

Candidates must maintain an up-to-date asset log and development log in order to document planning, development and evaluation.

Candidates are required to keep backups and maintain strict version control throughout the duration of their project. This will include iterations of the game files and details of alterations and scope.

Making informed design decisions and incorporating standard and advanced gaming features.

Candidates are required to use design tools that inform their design choices and be proficient in utilising a set of standard and advanced game development features especially aspects of the GML programming paradigm that enables both sets of features to be created.

Candidates should be fully aware of audience and user requirements when developing their game.

Candidates are required to showcase their game ideas to stakeholders in the form of a presentation and / or a report summarising key characteristics of the game.

Creating games

Candidates are required to implement one of their game designs. This must include the use of GML as well as the standard and advanced techniques they have identified.

All developed programming should use good coding practices such that a competent third party would be able to further develop the finished game. This must incorporate sufficient annotation to explain the functionality of the written programs.

Candidates should review their work regularly, documenting any changes based on the required functionality of their game.

Testing and developing games

Candidates are required to produce test plans and data for testing each module, section or part of their game as it is developed.

Candidates should implement those test plans using their test data and recording the results.

Candidates should perfectively re-test each module, section or part correcting any errors or making any further adjustments to ensure its viability.

Refining and reviewing games

Candidates should be able to adapt and refine their game in response to stakeholder feedback throughout the steps of the game development life cycle.

Candidates are required to document parameters or constraints that led to a change in scope during the game development life cycle. Any change in scope resulting should be fully documented.

Candidates will be required to review the fitness for purpose of their game.

Presenting outcomes

Candidates are required to produce a 5 –10 minute video demonstrating the appearance of their game against set criteria as well as describing the functionality of coded and non-coded elements and how the whole package works together.

Areas of content

Learners should be given the opportunity to develop their knowledge and understanding of, and skills in, seven areas of content set out on pages 23 to 28.

2.2.1	Investigating games
2.2.2	Planning games
2.2.3	Making informed design decisions
2.2.4	Creating games
2.2.5	Testing and developing games
2.2.6	Refining and reviewing games
2.2.7	Presenting outcomes

2.2.1 Investigating games

In this section learners will gain knowledge and understanding of the following:

- game genres and technical platforms.

Content		Amplification

(a)	Game genres and technical platforms	Learners should understand:
		• a range of genres of game
		• the similarities and differences between game genres and their sub genres
		• that aspects of games including:
		  • the use of sound
		  • high score tables
		  • competitions
		  • fun
		  • educational value
		  • user's expectations
		  • levelling
		  can have an impact on individuals
		• the potential positive and adverse effects of games on individuals.
		
		Learners should be aware of similarities and differences between technical platforms, such as:
		• arcade
		• augmented reality
		• casual (browser based / apps)
		• cloud
		• console
		• desktop
		• handheld
		• server (Massively Multiplayer Online (MMO))
		• virtual reality.

2.2.2 Planning games

In this section learners will gain knowledge and understanding of the following:

- action planning, asset and development logs, backup and file management.

Content		Amplification

(a)	Action planning, asset and development logs, backup and file management	Learners should understand the importance of maintaining task lists and time management. They should be able to:
		• set up and use procedures for storing and protecting project information, tracking and monitoring progress
		• define a project in terms of the stages of the game development cycle:
		  • analysis
		  • design
		  • prototyping
		  • testing
		  • producing documentation
		  • releasing
		• identify the activities that will be carried out in each stage and recognise the relationships between these activities
		• use appropriate software to produce a detailed action plan showing
		  • overall timescale
		  • project stages
		  • the activities in each stage
		  • timings for each activity
		• create and maintain an up-to-date asset log and development log in order to document the elements of planning, development and evaluation.
		
		Learners should understand the importance of keeping backups as well as maintaining strict version control of their files throughout a project. This should include iterations of the game project files as well as documentation scope change and include any alterations resulting from peer feedback.

2.2.3 Making informed design decisions

In this section learners will gain knowledge and understanding of the following:

- considering audience and user requirements and needs
- making informed design decisions and incorporating standard and advanced gaming features
- justifying the chosen game.

Content		Amplification

(a)	Considering audience and user requirements and needs	Learners should be able to:
		• take target audience and user requirements into consideration when developing a game
		• develop game ideas to showcase to stakeholders, these should take the form of a report or presentation combining audio and visual elements as applicable
		• create a range of visualisations that illustrate the key areas of each idea and are a fundamental part of the planning process
		• create a proposal for each idea that clearly summarises and outlines the:
		  • game audio
		  • characters
		  • core components
		  • gameplay
		  • interactivity
		  • narrative
		  • objectives
		  • structure
		  • target audience
		  • visual style.

(b)	Making informed design decisions and incorporating standard and advanced gaming features	Learners should be able to:
		• use design tools that will inform design choices, including:
		  • action lists
		  • diagrams
		  • graphical tools
		  • mock-ups
		  • mood boards
		  • narratives
		  • pseudo code
		  • storyboards
		  • videos
		  • wireframes
		• utilise game development features including:
		  • audio, image, level, object, script and tile editors
		  • physics and shader engines
		  • level inheritance
		  • animation sequencing
		  • layer based image editing
		  • tiling systems
		  • aspects of the GML programming paradigm that will enable both standard and advanced gaming features to be created.

Content		Amplification
(c)	Justifying the chosen game	Learners should be able to describe and justify, drawing from their research and stakeholder feedback, their decision for the: • genre • technical platform • key features to be utilised within their game.

2.2.4 Creating games

In this section learners will gain knowledge and understanding of the following:

- incorporating design decisions and utilising game design software to make use of standard and advanced features.

Content		Amplification
(a)	Incorporating design decisions and utilising game design software to make use of standard and advanced features	To support the development of the game learners should use a range of techniques including: • the implementation of one of the designs for the game including the use of GML • the standard and advanced techniques identified in their design • developing the draft game using informed design decisions based on stakeholder feedback on an initial concept • ensuring that the game uses the appropriate tools, facilities and techniques available through the GameMaker platform • using good coding practices, including sufficient annotation of code, such that a competent third party would be able to further develop the game. This should include the use of inbuilt and bespoke functions or procedures • reviewing their work and making appropriate documented changes, where justified, based on the required functionality of their game.

2.2.5 Testing and developing games

In this section learners will gain knowledge and understanding of the following:

- testing and developing using iterative design methodology.

Content		Amplification

(a)	Testing and developing using iterative design methodology	Learners should be able to test the functionality of a game during its development by:
		• producing test plans and test data for the summative unit testing of each module, section or part of the game as it is developed, including:
		  • end user interactions
		  • input and output
		  • object collisions
		  • game physics
		  • mathematical calculations
		• implementing the test plans using the test data and recording the results
		• using the test results to make adaptations, where necessary or desirable, to their game
		• adjusting test plans and test data to perfectively re-test a game module, section or part.

2.2.6 Refining and reviewing games

In this section learners will gain knowledge and understanding of:

- stakeholder feedback, scope change and refinement
- the game development life cycle
- reviewing and refining against the original game concept.

Content		Amplification
(a)	Stakeholder feedback, scope change and refinement	Learners should be able to: • gather and record stakeholder feedback using appropriate methods • review stakeholder feedback on the game concept and draft game to inform scope change • refine their game having gone through the steps of the game development life cycle.
(b)	The game development life cycle	Learners should be able to: • describe any parameters or constraints that prevented, influenced or enabled scope change during the game development life cycle • clearly document and justify any changes of scope during development.
(c)	Reviewing and refining against original game concept	Learners should be able to: • comment on the fitness for purpose of the completed game • make full use of stakeholder feedback to review and refine their game.

2.2.7 Presenting outcomes

In this section learners will gain knowledge and understanding of how to demonstrate:

- appearance of a game
- game functionality

by producing a 5-10 minute movie or screen capture.

Content		Amplification
(a)	Appearance of a game	Learners should be able to demonstrate the appearance of the game including: • general gameplay including levelling where appropriate • the use of sprites and any animation • the use of sound • scoring, lives and game progression.
(b)	Game functionality	Learners should be able to demonstrate the functionality of the game by describing: • the coded elements • the non-coded elements • how objects, sprites and coding work together.

2.3 A Level Unit 3

Connected Systems
On-screen examination: 2 hours 30 minutes
30% of A level qualification
100 marks

The examination must be conducted in accordance with *Instructions for Conducting Examinations*, available at www.jcq.org.uk

Learners will need access to a calculator in this examination.

Overview of unit

An assessment (taken on-screen), comprising of a range of question types including extended responses to assess specification content related to digital technology connected systems, collecting, storing, analysing and using data, cyber security and digital technology networks. Specific questions will assess learners' skills in communicating, evaluating and analysing digital technology concepts, including through extended responses.

All questions are compulsory.

Areas of content

Learners should be given the opportunity to develop their knowledge and understanding of the three areas of content set out on pages 30 to 38.

2.3.1	Contemporary practices involved in collecting, storing, analysing and using data
2.3.2	Cyber security
2.3.3	Digital technology networks
Integrated within relevant aspects of content in this unit, learners will explore a range of legal, social, ethical and professional dimensions.	

2.3.1 Contemporary practices involved in collecting, storing, analysing and using data

In this section learners will gain knowledge and understanding of contemporary practices involved in:

- collecting data
- storing data
- analysing data
- using data.

Content		Amplification

(a)	Collecting data	Learners should understand:
		• the purposes of collecting data
		• appropriate means of collecting data including:
		  • autonomous devices
		  • passive and active data collection
		  • manual data collection
		  • usage data
		• the legal and ethical implications of collecting data via various means, both with and without prior consent.

(b)	Storing data	Learners should understand:
		• the relationship between binary data and storage units
		• how to calculate appropriate storage requirements for varying types of files
		• that monitoring data usage and size is key to modern distribution networks, especially Content Delivery Networks (CDNs)
		• the following general storage methods and their application:
		  • digitally sampled sound
		  • bitmapped graphics
		  • compressed audio
		  • compressed video.
		
		Learners should be aware of the uses of more advanced storage techniques, including:
		• Redundant Array of Inexpensive Disks (RAID)
		• Network Attached Storage (NAS)
		• high availability storage
		• Storage Area Networks usage (SAN)
		• cloud storage
		• hosted storage.

Content		Amplification
(b)	Storing data (cont.)	Learners should understand: • virtualisation • hosted instance • hosted solution • clustering • Blockchain storage. Learners should understand how cloud computing provides services, including: • data storage • email • virtualised software • remotely hosted applications. Learners should understand cloud computing in terms of its business benefits.
(c)	Analysing data	Learners should understand: • how descriptive data analytics can provide useful information • how this can be achieved by carrying out descriptive analysis and data visualisation • the role of specialised Management Information Systems (MIS) in supporting decision making • the role of specialised Project Management Software (PMS) Learners should be aware of the use of: • data warehouses • data mining • large data sets.

Content		Amplification

(d)	Using data	Learners should understand:
		• what is meant by Artificial Intelligence (AI)
		• the significance of the Turing test
		• the main features of neural network modelling
		• the structure of an expert system and its components
		
		Learners should be aware of the following terms in relation to expert systems:
		• shell
		• heuristics
		• fuzzy logic
		• knowledge engineer
		
		Learners should understand:
		• the use of expert systems or neural networks in different contexts (e.g. health, employment, manufacturing)
		• the technology required for natural language and voice recognition systems
		• the ethical considerations of expert systems and AI.
		
		Learners should understand how to:
		• use different forms of data analysis to identify trends and patterns
		• present data and analyses, and adapt the presentation to differing audience needs
		• analyse given situations and use the data presented to produce data flow diagrams illustrating the flows of information:
		  • within an organisation
		  • between an organisation, its customers, suppliers and other external agencies
		Learners should understand how AI technologies use large data sets and the potential social implications which may arise.

2.3.2 Cyber security

In this section learners will gain knowledge and understanding of cyber security including:

- introduction to cyber security
- threats and vulnerabilities
- resilience controls
- social engineering.

Content		Amplification
(a)	Introduction to cyber security	Candidates should understand that cyber security: • is how individuals and organisations reduce the risk of cyber-attack • protects devices and services • prevents unauthorised access to personal information.

(b)	Threats and vulnerabilities	Learners should understand:
		• accidental damage – identifying how data can be at risk from accidental destruction
		• malicious and deliberate damage
		• the legal and professional responsibilities in identifying and mitigating threats and vulnerabilities
		• the following security measures:
		  • encryption
		  • firewalls
		  • antivirus software
		  • hierarchical access levels
		• the risks associated with online marketing communications
		• the special security and integrity problems which can arise during online updating of files
		• the need for and the purpose of cryptography
		• techniques of cryptography
		• symmetric and asymmetric encryption
		• the purpose and use of contemporary biometric technologies
		• a range of mechanisms for:
		  • attacking vulnerabilities
		  • defence from threats and vulnerabilities
		• cryptocurrencies and why they can sometimes be associated with cyber security.

Content		Amplification

(b)	Threats and vulnerabilities (cont.)	Learners should be aware of:
		• the benefits and drawbacks of biometric technologies
		• the complexities of capturing, storing and processing biometric data and the legal and ethical considerations of doing so
		• the types and operation of malicious software
		• black hat hacking, white hat hacking and penetration testing
		• the importance of large data sets to the operation and competitiveness of organisations in the health, finance and retail sectors
		• the threats to the privacy of the individual from the use of data mining
		• the use of mac addresses and mac address spoofing
		• the basic tools for diagnosing and tracing data over packet switched networks, including:
		  • Tracert
		  • Whois
		  • IP address masking and impersonating.

(c)	Resilience controls	Learners should understand:
		• cyber resilience
		• the potential consequences to a company of a cyber-attack
		• the difference between temporary or permanent loss of data and information, how this can occur and how it can be mitigated against
		• the impact of damaged or corrupted software
		• the effects of websites being unavailable in terms of:
		  • loss of reputation
		  • loss of competitive advantage
		  • legal and social implications
		  • financial loss

Content		Amplification

(c)	Resilience controls (cont.)	• the following resilience controls a company may use to prevent a cyber-attack:
		  • using a boundary firewall and internet gateway
		  • having secure system configuration including admin accounts, audit trails, account management and backup
		  • implementing access control, including restricted access to valuable data
		  • implementing malware protection
		  • having patch management to ensure the latest updates of software are applied
		  • implementing staff training
		• the resilience controls a company could use to recover from and mitigate a cyber-attack, including:
		  • making arrangements for the use of alternative premises, communication methods and facilities
		  • exploring various what-if scenarios
		  • ensuring regular backups of data
		• the legal and professional responsibilities associated with the placement of resilience controls.

(d)	Social engineering	Learners should be aware of social engineering, including the following techniques: • phishing • baiting • email hacking • contact spamming pretexting • quid pro quo scam • vishing • exploiting passive and active digital footprints Learners should be aware of the legal framework that exists to protect against social engineering. Learners should understand and give appropriate use case examples of where social engineering has been used to gain access within specific sectors including: • commerce • personal finance and home banking • process control.

2.3.3 Digital technology networks

In this section learners will gain knowledge and understanding of digital technology networks, including cloud environments, and their roles in:

- communications networks
- data transmission
- cloud services
- mobile technologies.

Content		Amplification

(a)	Communications networks	Learners should be aware of:
		• the Internet as a global communications network which uses interconnected computers
		• the infrastructure of the Internet
		• the environmental concerns related to providing infrastructure, power and production.
		
		Learners should understand:
		• the importance of standards and the role that W3C and IETF (RFCs) plays in them
		• aspects of the TCP/IP protocol, including:
		  • packet contents
		  • packet switching
		  • routing and its possible risks
		• the functionality provided by the DNS system and its basic vulnerabilities including DNS poisoning
		• the main components of computer networks including hardware, software and infrastructure
		• the main considerations involved in the selection of an Internet Service Provider (ISP)
		• how to analyse user requirements and produce specifications for suitable network and internet
		• components, including hardware, software and infrastructure
		• the main properties and characteristics of local area, (LAN) and wide area (WAN) networks
		• the characteristics of: VLAN, WLAN and VPN networks, their use and the equipment required to utilise them
		• contemporary issues involving usage of VPN technologies, their advantages and disadvantages (e.g. increased security, decreased visibility, dependence on third-party hardware)
		• the benefits of computer networks in terms of:
		  • efficient use of software and hardware resources
		  • data access and sharing
		  • collaborative working
		  • effective communication
		  • central management/monitoring of users, security and data

Content		Amplification

(a)	Communications networks (cont.)	• that in a distributed network, the sharing of resources is arranged by the operating system, without any action being required by the user
		• the different types of server, including:
		  • file server
		  • printer server
		  • internet (proxy) server and mail server
		in terms of the facilities and resources they provide to authorised client stations.

(b)	Data transmission	Learners should understand:
		• the function and performance of common hardware devices, including:
		  • hubs
		  • switched hubs
		  • routers
		  • repeaters
		  • wireless access points
		  • media converters
		• the role of, and facilities provided by, network operating and accounting software, including:
		  • resource and applications management
		  • data security
		  • data storage
		  • back up
		  • monitoring
		  • activity management
		• the role and facilities of firewall software or appliances
		• the characteristics of contemporary communication infrastructures, including:
		  • twisted pair wire (UTP and STP)
		  • fibre optic cable
		  • wireless (radio, infrared, microwave and satellite)
		• how to calculate transmission speeds and times to transfer files and the effect on end user experience.

(c)	Cloud services	Learners should understand: • the differences between file synchronisation, file backup and file archive systems • how cloud services work • the difference between cloud computing and cloud storage • the advantages and disadvantages of using cloud services (e.g. ease of building a new system, data are saved remotely from local hardware, reliance on internet connectivity, potential on going costs) • the environmental concerns around cloud server resource usage

Content		Amplification

(c)	Cloud services (cont.)	• different types of cloud services:
		  • Software as a Service (SaaS)
		  • Infrastructure as a Service (IaaS)
		  • Platform as a Service (PaaS)
		• how the following cloud services are delivered:
		  • public cloud services
		  • private cloud services
		  • hybrid cloud environment
		• the future of cloud services, including:
		  • content collaboration
		  • access control
		  • app delivery management
		  • virtual desktop solutions.

(d)	Mobile technologies	Learners should understand:
		• the social impacts of the proliferation of mobile technologies
		• the environmental impacts of providing infrastructure
		• how technology supports mobile phone communication, including:
		  • mobile phone masts
		  • cells
		  • handoffs
		  • base station controller
		  • IMIE and IMSI
		  • the working of SIP, SS7 and IPv6 protocols
		  • stateful and non-stateful calls
		  • mobile switching centre and Public Switched Telephone Network (PSTN) telephone systems.
		
		Learners should be aware of:
		• the history and contemporary developments in transmitting data over mobile technologies, and understand the evolution from:
		  • GPRS
		  • Edge
		  • 3G
		  • 4G or LTE
		  • 5G or Wideband and Ultrawide band
		• the relative data transmission speeds and what applications and experiences these allow for end users
		• future developments of mobile technologies, including:
		  • borderless technologies (no bezel)
		  • ‘transparent’ phones
		  • chip phones/‘bionic interface’ communication devices.

2.4 A Level Unit 4

Digital solutions

Non-exam assessment (NEA): approximately 45 hours
30% of A level qualification
100 marks

Overview of unit

In this unit learners will develop knowledge, skills and understanding in:

- the use of transactional websites[1] and associated back office processes
- the identification of the main characteristics of transactional websites including information processing and cyber security
- the back office processes that support the operation of a transactional website
- the measures taken to customise and enhance the presentation of information on transactional websites to support individual users.

This non-exam assessment (NEA) allows candidates to investigate transactional websites and to develop a solution to a realistic challenge or problem faced by an organisation of their choice.

Platforms

The desktop and server must be distinctly separate. Suggested configurations for the server and desktop platforms are as follows:

Server platforms should either be:

LAMP

- Linux operating system
- Apache Web server
- MySQL database
- PHP programming language

or

WIMP

- Windows operating system
- IIS Web server (or Apache if preferred)
- MySQL or MS SQL Server*
- PHP programming language

*It should be noted that because of the requirement for a separate desktop and server, MS Access is **not** a suitable database for this NEA project.

Desktop platforms:

- all website features should be accessible through Google Chrome
- candidates can use any desktop-based web development application and its associated facilities that they wish e.g. Adobe Dreamweaver, but they are **not** allowed to use any Content Management Systems e.g. Wordpress.

[1] The broad definition we have adopted is that a transactional website is the front-end for a production system, anything from a social media website to a stock control system. Transaction in this context means database transaction.

NEA formats

The NEA must be presented in the following ways:

- word processed A4 documents in PDF format
- fully annotated listings of all code including HTML, CSS, JavaScript/PHP and SQL, should be presented in PDF format
- each listing must be clearly identified in respect of its functionality and relationship with other listings
- candidates should make reference to any software or code provided by third parties
- a narrated or annotated 5-10 minute movie or screen capture in MP4 format to demonstrate the transactional website and its functionality.

Centres must remind candidates to keep their own work secure at all times and not share completed or partially completed work on-line, on social media or through any other means.

Investigating transactional websites

Candidates should research a wide range of transactional websites to identify their common characteristics in order to develop a digital solution to a realistic challenge or problem which could be faced by an organisation. They will also be required to consider the use of digital marketing techniques.

Candidates should produce a summary of their research that identifies characteristics of the transactional websites researched including consideration of their structure, data capture, data processing and marketing strategies.

Candidates are required to use their research findings to create a functional transactional website of their own choice, suitable for their chosen organisation, that will allow customers to complete multiple transactions. Candidates are not required to write original code to build their websites and can use appropriately attributed ‘building blocks’ or applets and APIs to support the functionality of the solution. Candidates are however, expected to have an original functioning solution.

Candidates should set clear aims and objectives for their work.

Candidates should use suitable project management tools to produce a plan showing overall timescale for the development, success criteria, activities at each stage of development, timings for the activities, contingency times and review points.

The design of transactional websites

Candidates are required to design the directory structure for their websites. They should create wireframes for each web page of the website showing the detailed structure of each page, fully dimensioned.

Candidates are required to prepare assets such as text, images, videos and audio files for use on a web page including consideration of resolution and compression.

Candidates should design HTML and Cascading Style Sheets (CSS) for the website which may apply to all pages or separate sections of the website depending on purpose.

Candidates should produce algorithms for JavaScript/PHP routines to create the interactive elements of the web pages as required.

Candidates should identify suitable blocks of code or applets for their chosen programming language that will enable them to provide functionality for the solution. These must be appropriately attributed.

Candidates should be able to write 'linking code' and perform their own validation and verification routines in order to put their websites together.

The capture, storage and processing of data

Candidates should consider the data that their transactional website will capture and store. They should design data capture HTML forms to capture the required data for each process to be carried out such as consumer registration, logon forms and transactions. The designs for the forms should include algorithms for data validation routines.

Candidates should consider the data that will be required to carry out successful transactions and use this data to design data tables and database relationships that will allow the production of the required outputs. The design should include an entity relationship diagram (ERD) that clearly sets out the primary keys, foreign keys and relationships between tables.

The data structure should be designed to allow users to make multiple changes in one transaction.

The use of Relational Database Management System (RDBMS) database systems, scripting languages and SQL

Candidates should consider which Relational Database Management System (RDBMS) that they will use, the location where the database will be stored and the method of connection to the website.

Candidates should consider how they will design routines to produce the output to be delivered to the consumer or end user of the website from the database. Server-side scripting languages should be run to deliver customised content to the front-end website.

Candidates should supply a database populated with suitable test data to enable testing and refinement of the solution.

Developing and reviewing transactional websites

Candidates should implement their designs for the front-end website, database structure and back-end processing to develop their transactional website. They should be mindful of the need to create a prototype system that can be reviewed and tested. Candidates should use the outcome of the review and the feedback they receive to refine their designs and reflect these changes in their prototype to complete their transactional website.

Candidates should review their time plan and revise timings to reflect progress to date and any alterations needed to reflect the changes required following the feedback received for the prototype.

Testing, refining and evaluating transactional websites

Candidates should plan their testing and design effective test data to demonstrate the functionality of their transactional website. They will need to gather feedback on the suitability and quality of their web pages for the end users of the system.

Candidates should then refine their work in the light of the outcome of the testing and the receipt of the feedback.

Candidates should evaluate their transactional websites against its suitability for their chosen organisation in terms of purpose, the intended end use and the original success criteria.

Candidates should evaluate their time plans and identify areas that required additional time during the development of the completed transactional website.

Candidates should identify further enhancements that could be implemented to improve their transactional website.

Presenting outcomes

Candidates should produce a movie or screen capture of approximately five minutes duration that demonstrates the functionality and appearance of their transactional website. The movie should cover user interactions with the transactional websites, data handling and processing.

Areas of content

Learners should be given the opportunity to develop their knowledge and understanding of, and skills in, seven areas of content set out on pages 43 to 49.

2.4.1	Investigating transactional websites
2.4.2	The design of transactional websites
2.4.3	The capture, storage and processing of data
2.4.4	The use of RDBMS database systems, scripting languages and SQL
2.4.5	Developing and reviewing transactional websites
2.4.6	Testing, refining and evaluating transactional websites
2.4.7	Presenting outcomes

2.4.1 Investigating transactional websites

In this section learners will gain knowledge and understanding of the following:

- the main characteristics of a transactional website
- the structure of a transactional website
- advantages and risks of the use of transactional websites for organisations
- advantages and risks of the use of transactional websites for end users
- digital marketing strategies
- types of transactional website business models.

Content		Amplification
(a)	The main characteristics of a transactional website	Learners should be aware that a transactional website: • processes database transactions • runs a production system of any kind.

(b)	The structure of a transactional website	Learners should understand that transactional websites include:
		• a website based front-end that is accessed by the user with the front-end code executed client-side
		• a server-based back end with code that runs on a server that:
		  • receives requests from clients and provides the appropriate data back to the client
		  • includes the database that stores all the data for transactions that take place via the website.

(c)	Advantages and risks of the use of transactional websites for organisations	Learners should understand the benefits and risks of the use of transactional websites including:
		• benefits:
		  • low set up costs
		  • low running costs (brick versus click)
		  • worldwide, 24/7 presence
		• risks:
		  • increased competition
		  • fraud:
		  • identity fraud
		  • financial fraud.

(d)	Advantages and risks of the use of transactional websites for end users	Learners should understand the benefits and risks of the use of transactional websites for end users including:
		• benefits:
		  • convenience of accessing goods and services
		  • ability to compare goods and services on different websites
		  • wider selection of goods and services
		• risks:
		  • potential for impulse buying
		  • imitation goods, services and fraudulent transactions.

Content		Amplification
(e)	Digital marketing strategies	Learners should be aware of the following: • digital marketing refers to strategies to market products and services online and through other digital means • companies and organisations use digital marketing to build their brands • digital marketing is an effective method of identifying a target market and building long-term relationships with customers and end users • digital marketing allows companies and organisations to use electronic communication directly to customers after gathering their details through website sign ups.

(f)	Types of transactional website business models	Learners should be aware of the following transactional website business models:
		• Business to Business (B2B):
		  • companies and organisations trade with each other
		  • the final consumer or end user is not involved
		  • online transactions may only involve manufacturers, wholesalers, retailers and service providers
		• Business to Consumer (B2C):
		  • a company or organisation will sell its goods and services directly to the consumer end user via an Internet based website
		  • consumers and end users can browse the website, view products and services, read descriptions and read customers' reviews of products
		• Consumer to Consumer (C2C):
		  • consumers are in direct contact with each other with no organisational involvement
		  • goods and services may be sold or auctioned with payment being made between consumers via 3rd party services.

2.4.2 The design of transactional websites

In this section learners will gain knowledge and understanding of the design of transactional web pages including:

- the structure of web pages
- preparation of assets for use on the Internet
- HTML
- Cascading Style Sheets (CSS)
- JavaScript/PHP to enhance web page functionality.

Content		Amplification
(a)	The structure of web pages	Learners should be aware of the need to design their website including: • creation of a root folder with sub directories • use of appropriate naming conventions • use of wireframes • setting page sizes • the key information to be included on each page • the size of each element/asset to be placed on the page.
(b)	Preparation of assets for use on the Internet	Learners should be aware of the need to prepare assets for use on web pages including: • sizing of images • compression of videos and audio assets • use of house styles for fonts.
(c)	HTML	Learners should understand how to use HTML to structure a web page including: • HTML elements – opening and closing tags, attributes and values • structural elements – DOCTYPE, head, metadata, title, link, body • HTML5 structure elements – header, footer, nav, article • organisational elements – div, span, table • lists – ordered and unordered • links – internal, external, email, use of anchors.
(d)	Cascading Style Sheets (CSS)	Learners should be aware of the need to create CSS to control and standardise web pages including how: • CSS describes how HTML elements are displayed on screen • CSS can be internal (included in the code for an individual web page) or external which can be attached to all web pages in a web site.

Content		Amplification
(e)	JavaScript/PHP to enhance web page functionality	Learners should be aware that JavaScript and PHP are scripting or programming languages that allow the implementation of complex or interactive features on a web page including: • content updates (time and date) • presence management • messaging • personalised content • wikis or blogs • interactive maps • animated graphics • image galleries. Learners should be able to identify suitable blocks of code for their chosen programming language and combine them to provide the functionality they require.

2.4.3 The capture, storage and processing of data

In this section learners will gain knowledge and understanding of the following:
- capture and validation of data
- storage and retrieval of user information
- the ability to process multiple items in a single transaction.

Content		Amplification

(a)	Capture and validation of data	Learners should be aware of the use of online data entry forms to collect and validate data entry including:
		• online data entry refers to gathering data from Internet sources and compiling it into a format that is suitable for storage in an online database
		• design and implementation of JavaScript/PHP and HTML5 routines used to validate data entry online including:
		  • presence checks for required fields
		  • data format/pattern validation
		  • range checks
		  • length checks
		  • type checks.

(b)	Storage and retrieval of user information	Learners should be aware of the need to store end user information and the procedures required to retrieve that data including: • the storage of end user information in a database that can be interrogated by end users and the web site • the retrieval of end user details including personal details.

Content		Amplification
(c)	The ability to process multiple items in a single transaction	Learners should be aware of the need to structure data storage facilities to allow multiple items to be processed in a single transaction including: • the need to create a relational database to store end user and transaction data • the need to normalise the database structure to 3rd Normal Form (3NF) to facilitate multiple processes in a single transaction.

2.4.4 The use of RDBMS database systems, scripting languages and SQL

In this section learners will gain knowledge and understanding of:
- The use of a Relational Database Management System (RDBMS) database program
- The use of a server-side scripting language
- The use of Structured Query Language (SQL) to handle data.

Content		Amplification
(a)	The use of a Relational Database Management System (RDBMS) database program	Learners should be aware that: • a RDBMS program is needed to allow data to be stored, retrieved and manipulated from a web based front-end web site • the database should be in 3NF.
(b)	The use of a server-side scripting language	Learners should be aware that: • server-side scripting languages run on a web server and respond to client (user) requests via HTTP to deliver content to the user • each client response is customised to the client's request to the website • server-side scripting is often used to present a customised interface to the user.
(c)	The use of Structured Query Language (SQL) to handle data	Learners should: • be aware that actions to be carried out on a database are performed using SQL statements • be familiar with commonly used SQL commands and operators in order to facilitate the construction of their website.

2.4.5 Developing and reviewing transactional websites

In this section learners will gain knowledge and understanding of the process of developing a transactional website including:

- developing and using appropriate technical skills to develop the transactional website
- reviewing the digital product in light of feedback received during the development process.

Content		Amplification
(a)	Developing and using appropriate technical skills to develop the transactional website	Learners should be aware of the importance of producing a prototype transactional website that can be reviewed and tested. To support the development of the transactional website learners should use a range of techniques including: • the implementation of the designs for the webpages including the use of HTML, CSS, JavaScript/PHP and appropriately prepared assets including appropriate complex and interactive features • the creation of the back end database, linking code, applets and SQL queries required to provide the required server-side functionality.
(b)	Reviewing the digital product in light of feedback received during the development process	Learners should be able to review their work and make appropriate changes, where justified, based on prototype feedback and required functionality.

2.4.6 Testing, refining and evaluating transactional websites

In this section learners will gain knowledge and understanding of the process of testing the functionality of a transactional website including:

- testing the functionality of a transactional website
- gathering and responding to feedback from others
- refining a system in response to the outcome of testing and receipt of feedback
- evaluating a transactional website.

Content		Amplification
(a)	Testing the functionality of a transactional website	Learners should be able to test the functionality of a transactional website including: • the ability to enter and store end user information • the validation of information entered into the data collection forms • the validation and authentication of usernames and passwords • the ability of an end user to transparently perform database transactions • the ability to search for an end user.

Content		Amplification
(b)	Gathering and responding to feedback from others	Learners should be able to gain feedback on the design and quality of transactional website pages including: • gathering feedback from competent third parties and users of the website • responding to feedback and giving reasons why feedback is to be acted on or dismissed.
(c)	Refining a system in response to the outcome of testing and receipt of feedback	Learners should be able to act on the results of the testing process and the receipt of feedback to refine the digital system's functionality and appearance including: • the refinement of transactional website pages • the refinement of data structures and data processing to improve the operation of the transactional website.
(d)	Evaluating a transactional website	Learners should be able to carry out an evaluation of a refined transactional website in terms of: • suitability for the intended purpose and end user • the extent to which the refined website meets the original aims and objectives • further enhancements that could be implemented to improve the transactional website.

2.4.7 Presenting outcomes

In this section learners will gain knowledge and understanding of how to demonstrate:
- end user interactions
- data handling and processing

by producing a 5-10 minute movie or screen capture.

Content		Amplification

(a)	End user interactions	Learners should be able to demonstrate the functionality of the transactional website including:
		• allowing an end user to:
		  • set up a new account
		  • logon to the system
		  • select multiple processes in a single transaction.

(b)	Data handling and processing	Learners should be able to demonstrate the functionality of the data handling and processing facilities of the website including the ability to: • enter and store end user information • validate information entered into the data collection forms • authenticate and verify of usernames and passwords.

3 ASSESSMENT

3.1 Assessment objectives and weightings

Below are the assessment objectives for this specification. Learners must:

AO1
Demonstrate knowledge and understanding of digital technology systems, including how they are used by, and impact on, individuals, organisations and society.

AO2
Apply knowledge and understanding to investigate, analyse and evaluate digital technology products and systems, approaches to their development, and their impact on individuals, organisations and society.

AO3
Plan, design, create and develop digital products.

The table below shows the weighting of each assessment objective for each unit and for the qualification as a whole.

AS	AO1	AO2	AO3	Total
Unit 1	30%	20%	0%	50%
Unit 2	0%	5%	45%	50%
Overall weighting	**30%**	**25%**	**45%**	**100%**

A level	AO1	AO2	AO3	Total
Unit 1	12%	8%	0%	20%
Unit 2	0%	2%	18%	20%
Unit 3	15%	15%	0%	30%
Unit 4	0%	6%	24%	30%
Overall weighting	**27%**	**31%**	**42%**	**100%**

Quality of written communication will be assessed in a specified question in each of the written examinations (Unit 1 and Unit 3) which requires extended writing.

Quality of written communication takes into account the candidate's use of specialist language. It also takes into account the candidate's spelling, punctuation and grammar.

3.2 Arrangements for non-examination assessment

Unit 2 and Unit 4 are non-exam assessments (NEA). They are internally assessed by the centre and externally moderated by WJEC. Details on arrangements for NEA are provided by the Joint Council for Qualifications (JCQ). Please refer to the JCQ website, www.jcq.org.uk for further information.

Tasks

The tasks for assessment within Unit 2 and Unit 4 are presented in Appendix B of this specification. Both tasks will remain the same for the lifetime of this specification, to allow scope for learners to focus on an area of particular interest to them.

Teachers should support learners with their choice of context for each task to help ensure learners have an opportunity to access the highest mark bands within the assessment criteria.

Preparation for NEA

NEA tasks may be completed and assessed at any suitable time during the course. However, centres need to ensure they have delivered the content needed for candidates to be able to access marks allocated to all aspects of the relevant NEA.

Before the course starts, the teacher is responsible for informing candidates of WJEC's regulations concerning malpractice. Candidates must not take part in any unfair practice in the preparation of work for GCE Digital Technology.

Candidates must understand that information from published sources must be referenced. They should be given guidance on setting out references and be aware that they must not plagiarise other material. They should know that to present material copied directly from books or other sources without acknowledgement will be regarded as deliberate deception. Centres must report suspected malpractice to WJEC.

It is important that NEA activity is monitored by centres to ensure that candidates' work is their own. All candidates are required to sign that the work submitted is their own and teachers are required to confirm that the work is solely that of the candidate concerned and was conducted under the required conditions.

Candidates must not work together on either of their NEA tasks.

Time available for NEA

Learners should spend approximately 45 hours on their NEA task for Unit 2 and approximately 45 hours on their NEA task for Unit 4. These times refer to work completed under direct supervision in the classroom.

The NEA tasks do not have a required or recommended length in words or pages.

Supervision and Monitoring of NEA

- Once the NEA is underway, candidates' work must be monitored to mitigate the risks of malpractice taking place.
- The teacher should be sufficiently aware of the candidate's standard and level of work to be able to identify if the NEA submitted appears to be beyond that candidate's talents.
- In most centres teachers are familiar with candidates' work through class and homework assignments. Where this is not the case, teachers should require NEA to be completed under direct supervision.
- In all cases, some direct supervision is necessary to ensure that the coursework submitted can be confidently authenticated as the candidate's own.
- During their NEA, the use of resources, including the Internet, is not tightly prescribed and candidates may have access to such resources. However, the centre **must** ensure that:
  - there is sufficient supervision of every candidate to enable work to be authenticated
  - the work that an individual candidate submits for assessment is their own.
- Teachers may provide guidance and support to candidates to ensure that they have a clear understanding of the requirements of the NEA tasks, the assessment and the associated marking criteria.
- Teachers may advise candidates on the suitability of the context chosen for their NEA work, with regard to the opportunity for the resulting work to address all relevant assessment requirements. Once work is underway, feedback must be limited to general advice on what needs to be improved. Teachers must not provide specific guidance on how to make these improvements.
- 'General advice' in the context of GCE Digital Technology NEA includes:
  - ensuring that candidates understand the requirements of the relevant task, including the required outcome and the time available
  - ensuring that candidates' choice and scope of NEA task/context has the potential to meet the requirements of the marking criteria and be of sufficient demand to achieve marks from the highest bands
  - providing guidance on the safe use of equipment and materials, and the ICT hardware and software available to candidates undertaking NEA activities.
- Within the context of 'general advice' teachers are **not allowed** to**:**
  - give a candidate detailed advice and take the lead through the NEA process
  - specify the context for the NEA activity, it must be the candidate's own decision
  - correct or modify a candidate's work
  - give specific direction to a candidate in order to achieve higher marks
  - produce any form of writing frame for use within NEA activities.
- Candidates are allowed access to resources which may include information gathered outside of school/college, for example as part of their investigation or research activities.
- Once the task is finished and the final assessment made, no further amendments may be made.
- The time spent working on each NEA task during timetabled sessions should be recorded by the teacher as a log and this may be requested by WJEC in addition

to the work submitted for moderation. The log should be monitored by the centre to ensure that candidates spend approximately 45 hours on each of their relevant NEA tasks for both Unit 2 and Unit 4.

Authentication

It is important that NEA work is monitored by centres to ensure that candidates' work is their own. Centres should monitor candidates' work by:

- carefully considering whether the evidence submitted is characteristic of the candidates' ability/attainment
- keeping work secure in the centre once the evidence is handed in
- ensuring work is not returned to the candidate to make changes.

References

References to sources of information used in NEA tasks must be acknowledged. This can be through an appended bibliography using a conventional in-text referencing system, or through footnotes.

Evidence to be submitted

Teachers must confirm that all of the work submitted for assessment was completed under the required conditions and that they are satisfied the work is solely that of the individual candidate concerned.

All teachers must sign the declaration of authentication after the work has been completed.

Unit 2
A game project completed by the candidate, a mark sheet completed by the assessor, signed declarations of authentication (by the teacher and the candidate) submitted to the moderator.

Unit 4
A transactional website project completed by the candidate, a mark sheet completed by the assessor, signed declarations of authentication (by the teacher and the candidate) submitted to the moderator.

NEA coversheets must be completed for all candidates, not just those selected for moderation. The forms can be downloaded from WJEC's secure website.

Security of candidates' work

Candidates' work **must** be kept securely until the deadline for a review of moderation has passed or until a review of moderation or appeal or malpractice investigation has been completed, whichever is the later.

Assessment criteria for Unit 2 and Unit 4

The assessment criteria for Unit 2 and Unit 4 are summarised in the tables below and shown in detail in Appendix A.

Unit 2

Assessment Criteria		Assessment objective	Marks
(a)	Investigating games	AO2	8
(b)	Planning games	AO3	8
(c)	Making informed design decisions	AO3	12
(d)	Creating games	AO3	20
(e)	Testing and developing games	AO3	15
(f)	Refining and reviewing games	AO3	12
(g)	Presenting outcomes	AO3	5
			Total 80

Unit 4

Assessment Criteria		Assessment objective	Marks
(a)	Investigating transactional websites	AO2	15
(b)	The design of a transactional website	AO3	15
(c)	The capture, storage and processing of data	AO3	15
(d)	The use of RDBMS database systems, scripting languages and SQL	AO3	15
(e)	Developing and reviewing a transactional website	AO3	20
(f)	Testing and refining a transactional website	AO3	10
(g)	Evaluating a transactional website	AO2	5
(h)	Presenting outcomes	AO3	5
			Total 100

4 TECHNICAL INFORMATION

4.1 Making entries

This is a unitised qualification which allows for an element of staged assessment.

Assessment opportunities will be available in the summer assessment period each year, until the end of the life of this specification.

Unit 1 and Unit 2 will be available in 2023 (and each year thereafter) and the AS qualification will be awarded for the first time in summer 2023.

Unit 3 and Unit 4 will be available in 2024 (and each year thereafter) and the A level qualification will be awarded for the first time in summer 2024.

Assessment opportunities will be available in May/June each year, until the end of the life of this specification.

A qualification may be taken more than once. However, if any unit has been attempted twice and a candidate wishes to enter the unit for the third time, then the candidate will have to re-enter all units and the appropriate cash-in(s). This is referred to as a 'fresh start'. When retaking a qualification (fresh start), a candidate may have up to two attempts at each unit. However, no results from units taken prior to the fresh start can be used in aggregating the new grade(s).

Marks for either or both of the NEA units may be carried forward for the life of this specification.

If a candidate has been entered for but is absent for a unit, the absence does not count as an attempt. The candidate would, however, qualify as a resit candidate.

The entry codes appear overleaf.

	Title	Entry codes	
		English-medium	Welsh-medium
Unit 1	Innovation in Digital Technology	2540U1	2540N1
Unit 2	Creative Digital Practices	2540U2	2540N2
Unit 3	Connected Systems	1540U3	1540N3
Unit 4	Digital Solutions	1540U4	1540N4
AS Digital Technology cash-in		2540QS	2540CS
A level Digital Technology cash-in		1540QS	1540CS

The current edition of our *Entry Procedures and Coding Information* gives up-to-date entry procedures.

There is no restriction on entry for this specification with any other WJEC AS or A level specification.

4.2 Grading, awarding and reporting

The overall grades for the GCE AS qualification will be recorded as a grade on a scale A to E. The overall grades for the GCE A level qualification will be recorded as a grade on a scale A* to E. Results not attaining the minimum standard for the award will be reported as U (unclassified). Unit grades will be reported as a lower case letter a to e on results slips but not on certificates.

The Uniform Mark Scale (UMS) is used in unitised specifications as a device for reporting, recording and aggregating candidates' unit assessment outcomes. The UMS is used so that candidates who achieve the same standard will have the same uniform mark, irrespective of when the unit was taken. Individual unit results and the overall subject award will be expressed as a uniform mark on a scale common to all GCE qualifications. An AS GCE has a total of 200 uniform marks and an A level GCE has a total of 500 uniform marks. The maximum uniform mark for any unit depends on that unit's weighting in the specification.

Uniform marks correspond to unit grades as follows:

		Unit grade				
Unit Weightings	**Maximum unit uniform mark**	**a**	**b**	**c**	**d**	**e**
Unit 1 (20%)	100	80	70	60	50	40
Unit 2 (20%)	100	80	70	60	50	40
Unit 3 (30%)	150	120	105	90	75	60
Unit 4 (30%)	150	120	105	90	75	60

The uniform marks obtained for each unit are added up and the subject grade is based on this total.

		Qualification grade				
	Maximum uniform marks	**A**	**B**	**C**	**D**	**E**
GCE AS	200	160	140	120	100	80
GCE A level	500	400	350	300	250	200

At A level, Grade A* will be awarded to candidates who have achieved a Grade A (400 uniform marks) in the overall A level qualification and at least 90% of the total uniform marks for the A2 units (270 uniform marks).

Appendix A

Marking Grids for Unit 2 and Unit 4

Marking Grid for Unit 2

<table>
<tr><th colspan="3">(a) Investigating games (2.2.1) [8 marks]</th></tr>
<tr><td>Band</td><td>AO2:</td><td>Apply knowledge and understanding to investigate, analyse and evaluate digital technology products and systems, approaches to their development, and their impact on individuals, organisations and society.</td></tr>
<tr><td>4</td><td colspan="2">7-8 marks

The candidate has demonstrated excellent application of knowledge and understanding to conduct thorough and extensive research into the genres and platforms of games. The research has considered:
• three different games
• the similarities and differences between:
  • the game genres and their subgenres
  • technical platforms
• the impact that aspects of games can have on individuals
• positive and adverse effects that gaming can have on individuals.

The candidate has produced a comprehensive summary of the investigation and has demonstrated excellent application of knowledge and understanding to identify an appropriate context for the development of a game of their choice.</td></tr>
<tr><td>3</td><td colspan="2">5-6 marks

The candidate has demonstrated good application of knowledge and understanding to conduct thorough research into the genres and platforms of games. The research has considered:
• two different games
• the similarities and differences between
  • the game genres and their subgenres
  • technical platforms
• the impact that aspects of games can have on individuals
• positive and adverse effects that gaming can have on individuals.

The candidate has produced a detailed summary of the investigation and has demonstrated good application of knowledge and understanding to identify an appropriate context for the development of a game of their choice.</td></tr>
</table>

Band	AO2:	*Apply knowledge and understanding to investigate, analyse and evaluate digital technology products and systems, approaches to their development, and their impact on individuals, organisations and society.*

2	**3-4 marks**
	
	The candidate has demonstrated basic application of knowledge and understanding to conduct some research into the genres and platforms of games. The research has considered:
	• up to two games
	• some of the similarities and/or differences between:
	  • the game genres and their subgenres
	  • technical platforms
	• the impact that some aspects of games can have on individuals
	• some positive and/or adverse effects that gaming can have on individuals.
	
	The candidate has produced a summary of the investigation and has demonstrated some application of knowledge and understanding to identify an appropriate context for the development of a game of their choice.	

1	**1-2 marks** The candidate has demonstrated limited application of knowledge and understanding to research into the genres and/or platforms of games. The research has considered: • one game • limited similarities or differences between the game genres and/or technical platforms • limited positive or adverse effects that gaming can have on individuals. The candidate has produced a brief summary of the investigation and has attempted to identify a context for the development of a game of their choice.	
	0 marks Not credit worthy or not attempted.	

(b) Planning games (2.2.2)		[8 marks]
Band	**AO3:**	*Plan, design, create and develop digital products.*

4	**7-8 marks**
	
	The candidate has demonstrated excellent technical ability to produce a thoroughly detailed plan for the creation of the game by:
	• designing a comprehensive:
	  • directory structure for the game assets
	  • set of procedures for storing and protecting information
	  • tracking and monitoring system for the game development cycle
	• designing and maintaining comprehensive asset logs and development logs
	• planning carefully chosen assets for the game including text, images and audio files taking full account of required resolution and compression.
	
	The candidate has documented the planning work in an action plan to a high standard that could be implemented by a competent third party.	

3	**5-6 marks**
	
	The candidate has demonstrated good technical ability to produce a detailed plan for the creation of the game by:
	• designing a detailed:
	  • directory structure for the game assets
	  • set of procedures for storing and protecting information
	  • tracking and monitoring system for the game development cycle
	• designing and maintaining detailed asset logs and development logs
	• planning chosen assets for the game including text, images and audio files taking account of required resolution and compression.
	
	The candidate has documented the planning work in an action plan to a standard that could be used as a basis for implementation by a competent third party.	

2	**3-4 marks**
	
	The candidate has demonstrated basic technical ability to produce a plan for the creation of the game by:
	• designing a basic:
	  • directory structure for the game assets
	  • set of procedures for storing and/or protecting information
	  • tracking and monitoring system for the game development cycle
	• designing and maintaining asset logs and/or development logs
	• planning assets for the game including text, images and/or audio files.
	
	The candidate has documented the planning work in an action plan to a basic standard.	

Band	**AO3:**	*Plan, design, create and develop digital products.*

1	**1-2 marks**
	
	The candidate has demonstrated limited technical ability to produce a plan for the creation of the game by:
	• designing a limited:
	  • directory structure for the game assets
	  • tracking and monitoring system for the game development
	• designing a limited asset log or development log
	• planning a limited range of assets for the game.
	
	The candidate has documented the planning work in an action plan to a limited standard.	

	0 marks Not credit worthy or not attempted.	

(c) Making informed design decisions (2.2.3)		[12 marks]
Band	**AO3:**	*Plan, design, create and develop digital products.*
4	**10-12 marks** The candidate has demonstrated excellent technical ability to produce a thoroughly detailed design for an initial game concept by: • producing a detailed report or presentation which combines audio and visual elements • creating a well-designed document to clearly convey their concepts • making use of a wide range of design tools to fully propose their game concepts • demonstrating aspects of code that could be used within the game • taking full account of target audience and user requirements and needs for the game concepts • clearly presenting their choice of genre, technical platform and features to be utilised within their game. The candidate has shown their choice of game and fully documented the design work to a high standard that could be implemented by a competent third party developer.	
3	**7-9 marks** The candidate has demonstrated good technical ability to produce a detailed design for an initial game concept by: • producing a report or presentation which combines audio and visual elements • creating a well-designed document to convey their concepts • making use of a range of design tools to propose their game concepts • demonstrating aspects of code that could be used within the game • taking account of target audience and user requirements and needs for the game concepts • presenting their choice of genre, technical platform and features to be utilised within their game. The candidate has shown their choice of game and documented the design work to a standard that could be used as a basis for implementation by a competent third party developer.	
2	**4-6 marks** The candidate has demonstrated basic technical ability to produce a design for an initial game concept by: • producing a basic report or presentation including audio and/or visual elements • creating a document to convey their concepts • making use of some design tools to propose their game concepts • taking account of target audience and user requirements and/or needs for the game concepts • presenting their choice of genre, technical platform and/or features to be utilised within their game. The candidate has documented the design to a basic standard.	

Band	**AO3:**	*Plan, design, create and develop digital products.*
1	**1-3 marks** The candidate has demonstrated limited technical ability to produce a design for an initial game concept by: • producing a limited report or presentation • creating a document to convey some concepts • taking some account of target audience or user requirements • presenting their choice of genre, technical platform or features to be utilised within their game. The candidate has documented the design to a limited standard.	
	0 marks Not credit worthy or not attempted.	

(d) Creating games (2.2.4)		[20 marks]
Band	**AO3:**	*Plan, design, create and develop digital products.*

5	**17-20 marks**
	
	The candidate has demonstrated excellent technical ability to produce the draft game by:
	• reviewing a wide range of stakeholder feedback
	• fully considering and thoroughly documenting:
	  • feedback received
	  • scope change
	• fully refining the game concept in light of feedback
	• fully developing a game with both standard and advanced game features
	• demonstrating a thorough understanding of a wide range of tools and techniques
	• utilising and fully exploiting the programming facilities of the GML
	• demonstrating excellent coding practices throughout.	

4	**13-16 marks**
	
	The candidate has demonstrated good technical ability to produce the draft game by:
	• reviewing a range of stakeholder feedback
	• considering and thoroughly documenting:
	  • feedback received
	  • scope change
	• refining the game concept in light of feedback
	• developing a game with both standard and advanced game features
	• demonstrating good understanding of a range of tools and techniques
	• utilising and exploiting the programming facilities of the GML
	• demonstrating good coding practices throughout.	

3	**9-12 marks**
	
	The candidate has demonstrated satisfactory technical ability to produce the draft game by:
	• reviewing some stakeholder feedback
	• considering and documenting:
	  • feedback received
	  • scope change
	• refining the game concept in light of some of the feedback
	• developing a game with both standard and some advanced game features
	• demonstrating satisfactory understanding of tools and techniques
	• utilising the programming facilities of the GML
	• demonstrating satisfactory coding practices throughout.	

Band	AO3:	*Plan, design, create and develop digital products.*

2	**5-8 marks**
	
	The candidate has demonstrated basic technical ability to produce the draft game by:
	• basic review of stakeholder feedback
	• considering and/or documenting:
	  • feedback received
	  • scope change
	• refining the game concept
	• developing a game with some standard and few advanced game features
	• demonstrating basic understanding of tools and techniques
	• utilising some of the programming facilities of the GML
	• demonstrating basic coding practices.	

1	**1-4 marks**
	
	The candidate has demonstrated limited technical ability to produce the draft game by:
	• making limited use of stakeholder feedback
	• considering or documenting:
	  • feedback received
	  or
	  • scope change
	• developing a game with some standard game features
	• demonstrating limited understanding of tools and techniques
	• demonstrating limited coding practices.	

	0 marks Not credit worthy or not attempted.	

(e) Testing and developing games (2.2.5)		[15 marks]
Band	**AO3:**	*Plan, design, create and develop digital products.*
4	**12-15 marks** The candidate has demonstrated excellent technical ability to carry out iterative testing and development of the functionality and appearance of the game. The functional testing is highly effective, and the testing process is comprehensive and includes: • detailed plans of testing to be conducted and the data to be used • detailed and fully documented testing of in-game actions • detailed discussion of test outcomes • utilising test results to effectively refine gameplay until final iteration.	
3	**8-11 marks** The candidate has demonstrated good technical ability to carry out iterative testing and development of the functionality and appearance of the game. The functional testing is effective and includes: • plans of testing to be conducted and the data to be used • detailed and documented testing of in-game actions • discussion of test outcomes • utilising test results to refine gameplay until final iteration.	
2	**4-7 marks** The candidate has demonstrated basic technical ability to carry out testing and development of the functionality and appearance of the game. The functional testing includes: • plans of testing to be conducted and the data to be used • basic testing and documenting of in-game actions • some discussion of test outcomes • utilising some test results to refine gameplay.	
1	**1-3 marks** The candidate has demonstrated limited technical ability to carry out testing and development of the functionality and/or appearance of the game. The functional testing includes limited: • plans of testing to be conducted and/or the data to be used • testing or documenting of in-game actions.	
	0 marks Not credit worthy or not attempted.	

(f) Refining and reviewing games (2.2.6)		[12 marks]
Band	**AO3:**	*Plan, design, create and develop digital products.*
4	**10-12 marks** The candidate has demonstrated excellent technical ability to produce a game that has well-designed core components by: • utilising a wide range of game development tools and features • obtaining a wide range of stakeholder feedback on the game • fully considering and thoroughly documenting feedback received • fully refining the game in light of feedback • completing the final version of the game to fully reflect the original designs and feedback received. The candidate has successfully exported the final game having completed the game development cycle.	
3	**7-9 marks** The candidate has demonstrated good technical ability to produce a game that has well-designed core components by: • utilising a range of game development tools and features • obtaining a range of stakeholder feedback on the game • considering and thoroughly documenting feedback received • refining the game in light of feedback • completing the final version of the game to reflect the original designs and feedback received. The candidate has successfully exported the final game having completed the game development cycle.	
2	**4-6 marks** The candidate has demonstrated basic technical ability to produce a game by: • utilising a number of game development tools and features • obtaining some stakeholder feedback on the game • considering and/or documenting feedback received • refining the game in light of some of the feedback • completing the final version of the game to reflect some of the original designs and feedback received. The candidate has partly completed the game development cycle.	

Band	**AO3:**	*Plan, design, create and develop digital products.*
1	**1-3 marks** The candidate has demonstrated limited technical ability to produce a game by: • utilising some game development tools and features • obtaining limited stakeholder feedback on the game • considering or documenting feedback received • partly completing the game.	
	0 marks Not credit worthy or not attempted.	

(g)	**Presenting outcomes** (2.2.7)	[5 marks]
Band	**AO3:**	*Plan, design, create and develop digital products.*
3	**5 marks** The candidate has demonstrated very good technical ability to create an informative video or screen capture, clearly demonstrating the appearance and functionality of their final game.	
2	**3-4 marks** The candidate has demonstrated good technical ability to create a video or screen capture, demonstrating the appearance and functionality of their final game.	
1	**1-2 marks** The candidate has demonstrated basic technical ability to create a video or screen capture, demonstrating some of the appearance and functionality of their final game.	
	0 marks Not credit worthy or not attempted.	

Assessment criteria	**Specification content (main focus)**							**Mark allocation**			
	Section							Total Marks	AO1 Marks	AO2 Marks	AO3 Marks
	2.2.1	2.2.2	2.2.3	2.2.4	2.2.5	2.2.6	2.2.7				
(a)	✓							**8**	0	8	0
(b)		✓						**8**	0	0	8
(c)			✓					**12**	0	0	12
(d)				✓				**20**	0	0	20
(e)					✓			**15**	0	0	15
(f)						✓		**12**	0	0	12
(g)							✓	**5**	0	0	5
	Total marks							**80**	**0**	**8**	**72**

Marking grids for Unit 4

<table>
<tr><th colspan="3">(a) Investigating Transactional Websites (2.4.1) [15 marks]</th></tr>
<tr><td>Band</td><td>AO2:</td><td>Apply knowledge and understanding to investigate, analyse and evaluate digital technology products and systems, approaches to their development, and their impact on individuals, organisations and society.</td></tr>
<tr><td>4</td><td colspan="2">12-15 marks

The candidate has demonstrated excellent application of knowledge and understanding to conduct thorough and extensive research into the main characteristics of transactional websites. The research has considered:
• a wide range of transactional website models and has clearly identified a comprehensive list of common characteristics (including the front-end client-side website and the back-end server-side database and scripting) and structures
• the advantages and risks of the use of transactional websites for organisations and end users
• digital marketing strategies associated with the data stored in transactional websites.

The candidate has produced a thorough and detailed summary of the investigation and has demonstrated excellent application of knowledge and understanding to identify an appropriate context for the development of a transactional website for their chosen organisation.</td></tr>
<tr><td>3</td><td colspan="2">8-11 marks

The candidate has demonstrated good application of knowledge and understanding to conduct thorough research into the main characteristics of transactional websites. The research has considered:
• a range of transactional website models and has clearly identified a list of common characteristics (including the front-end client-side website and the back-end server-side database and scripting) and structures
• the advantages and risks of the use of transactional websites for organisations and end users
• digital marketing strategies associated with the data stored in transactional websites.

The candidate has produced a detailed summary of the investigation and has demonstrated the application of knowledge and understanding to identify an appropriate context for the development of a transactional website for their chosen organisation.</td></tr>
</table>

Band	AO2:	*Apply knowledge and understanding to investigate, analyse and evaluate digital technology products and systems, approaches to their development, and their impact on individuals, organisations and society.*
2	**4-7 marks** The candidate has demonstrated basic application of knowledge and understanding to conduct some research into the main characteristics of transactional websites. The research has considered: • a number of transactional website models and has identified a list of common characteristics (including the front-end client-side website and the back-end server-side database) and/or structures • some of the advantages and risks of the use of transactional websites for organisations and end users • several digital marketing strategies associated with the data stored in transactional websites. The candidate has produced a summary of the investigation and has demonstrated some application of knowledge and understanding to identify a context for the development of a transactional website for their chosen organisation.	
1	**1-3 marks** The candidate has demonstrated limited application of knowledge and understanding to research into characteristics of transactional websites. The investigation has considered: • a limited number of transactional website models and has identified a list of common characteristics (including the front-end client-side website and the back-end server-side database) or structures • limited advantages and risks of the use of transactional websites for organisations and end users • limited digital marketing strategies associated with transactional websites. The candidate has produced a brief summary of the investigation and has attempted to identify a context for the development of a transactional website for their chosen organisation.	
	0 marks Not credit worthy or not attempted.	

(b) The design of a transactional website (2.4.2)		[15 marks]
Band	**AO3:**	*Plan, design, create and develop digital products.*

4	**12-15 marks**
	The candidate has demonstrated excellent technical ability to produce a thoroughly detailed design for the web pages for the transactional website.
	The candidate has:
	• fully documented the design work to a standard that could be implemented by a competent third party, including:
	  • designing clear and detailed wireframes
	  • preparing high quality and appropriate assets
	  • designing CSS to fully structure HTML web pages
	  • writing efficient and effective algorithms
	  • identifying efficient and effective scripting language routines or applets
	• set clear and measurable success criteria for the development of their transactional website
	• demonstrated a clear and effective design for the implementation of complex or interactive features
	• created a clear plan showing the overall timescale for the development of the transactional website showing activities in each stage of the development, timings for each activity, contingency times and review points.	

3	**8-11 marks**
	The candidate has demonstrated good technical ability to produce designs of the web pages for the transactional website.
	The candidate has:
	• documented the design work to a standard that could be used as a basis to create the website by a competent third party, including:
	  • designing detailed wireframes
	  • preparing appropriate assets
	  • designing CSS to structure HTML web pages
	  • writing effective algorithms
	  • identifying effective scripting language routines or applets
	• set measurable success criteria for the development of their transactional website
	• demonstrated a clear design for the implementation of complex or interactive features
	• created a plan showing the overall timescale for the development of the transactional website showing activities in most stages of the development, timings for most activities, some contingency times and review points.	

Band	AO3:	*Plan, design, create and develop digital products.*

2	**4-7 marks**
	
	The candidate has demonstrated basic technical ability to produce designs of the web pages for the transactional website.
	
	The candidate has:
	• documented the design work to a basic standard, including:
	  • designing wireframes
	  • preparing assets
	  • designing CSS to structure HTML web pages
	  • writing algorithms
	  • identifying scripting language routines or applets
	• set some measurable success criteria for the development of their transactional website
	• demonstrated a design for the implementation of complex or interactive features
	• created a plan showing the overall timescale for the development of the transactional website showing activities in some stages of the development and timings for some activities.	

1	**1-3 marks** The candidate has demonstrated a limited technical ability to produce designs of the web pages for the transactional website. The candidate has: • documented the design work to a limited standard • set some success criteria for the development of their transactional website • created a plan showing the overall timescale for the development of the transactional website showing activities in some stages.	
	0 marks Not credit worthy or not attempted.	

(c) The capture, storage and processing of data (2.4.3)		[15 marks]
Band	**AO3:**	*Plan, design, create and develop digital products.*
4	**12-15 marks** The candidate has demonstrated excellent technical ability to produce a thoroughly detailed design for the capture, storage, and processing of data for the transactional website by: • giving detailed consideration of the data that will be required • designing appropriate data capture forms for each process to be carried out • designing efficient algorithms for effective JavaScript/PHP routines to validate data input • identifying all related sets of data • designing effective and efficient data structures normalised to third normal form to enable the data to be managed • producing an ERD that clearly sets out the relationships between tables that will allow multiple products or services to be processed in a single transaction. The candidate has produced detailed design documentation to a high standard that could be implemented by a competent third party.	
3	**8-11 marks** The candidate has demonstrated good technical ability to produce a detailed design for the capture, storage, and processing of data for the transactional website by: • giving consideration of the data that will be required • designing appropriate data capture forms for each process to be carried out • designing algorithms for effective JavaScript/PHP routines to validate data input • identifying all related sets of data • designing effective data structures normalised to third normal form to enable the data to be managed • producing an ERD that sets out the relationships between tables that will allow multiple products or services to be processed in a single transaction. The candidate has produced design documentation to a standard that could be a basis for implementation by a competent third party.	

Band	AO3:	*Plan, design, create and develop digital products.*
2	**4-7 marks** The candidate has demonstrated basic technical ability to produce a design for the capture, storage, and processing of data for the transactional website by: • giving consideration of the main items of data that will be required • designing appropriate data capture forms for each process to be carried out • designing algorithms for basic JavaScript/PHP routines to carry out presence checks • identifying the main related sets of data • designing basic data structures to enable the data to be managed • producing an ERD that sets out the relationships between tables. The candidate has produced design documentation to a basic standard.	
1	**1-3 marks** The candidate has limited technical ability to produce a partial design for the capture, storage, and processing of data for the transactional website by: • identifying some of the main items of data that will be required • identifying the main related sets of data • designing limited data structures to enable the data to be managed. The candidate has produced design documentation to a limited standard.	
	0 marks Not credit worthy or not attempted.	

(d) The use of RDBMS database systems, scripting languages and SQL (2.4.4) [15 marks]		
Band	**AO3:**	*Plan, design, create and develop digital products.*
4	**12-15 marks** The candidate has demonstrated excellent technical ability to produce a thoroughly detailed design for the use of a RDBMS, scripting language and SQL by: • choosing an appropriate RDBMS program to allow the storage, retrieval and manipulation of data from the web based front-end • fully considering the hosting of the database and methods of establishing the connection from the website to the database • designing effective algorithms for server-side scripting language routines to respond to a wide range of client requests • designing a database in 3NF • designing a wide range of effective SQL statements.	
3	**8-11 marks** The candidate has demonstrated good technical ability to produce a detailed design for the use of a RDBMS, scripting language and SQL by: • choosing an appropriate RDBMS program to allow the storage, retrieval and manipulation of data from the web based front-end • considering the hosting of the database and methods of establishing the connection from the website to the database • designing algorithms for server-side scripting language routines to respond to a wide range of client requests • designing a database in 3NF • designing a range of effective SQL statements.	
2	**4-7 marks** The candidate has demonstrated basic technical ability to produce a design for the use of a RDBMS, scripting language and SQL by: • choosing an RDBMS program to allow the storage, retrieval and manipulation of data from the web based front-end • considering the hosting of the database and methods of establishing the connection from the website to the database • designing basic algorithms for server-side scripting language routines to respond to a range of client requests • designing a database which may be in 3NF or 2NF • designing a selection of SQL statements.	

Band	**AO3:**	*Plan, design, create and develop digital products.*
1	**1-3 marks** The candidate has demonstrated limited technical ability to produce a design for the use of a RDBMS, scripting language and SQL by: • designing limited algorithms for server-side scripting language routines to respond to client requests • designing a database which may not be normalised • designing a limited selection of SQL statements.	
	0 marks Not credit worthy or not attempted.	

(e) Developing and reviewing a transactional website (2.4.5) [20 marks]		
Band	**AO3:**	*Plan, design, create and develop digital products.*
5	**17-20 marks** The candidate has demonstrated excellent technical ability to produce an effective and efficient transactional website by following a series of processes including: • creating an RDBMS stored in an appropriate location • creating and establishing a connection from the website to the webserver to access the data stored in the RDBMS • implementing efficient processes to carry out data entry, storage and retrieval • developing an excellent prototype website • obtaining a wide range of feedback on the prototype from peers and a competent third party • fully considering the feedback received and refining the prototype • completing the transactional website to fully reflect the original designs and the feedback received • fully implemented at least three appropriate complex or interactive features • carrying out a detailed and effective review of progress against the time plan, amending the time plan where necessary.	
4	**13-16 marks** The candidate has demonstrated good technical ability to produce an effective transactional website by following a series of processes including: • creating an RDBMS stored in an appropriate location • creating and establishing a connection from the website to the webserver to access the data stored in the RDBMS • implementing processes to carry out data entry, storage and retrieval • developing a good prototype website • obtaining a range of feedback on the prototype from peers and a competent third party • considering the feedback received and refining the prototype • completing the transactional website to reflect the original designs and the feedback received • fully implemented at least two appropriate complex or interactive features and partially implemented at least one other • carrying out a detailed review of progress against the time plan, amending the time plan where necessary.	
3	**9-12 marks** The candidate has demonstrated satisfactory technical ability to produce a transactional website by following a series of processes including: • creating an RDBMS stored in an appropriate location • creating and establishing a connection from the website to the webserver to access the data stored in the RDBMS • implementing processes to carry out data entry, storage and retrieval • developing a satisfactory prototype website • obtaining some feedback on the prototype from peers and a competent third party • considering the feedback received and/or refining the prototype • completing the transactional website to reflect the original designs and/or the feedback received • fully implemented at least one appropriate complex or interactive feature and partially implemented at least one other • carrying out a review of progress against the time plan amending the time plan where necessary.	

Band	**AO3:**	*Plan, design, create and develop digital products.*
2	**5-8 marks** The candidate has demonstrated basic technical ability to produce a transactional website by following a series of processes including: • using an RDBMS stored in an appropriate location • creating a connection from the website to the webserver to access the data stored in the RDBMS • implementing basic processes to carry out data entry, storage and retrieval • developing a basic prototype website • obtaining basic feedback on the prototype from peers and/or a competent third party • considering some of the feedback received or refining the prototype • completing the majority of the transactional website to reflect most of the original designs or the feedback received • partially implemented at least two appropriate complex or interactive features • carrying out a basic review of progress.	
1	**1-4 marks** The candidate has demonstrated limited technical ability to produce a transactional website by following a series of processes including: • using an RDBMS stored in an appropriate location • using a connection from the website to the webserver to access the data stored in the RDBMS • implementing limited processes to carry out data entry, storage and retrieval • developing a limited prototype website • obtaining limited feedback on the prototype from peers or a competent third party • refining the prototype • completing some of the transactional website to reflect some of the original designs or the feedback received • carrying out a limited review of progress.	
	0 marks Not credit worthy or not attempted.	

(f) Testing and refining a transactional website (2.4.6)		[10 marks]
Band	**AO3:**	*Plan, design, create and develop digital products.*

4	**9-10 marks**
	
	The candidate has demonstrated excellent technical ability to carry out testing and refinement of the functionality and appearance of a transactional website.
	
	The functional testing is highly effective in terms of:
	• gathering and responding to feedback from competent third parties and users of the website
	• using testing results and feedback to:
	  • effectively refine web pages and data input facilities
	  • refine data structures and data processing routines to ensure the efficient operation of the website.	

3	**6-8 marks**
	
	The candidate has demonstrated good technical ability to carry out testing and refinement of the functionality and appearance of a transactional website.
	
	The functional testing is effective in terms of:
	• gathering and responding to feedback from competent third parties and users of the website
	• using testing results and feedback to:
	  • refine web pages and data input facilities
	  • refine data structures and data processing routines to improve the operation of the website.	

2	**3-5 marks**
	
	The candidate has demonstrated basic technical ability to carry out testing and refinement of the functionality and appearance of a transactional website.
	
	The functional testing is basic in terms of:
	• gathering and attempting to respond to feedback from competent third parties and users of the website
	• using testing results and feedback to:
	  • refine web pages and/or data input facilities.
	  • refine data structures to improve the operation of the website.	

1	**1-2 marks** The candidate has demonstrated limited technical ability to carry out testing and refinement of the functionality and appearance of a transactional website. The functional testing is limited in terms of: • gathering and/or attempting to respond to feedback from competent third parties and/or users of the website • using testing results and feedback to refine web pages.	
	0 marks Not credit worthy or not attempted.	

(g) Evaluating a transactional website (2.4.6)		[5 marks]
Band	**AO2:**	*Apply knowledge and understanding to investigate, analyse and evaluate digital technology products and systems, approaches to their development, and their impact on individuals, organisations and society.*

3	**5 marks**
	
	The candidate has demonstrated very good application of knowledge and understanding to conduct a thorough evaluation of their transactional website by:
	• objectively evaluating the extent to which:
	  • the time plan was followed
	  • the transactional website fulfils the success criteria
	• clearly identifying the potential for future development.	

2	**3-4 marks**
	
	The candidate has demonstrated good application of knowledge and understanding to conduct an evaluation of their transactional website by:
	• evaluating the extent to which:
	  • the time plan was followed
	  • the transactional website fulfils the success criteria
	• identifying the potential for future development.	

1	**1-2 marks**
	
	The candidate has demonstrated basic application of knowledge and understanding to conduct a straightforward evaluation of their transactional website by:
	• evaluating some of the extent to which:
	  • the time plan was followed
	  • the transactional website fulfils the success criteria
	• identifying some potential for future development.	

	0 marks Not credit worthy or not attempted.	

(h) Presenting outcomes (2.4.7)		[5 marks]
Band	**AO3:**	*Plan, design, create and develop digital products.*
3	**5 marks** The candidate has demonstrated very good technical ability to create an informative video clearly demonstrating the functionality of end user interactions, data handling and processing and the appearance of their transactional website.	
2	**3-4 marks** The candidate has demonstrated good technical ability to create a video demonstrating the functionality of end user interactions, data handling and processing and the appearance of their transactional website.	
1	**1-2 marks** The candidate has demonstrated basic technical ability to create a video demonstrating some of the functionality of end user interactions, data handling and processing and the appearance of their transactional website.	
	0 marks Not credit worthy or not attempted.	

Unit 4

Assessment criteria	**Specification content (main focus)**							**Mark allocation**			
	Section							Total Marks	AO1 Marks	AO2 Marks	AO3 Marks
	2.4.1	2.4.2	2.4.3	2.4.4	2.4.5	2.4.6	2.4.7				
(a)	✓							**15**	0	15	0
(b)		✓						**15**	0	0	15
(c)			✓					**15**	0	0	15
(d)				✓				**15**	0	0	15
(e)					✓			**20**	0	0	20
(f)						✓		**10**	0	0	10
(g)						✓		**5**	0	5	0
(h)							✓	**5**	0	0	5
	Total marks							**100**	**0**	**20**	**80**

Appendix B

NEA Tasks

GCE DIGITAL TECHNOLOGY

UNIT 2

CREATIVE DIGITAL PRACTICES

GAME PROJECT

Approximately 45 hours

INSTRUCTIONS FOR CANDIDATES

Read the information overleaf carefully to make sure that you understand what is needed.

It is important that you work independently from other candidates and make sure that what you hand in is your own unaided work.

Make sure that you check your work carefully to ensure that it is accurate and correct.

INFORMATION FOR CANDIDATES

Teachers and candidates will be required to sign a declaration that all work presented is the work of the candidate alone.

Information about the assessment of this unit is shown in Appendix A of the specification.

This task is about the development of a game.

Your task is to create a game.

You are required to:

a) Investigate the characteristics of three different games and prepare a report. You should consider:
   - the similarities and differences between:
     - genres and sub-genres of games
     - technical platforms of games
   - the impact and the positive and adverse effects that gaming can have on individuals.

   Using the outcomes of your investigation, you should produce a summary, identifying an appropriate context for the development of a game of your choice.

b) Produce an action plan for creating the game, including:
   - designing a directory structure
   - procedures for storing and protecting information
   - a tracking and monitoring system for the game development cycle
   - designing and maintaining asset logs and development logs
   - planning appropriate assets for the game and considering whether these should be original or existing assets.

c) Design an initial game concept and produce a report or presentation for stakeholders to convey the design that includes:
   - audio and visual elements
   - use of design tools
   - code that could be used in the game
   - choice of genre, game, technical platform and features
   - consideration of target audience and user requirements and needs.

   You should obtain stakeholder feedback on your game concept and record it in your development log.

d) Produce a draft game. You should consider:
   - acting upon stakeholder feedback on the game concept and the draft game to inform scope change
   - refining the game concept in light of feedback
   - utilising standard and advanced features of the software package
   - tools and techniques
   - programming facilities
   - coding practices.

e) Test and develop the game. You should:
   - produce plans for testing the game
   - carry out functional testing, adjusting the test plans as necessary
   - discuss test outcomes
   - use test results to refine the game.

   You should obtain stakeholder feedback on your game and record it in your development log.

f) Refine and review the game by:
- using game development tools and features
- obtaining and acting upon stakeholder feedback on the game
- documenting feedback
- refining the game in light of feedback
- completing the final version of the game to reflect designs and feedback.

You will need to export the final version of the game.

g) Produce a 5-10 minute movie or screen capture to demonstrate the functionality and appearance of the final version of the game.

Marks are awarded for:

(a)	Investigating games	[8]
(b)	Planning games	[8]
(c)	Making informed design decisions	[12]
(d)	Creating games	[20]
(e)	Testing and developing games	[15]
(f)	Refining and reviewing games	[12]
(g)	Presenting outcomes	[5]
Total marks		**[80]**

GCE DIGITAL TECHNOLOGY

UNIT 4

DIGITAL SOLUTIONS

TRANSACTIONAL WEBSITE PROJECT

Approximately 45 hours

INSTRUCTIONS FOR CANDIDATES

Read the information overleaf carefully to make sure that you understand what is needed.

It is important that you work independently from other candidates and make sure that what you hand in is your own unaided work.

Make sure that you check your work carefully to ensure that it is accurate and correct.

INFORMATION FOR CANDIDATES

Teachers and candidates will be required to sign a declaration that all work presented is the work of the candidate alone.

Information about the assessment of this unit is shown in Appendix A of the specification.

This task is about the development of a transactional website.

Your task is to choose an organisation that requires a transactional website. In the context of this task, the transactions should reflect the nature of your chosen organisation.

You are required to:

a) Investigate the main characteristics of transactional websites, including their structure, the front-end client-side website and the back-end server-side database and scripting. You should consider:
- the advantages and risks of the use of transactional websites for organisations and end users
- digital marketing strategies associated with the data stored in transactional websites
- types of transactional website models.

Using the outcomes of your investigation, you should produce a summary, identify an appropriate context, and choose an organisation for the development of your transactional website.

b) Produce designs and prepare assets for the web pages of your transactional website including:
- designing wireframes for each of the pages of the website including the detailed structure of each page and the contents, with clear and accurate dimensions for the positioning of content
- preparing assets such as text, images, video files and audio files including the resolution of images and the compression of video and audio files
- designing Cascading Style Sheets (CSS) to fully structure the HTML web pages
- writing algorithms for JavaScript/PHP routines to create complex and interactive content
- identifying appropriate server-side scripting language routines or applets to provide the intended functionality.

You should set clear and measurable success criteria for the development of your transactional website

You should create a time plan for the development of your transactional website including overall timings, identification of all activities, timings for each activity, contingency times and review points.

c) Produce designs for the capture, storage and processing of data for your transactional website including designing:
- HTML data capture forms
- algorithms for JavaScript/PHP routines to validate data
- data structures normalised to 3rd Normal Form (3NF) including fieldnames, data types, field sizes and key fields
- an Entity Relationship Diagram (ERD) that sets out the relationships between tables that will allow multiple products or services to be processed in a single transaction.

You should produce an entity relationship design including primary keys, foreign keys and relationships between data tables.

d) Produce a detailed design for the use of RDBMS, scripting language and SQL to allow the storage, retrieval and manipulation of data including:
- an RDBMS program that will allow the storage, retrieval and manipulation of data including the hosting of the database and methods of connecting the website and the database
- designing algorithms for server-side scripting language routines to respond to client requests
- designing a database in 3rd Normal Form (3NF)
- designing SQL statements to access stored data.

e) Develop and review the designs for your transactional website including:
- creating an RDBMS stored in an appropriate location
- creating a connection from the website to the web server to access data in the RDBMS
- developing a prototype website with pages incorporating essential content
- obtaining feedback on the prototype from peers and a competent third party
- refining the prototype in light of feedback received
- completing your transactional website to reflect the original designs and feedback, including your created data validation and verification routines
- developing a range of complex or interactive features that are appropriate for your transactional website
- reviewing progress against the time plan in terms of overall progress and use of contingency time
- amending the time plan to reflect progress to date.

f) Test and refine your transactional website including:
- testing its functionality
- gathering and responding to feedback from users
- using the testing results and feedback to refine the functionality and appearance of your transactional website.

g) Evaluate your transactional website including:
- the extent to which you followed the time plan
- the extent to which your transactional website fulfils your success criteria
- identifying the potential for future development.

h) Produce a 5-10 minute movie or screen capture of approximately five minutes duration to demonstrate the functionality and appearance of your transactional website including:
- end user interactions with the transactional website
- data handling and processing.

Marks are awarded for:

(a)	Investigating transactional websites	[15]
(b)	The design of a transactional website	[15]
(c)	The capture, storage and processing of data	[15]
(d)	The use of RDBMS database systems, scripting languages and SQL	[15]
(e)	Developing and reviewing a transactional website	[20]
(f)	Testing and refining a transactional website	[10]
(g)	Evaluating a transactional website	[5]
(h)	Presenting outcomes	[5]
Total marks		**[100]**