Level 3 Advanced Technical Certificate in Digital Technologies (5220-30)
Level 3 Advanced Technical Extended Diploma in Digital Technologies (720) (5220-32)

Level 3 Digital Technologies 5220-030 / 5220-530

Guide to the examination

March 2020 Version 1.2

Who is this document for?

This document has been produced for centres who offer **City & Guilds Level 3 Advanced Technical Certificate in Digital Technologies (5220-30)** and **Level 3 Advanced Technical Extended Diploma in Digital Technologies (720) (5220-32).** It gives all of the essential details of the qualification's external assessment (exam) arrangements and has been produced to support the preparation of candidates to take the exam/s.

The document comprises four sections:

1. **Details of the exam**. This section gives details of the structure, length and timing of the exam.
2. **Content assessed by the exam.** This section gives a summary of the content that will be covered in each exam and information of how marks are allocated to the content.
3. **Guidance.** This section gives guidance on the language of the exam, the types of questions included and examples of these, and links to further resources to support teaching and exam preparation.
4. **Further information.** This section lists other sources of information about this qualification and City & Guilds Technical Qualifications.

1. Details of the exam

External assessment

City & Guilds Technical qualifications have been developed to meet national policy changes designed to raise the rigour and robustness of vocational qualifications. These changes are being made to ensure our qualifications can meet the needs of employers and Higher Education. One of these changes is for the qualifications to have an increased emphasis on external assessment. This is why you will see an external exam in each of our Technical qualifications.

An external assessment is an assessment that is set and/or marked by the awarding organisation (ie externally). All City and Guilds Technical qualifications include an externally set and marked exam. This must be taken at the same time by all candidates who are registered on a particular qualification. We produce an exam timetable each year. This specifies the date and time of the exam so you can plan your delivery, revision and room bookings/PC allocation in plenty of time.

The purpose of this exam is to provide assurance that all candidates achieving the qualification have gained sufficient knowledge and understanding from their programme of study and that they can independently recall and draw their knowledge and understanding together in an integrated way. Whilst this may not be new to you, it is essential that your learners are well prepared and that they have time to revise, reflect and prepare for these exams. We have produced a Teaching, Learning, and Assessment guide that is you should refer to alongside the present document *(Teaching, Learning and Assessment Guide).* If a learner does not pass the exam at their first attempt, there is only one opportunity to resit the exam, so preparation is essential.

Exam requirements of this qualification

These qualifications have **one** pathway. This pathway is assessed by the following examination:

- **Level 3 in Digital Technologies (030/530)** – Theory exam (2 hours and 30 minutes).

The exam is graded and a candidate must achieve at least a Pass grade in order to be to be awarded the qualification. (In addition to the exam, a synoptic assignment must also be completed and passed. You can find full details of the synoptic assignment in the *Qualification Handbook* and the *Synoptic Assessment Guide* -please see the links at the end of this document).

When does the exam take place?

The exam is offered on two fixed dates in March and June. The exact dates will be published at the start of the academic year in the *Assessments and Exam Timetable*
http://www.cityandguilds.com/delivering-our-qualifications/exams-and-admin

At the start of the programme of study for each of the two years, in order to effectively plan teaching and exam preparation, centres should know when the exam will be taking place and allocate teaching time accordingly. Section 2 of this document gives a summary of the content that needs to be covered in order to prepare learners for the exam and full details of this are given in the Qualification Handbook.

Form of exam

The exam for this qualification can be taken either on paper or online.

Can candidates resit the exam?

Candidates who have failed an exam or wish to retake it in an attempt to improve their grade, can do so twice. The third and final retake opportunity applies to Level 3 only. The best result will count towards the final qualification. If the candidate fails the exam three times then they will fail the qualification.

How the exam is structured

Each exam has a total of **80 marks** available.

Each exam is made up of:

- Approximately 10-12 short answer questions;
- 1-2 extended response questions.

Short answer questions are used to confirm **breadth of knowledge and understanding**.

The extended response questions are to allow candidates to demonstrate **higher level and integrated understanding** through written discussion, analysis and evaluation. These questions also ensure the exam can differentiate between those learners who are 'just able' and those who are higher achieving.

More details about and examples of question types are given in Section 3 of this document.

Assessment Objectives

The exams are based on the following set of assessment objectives (AOs). These are designed to allow the candidate's responses to be assessed across the following three categories of performance:

- **Recollection** of knowledge.
- **Understanding** of concepts, theories and processes.
- **Integrated application** of knowledge and understanding.

In full, the assessment objectives covered by the exam for this qualification are:

Assessment objective ***The candidate..***	**Mark allocation (approx %)**
AO1 **Recalls knowledge** from across the breadth of the qualification	20%
AO2 **Demonstrates understanding** of concepts, theories and processes from a range of learning outcomes.	57.50%
AO4 **Applies knowledge, understanding and skills** from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	22.5%

Booking and taking the exam

All assessments for City & Guilds Technical Exams must be booked through Walled Garden. There is a deadline for booking exams, synoptic assessments and any other centre marked assessments, please refer to the time line to check these dates.

The exam must be taken under the supervision of an invigilator who is responsible for ensuring that it is conducted under controlled conditions. Full details of the conditions under which the exam must be taken can be found in the Joint Council for Qualifications (JCQ) document, *Instructions for Conducting Examinations (ICE)*.

Special consideration

Candidates who are unable to sit the exam owing to temporary injury, illness or other indisposition at the scheduled time may qualify for special consideration. This is a post-examination adjustment that can, in certain circumstances, be made to a candidate's final grade. The Joint Council for Qualifications' guide to the special consideration process can be found at www.jcq.org.uk .

To make a request for special consideration, please contact: policy@cityandguilds.com

Access arrangements

Access arrangements are arrangements that allow candidates with particular requirements, disabilities or temporary illness to take assessments, where appropriate, using their normal way of working. The Joint Council for Qualifications document, *Access Arrangements and Reasonable Adjustments* gives full details and can be downloaded here.

For further information and to apply for access arrangements please see:

Access arrangements - When and how applications need to be made to City & Guilds

Applying for access arrangements on the Walled Garden

2. Content assessed by the exam

Level 3 Advanced Technical Certificate in Digital Technologies (5220-30)

The exam assesses:

- **Unit 301: Project Management**
- **Unit 302: Information Security**
- **Unit 303: Networking fundamentals**
- **Unit 305: Software development fundamentals**

Each exam assesses a sample of the content of these units. This means that a single exam will **not** cover 100% of the unit content. The full range of content will be assessed over a number of examination series. Details of the coverage of a particular exam paper will **not** be released in advance of the exam itself. Centres should **not** make assumptions about what will be assessed by a particular exam based on what has been covered on previous occasions. In order to be fully prepared for the exam, learners **must** be ready to answer questions on **any** of the content outlined below.

The table below provides an overview of how the qualification's Learning Outcomes are covered by each exam and the number of **marks** available per Learning Outcome (ie **not** the number of *questions* per Learning Outcome). In preparing candidates for the exam, we recommend that centres take note of the number of marks allocated to Learning Outcomes and to assign teaching and preparation time accordingly.

In preparing candidates for the exam, **centres should refer to the Qualification Handbook** which gives full details of each Learning Outcome.

The following is a summary of only that qualification content which is assessed by the exam and **not** a summary of the full content of the qualification.

Unit	Learning outcome	Topics	Number of marks
301 Project Management	LO1 Apply Principles of Project Management	1.1 Application of Principles 1.2 Roles and responsibilities within a project	6 marks
	LO2 Apply stages of Project Management Life Cycle	2.1 Document key stages 2.2 Use Life cycle models	

	LO3 Present a project Review	3.1 Review outcome of a specified project 3.2 Use technology to communicate a project review	
302 Information Security	LO1 Apply security concepts	1.1 Types of access control methods 1.2 Vulnerabilities and threats 1.3 Protect technology systems	18 marks
	LO2 Determine infrastructure security	2.1 The mitigation of risks associated with technology systems 2.2 Security vulnerabilities associated with storage media 2.3 Security vulnerabilities associated with networking infrastructure 2.4 Types of intrusion detection methods 2.5 Security baselines	
	LO3 Identify types of cryptography	3.1 Types of cryptographic algorithms 3.2 Cryptography addresses 3.3 Public key/Private key infrastructure 3.4 The concepts of key management and certificate lifecycles	
303 Networking fundamentals	LO1 Determine physical and logical network topologies and components	1.1 The difference between physical and logical network topologies 1.2 Hardware and software technologies used in networking	18 marks
	LO2 Recognise the Open Systems Interconnection (OSI) model of networking	2.1 The 7 Layers of the OSI model and the relationship between each layer 2.2 The network functionality within each layer	

	LO3 Recognise the Transmission Control Protocol/Internet Protocol (TCP/IP) model of networking	3.1 The layers of the TCP/IP model and the relationship between each layer 3.2 The network functionality within each layer of the TCP/IP model 3.3 The relationship(s) between the OSI 7 Layer model and the TCP/IP model	
	LO4 Configure networks	4.1 Connect multiple network components 4.2 Carry out the configuration of network connection and security	
305 Software development fundamentals	LO1 Determine the design of programming languages	1.1 The differences between programming languages 1.2 The systems life cycles 1.3 The testing of software 1.4 The storage of information	20 marks
	LO2 Recognise common programming language data structures	2.1 Data structures 2.2 Programming constructs 2.3 Object oriented programming	
	LO3 Determine application software for business purposes	3.1 Integrated software applications 3.2 Web applications	
	LO4 Create documented code	4.1 Develop software 4.2 Review development	
		Total marks for sections:	62 marks
		Integration across units*:	18 marks
		Total marks for exam:	**80 Marks**

* *Integration across units.* These marks relate to Assessment Objective 4). These marks are awarded to differentiate between levels of performance by candidates taking the exam. The marks are given for how well a candidate has applied their knowledge, understanding and skills from across the units that make up the qualification in an integrated way to meet the requirements of the exam questions.

3. Guidance

Vocabulary of the exam: use of 'command' verbs

The exam questions are written using 'command' verbs. These are used to communicate to the candidate the type of answer required. Candidates should be familiarised with these as part of their exam preparation.

The following guidance has been produced on the main command verbs used in City & Guilds Technicals exams.

A more detailed version of this table, which also includes the command verbs used in the assignments is published in *City & Guilds Technical Qualifications Teaching, Learning and Assessment* guide.

Command verb	Explanation and guidance
Analyse	Study or examine a complex issue, subject, event, etc in detail to explain and interpret, elements, causes, characteristics etc
Calculate	Work out the answer to a problem using mathematical operations
Compare (…and contrast) (or ***describe*** the similarities/differences)	Consider and describe the similarities (and differences) between two or more features, systems, ideas, etc
Define	Give the meaning of, technical vocabulary, terms, etc.
Describe	Give a detailed written account of a system, feature, etc **(..the effect of…on…)** the impact, change that has resulted from a cause, event, etc **(..the process..)** give the steps, stages, etc
Differentiate between	Establish and relate the characteristic differences between two or more things, concepts, etc
Discuss	Talk/write about a topic in detail, considering the different issues, ideas, opinions related to it
Distinguish between	Recognise and describe the characteristic differences between two things, or make one thing seem different from another
Evaluate	Analyse and describe the success, quality, benefits, value, etc (of an end product, outcome, etc)
Explain	Make (a situation, idea, process, etc) clear or easier to understand by giving details, **(..how..)** Give the stages or steps, etc in a process, including relationships, connections, etc between these and causes and effects.

Give example(s) illustrate/	Use examples or images to support, clarify or demonstrate, an explanation, argument, theory, etc
Give a rationale	Provide a reason/reasons/basis for actions, decisions, beliefs, etc
Identify	Recognise a feature, usually from a document, image, etc and state what it is
Justify	Give reasons for, make a case for, account for, etc decisions, actions, conclusions, etc, in order to demonstrate why they suitable for or correct or meet the particular circumstances, context
Label	Add names or descriptions, indicating their positions, on an image, drawing, diagram, etc
List	Give as many answers, examples, etc as the question indicates (candidates are not required to write in full sentences)
Name	Give the (technical) name of something
Propose	Present a plan, strategy, etc (for consideration, discussion, acceptance, action, etc).
Select	choose the best, most suitable, etc, by making careful decisions
State	Give the answer, clearly and definitely
Summarise	Give a brief statement of the main points (of something)

Question types

The following explains, and gives examples of, types of questions used in City & Guilds Technical exams. In preparing candidates to take the exam, it is recommended that you familiarise them with the requirements of each question type so that they can be effective and make best use of the time available when sitting the exam.

- An effective candidate will gauge the type and length of response required from the question and the number of marks available (which is given for each question on the exam paper).
- Short answer questions may not require candidates to write in complete sentences. Extended response questions will require a more developed response.
- Candidates should read the exam paper before attempting to answer the questions and should allocate time proportionate to the number of marks available for each question or section.

Question type:

Short answer questions (restricted response)
These are questions which require candidates to give a brief and concise written response. The number of marks available will correspond to the number of pieces of information/examples and the length of response required by the question.

Example question:

Mark scheme:

State **four** specialist roles in a project team. (4 marks) **Answer:** **Accept any of the following or any other reasonable answer** • Financial staff (1) • Resource manager (1) • Estimator (1) • Design staff (1) • Team manager (1) • Project sponsor (1) **One mark for each role stated, maximum of four marks.**	
Test spec reference: 301 1.2	**Total marks: 4**

Question type:

Structured Response Questions

These are questions that have more than one part (eg a), b), etc.). The overall question is made up of linked, short answer questions which move the candidate through the topic in a structured way. For example, the question will usually start with a 'recall'/'state'/ 'describe' question followed by an 'explain' to draw out understanding of the topic. They usually have a shared introductory 'stem', and the number of marks may increase through the question.

Example question:

Mark scheme:

a) State **two** actions taken in key management lifecycles. (2 marks)

b) Describe **each** of the actions in Question a). (4 marks)

Answer:

a) Accept any of the following or any other reasonable answer

- Generation/Granting (1)
- Back Up/Recovery (1)
- Distribution (1)
- Deployment/Testing (1)
- Revocation (1)
- Suspension (1)
- Rotation/Renewal (1)
- Archival/Storage (1)Destruction (1)

One mark for each action stated, maximum of two marks.

Answer:

b) Accept any of the following or any other reasonable answer

- Generation/Granting: This is where the new key is created (1), in a 'hardened system' and it should be capable of withstanding a 'brute-force' attack for the intended life (duration) of the key (1).
- Back Up/Recovery: Before the new key is used to encrypt any data, a secure backup copy of the key should be made (1) and securely stored (1).
- Distribution: The key is now securely distributed (1) to the appropriate device (1).
- Deployment/Testing: The key is tested for a pre-determined period of time (1) – usually decided by the organisation's policy – if successful the key is then fully deployed (1).
- Revocation: If, for whatever reason, a key needs to be withdrawn from use (1), it should be completed in the absolute minimum amount of time necessary. The authority to use should be revoked (1) and the key should be returned / recovered to the secure central key store.
- Suspension: (temporary) In this situation, the authority for use should be withdrawn for a specified time (1), and the key returned to the secure key store (1).
- Rotation/Renewal: Where a key is coming to the end of its life the process of key rotation may come into play. This is where all the stored and encrypted data is converted to the new key (1) by unencrypting using the old key and re-encrypting using the new key (1).
- Archival/Storage: Although permanent deletion of an existing key does take place, in most cased the old key is itself encrypted (1) and stored (archived) in case it is required at some future date (1) to unencrypt some outstanding data.
- Destruction: The life of a key will end when it is destroyed (1). Key destruction should follow secure deletion procedures so as to ensure that it is properly obliterated (1).

Two marks for each description, maximum of four marks.

Test spec reference: 302 3.3	**Total marks: 6**

Question type:

Extended response questions

Extended response questions are those that require the candidate to write a longer written response using sentences and paragraphs. These usually require candidates to discuss, explain, etc. a topic in some detail. The question is often based on a short case study, scenario or other prompt. The level of detail should be gauged from the question and the number of marks available.

Example question:

Mark scheme:

A company's network team needs to design a secure network for a new building they are moving to. The development team for the network design are currently based in different locations.

Discuss the processes the company should complete to design the network. (9 marks)

Answer

Indicative content

- Principles of project management
- Network security, topologies and components
  Using collaborative tools to complete tasks

0 – No awardable material

Band 1:
1– 3 marks

The response demonstrates a limited understanding of the processes and technologies involved and is mostly a statement of facts which are not developed. The approach to the task is inconsistent. Statements may be occasionally incorrect and the use of precise technical language is sparse.

Band 2:
4 – 6 marks
The candidate has produced a discussion that expands on the factual knowledge but lacks detail in some areas. They show an adequate understanding of the processes and technologies involved including some reasons for their selection. They have provided some valid reasons for their choices. The response is structured and presented in a logical order.

Band 3:
7 – 9 marks
The candidate has produced a thorough discussion in a logical and professional manner. They show a thorough understanding of the processes and technologies involved and have covered these in the correct logical order, including reasons behind the processes and technologies, the factors that need to be considered and the impact these factors may have on the implementation. They have clearly understood how all of the processes and technologies link to one another in terms of order and importance. They have provided valid reasons for their choices. The response is clear, coherent and all information has been presented in a logical order.

Test spec reference:	**Total marks: 9**
301: 1.1; 1.2; 2.1; 2.2; 3.1 **302: 1.1; 1.2; 1.3; 2.1; 2.2; 2.3; 2.4; 2.5; 3.2** **303: 1.1; 1.2; 4.1; 4.2** **304: 2.1; 2.2; 2.3**	

Band 1

1– 3 marks

Example band 1 response

The company will use the life cycle model to design a secure network. First they will need to gather information to decide what topology they will be using. They will be using star topology, by using that it can be easy to place everything. But if the main switch gets damaged then the whole network is down. They will need to design a good secure network, then start buying all the hardware and putting everything together.

After that they will test the star topology and make sure its running perfectly. Lastly if any bug or error they will need to go back and find the error.

Using documentation will make it easier and they can know where it stopped working or where any errors or bugs occurred.

Band 2

4 – 6 marks

Example band 2 response

The company should first do a feasibility study to check where the new building is suited for their network size and structure. Based on this study they may need to decide whether they need to modify the building or the network to suit their needs. In this study they should also consider contingencies and ROI (return of investment). These contingencies can include: planned time slippage, scope creep, finances, human resources and dependencies. They should also consider downtime, because data from the current network will have to be moved to the new office. This should be done out of hours when no one is using the network, as to not disturb anyone.

However, before they start working of the network, the company should choose what type of lifecycle they want to use. For the purposes of this discussion, we will assume the waterfall model was chosen. The waterfall model consists of the following: Design, Implementation, Testing, Deployment and Maintenance. In the Design stage, client requirements should be gathered and both the logical and the physical plan for the network should be created. In the Implementation stage, the network should be set-up, following the plans created in the Design stage.

Next, the network should be thoroughly tested. The tests should be both black box and white box. White box testing represents a type of testing where the inner workings of the network are tested. The network team should test the new network to see how it compares to the old on and if it meets the needs of its users. Black box represents a type of test where the network is tested by the users without access to the internals of the network. After testing is done the new network should be deployed for use.

Finally, the new network should be properly administered to ensure good performance and productivity.

Band 3

7 – 9 marks

Example band 3 response

The company should set up a project team and make it clear what everyone's responsibility is. The sponsor and the project manager could do a feasibility study to make sure that the project is worth doing so that the benefits justify the money in the budget. If they decide that it's not, they must change the project or abandon it. Based on this study they may need to decide whether they need to modify the building or the network to suit their needs. In this study they should also consider contingencies and ROI (return of investment). These contingencies can include: planned time slippage, scope creep, finances, human resources and dependencies.

They must be very clear if the project will interrupt the exiting work of the company. If the company want to make sure that no-one is interrupted, they can complete the work outside the normal working hours. However, this will add cost as it's more expensive to get people to work at night. When that decision is made they have to check that it doesn't change the feasibility or viability.

They have to make it clear what development life cycle model they will use and arrange to check the progress of the project with milestones where certain things have to be completed. If they use the Waterfall Model, it means that the different stages (Design, Implementation, Testing, Deployment, and Maintenance) must go in that direction. If a milestone shows that something is not finished, it could hold up the next stage of the project. That may mean more cost if people are booked for a certain time.

The network needs to be tested completely. The test plan should be created at the design stage and must test for three things: usability, functionality and security. What I mean is, can the users of the network use its features, can the network do all the tasks it is designed for, especially when it's under load stress testing, and does the testing show that the network is secure against attacks from inside and outside the company.

The company should review the finished network and ask the users to report issues to the project manager and suggest improvements. They could set up a shared reporting tool so that the information from everywhere is in the same place and easy for the project manager to get to and reply.

Examination technique

Candidates with a good understanding of the subject being assessed can often lose marks in exams because they lack experience or confidence in exams or awareness of how to maximise the time available to get the most out of the exam. Here is some suggested guidance for areas that could be covered in advance to help learners improve exam performance.

Before the exam

Although candidates cannot plan the answers they will give in advance, exams for Technical qualifications do follow a common structure and format. In advance of taking the exam, candidates should:

- be familiar with the structure of the exam (ie number and type of questions).
- be aware of the amount of time they have in total to complete the exam.
- have a plan, based on the exam start and finish time for how long to spend on each question/section of the exam.
- be aware of how many marks are available for each question, how much they should expect to write for each question and allow most time for those questions which have the most marks available.

At the start of the exam session

At the start of the exam, candidates:

- should carefully read through the exam paper before answering any questions.
- may find it helpful, where possible, to mark or highlight key information such as command words and number of marks available on the question paper.
- identify questions which require an extended written answer and those questions where all or part of the question may be answered by giving bullets, lists etc rather than full sentences.

Answering the questions

Candidates do not have to answer exam questions in any particular order. They may find it helpful to consider, for example:

- tackling first those questions which they find easiest. This should help them get into the 'flow' of the exam and help confidence by building up marks quickly and at the start of the exam.
- tackling the extended answer question at an early stage of the exam to make sure they spend sufficient time on it and do not run out of time at the end of the exam.

Candidates should avoid wasting time by repeating the question either in full or in part in their answer.

Candidates should **always** attempt every question, even questions where they may be less confident about the answer they are giving. Candidates should be discouraged however, from spending too long on any answer they are less sure about and providing answers that are longer and give more detail than should be necessary in the hope of picking up marks. This may be mean they have less time to answer questions that they are better prepared to answer.

Extended answer questions

Before writing out in full their answer to extended questions, candidates may find it helpful to identify the key requirements of the question and jot down a brief plan or outline of how they will

answer it. This will help clarify their thinking and make sure that they don't get 'bogged down' or provide too much detail for one part of the question at the expense of others.

Towards the end of the exam

Candidates should always set aside time at the end of the exam to read back through and review what they have written in order to make sure this is legible, makes sense and answers the question in full.

If a candidate finds they are running out of time to finish an answer towards the end of the exam, they should attempt to complete the answer in abbreviated or note form. Provided the content is clear and relevant, examiners will consider such answers and award marks where merited.

Further guidance on preparing candidates to take the exam is given in the City & Guilds publication, which can be downloaded free of charge from City & Guilds website.

4. Further information

For further information to support delivery and exam preparation for this qualification, centres should see:

City & Guilds

Qualification homepage: which includes:

- *Qualification handbook*
- *Synoptic Assignment*
- *Sample assessments*

Technical Qualifications, Resources and Support:
http://www.cityandguilds.com/techbac/technical-qualifications/resources-and-support

Joint Council for Qualifications

Instructions for Conducting Examinations: www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations