

# 1145-32 Level 3 Advanced Technical Extended Diploma in Engineering

**2022**

**Qualification Report**

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# Introduction

This document has been prepared by the Chief Examiner and Principal Moderator; it is designed to be used as a feedback tool for centres in order to enhance teaching and preparation for assessment. It is advised that this document is referred to when planning delivery and when preparing candidates for City & Guilds Technical assessments.

This report provides general commentary on candidate performance in both the synoptic assignment and theory exam. It highlights common themes in relation to the technical aspects explored within the assessment, giving areas of strengths and weakness demonstrated by the cohort of candidates who sat assessments in the 2022 academic year. It will explain aspects which caused difficulty and potentially why the difficulties arose.

The document provides commentary on the following assessments:

- 1145-530 Level 3 Engineering - Theory exam (1)
  - March 2022 (Spring)
  - June 2022 (Summer)
- 1145-532 Level 3 Engineering - Theory exam (2)
  - March 2022 (Spring)
  - June 2022 (Summer)
- 1145-031 Level 3 Engineering - Synoptic assignment (1)
- 1145-034 Level 3 Engineering - Synoptic assignment (2)

# Foreword

## Results August 2022

As you will likely be aware, Ofqual has announced that grading for General Qualifications this summer will be more generous than prior to the pandemic. This is partly due to managing the impact of disruption and learning loss on learner performance and also managing fairness between learners in different years who had different methods of determining their grades. Therefore, for A levels and GCSEs, grading will seek a midway position between 2019 and 2021, meaning, in general, results will be somewhat higher than prior to the pandemic. This year, 2022, is a transitional year and outcomes and standards will likely return to pre-pandemic levels in 2023.

Similarly, for Vocational and Technical Qualifications (VTQs), this summer will be a transitional year and Ofqual has now been clear that for VTQs “we should expect that this summer’s results will look different, despite exams and assessments taking a big step towards normality.” Ofqual has published a blog [What’s behind this summer’s VTQ results](#)

In acknowledgement of the disruption to learning and to support fairness for all learners certificating this summer (some of whom will be competing against learners taking General Qualifications for the same progression and higher education opportunities), we will be taking loss of learning into consideration, whilst still acknowledging the need to uphold the validity of the qualifications. On this basis, we have made the decision to apply a form of ‘safety net’ through some additional ‘generosity’ to both the theory examinations and synoptic assignments within our Technical Qualifications wherever appropriate, (noting that it may not be appropriate to apply where there is a clear impact on knowledge and skills to practice, particularly health and safety requirements or other relevant legislation). We are therefore also reviewing candidate work a few marks below (equivalent to 5% of maximum marks) the Pass and Distinction notional boundaries – the boundaries used during the awarding process as the best representation of maintaining the performance standard from 2019.

The reason for lowering boundaries, where appropriate, by 5% of the maximum marks available, is that it is broadly commensurate with the level of generosity learners are likely to see in General Qualifications at level 2 and level 3. Providing that senior examiners can support the quality of learners’ work seen below the notional boundaries and agree it is sufficient to maintain the integrity, meaning and credibility of the qualifications, the grade boundaries will be lowered across the full set of grades – e.g Pass, Merit, Distinction and Distinction Star.

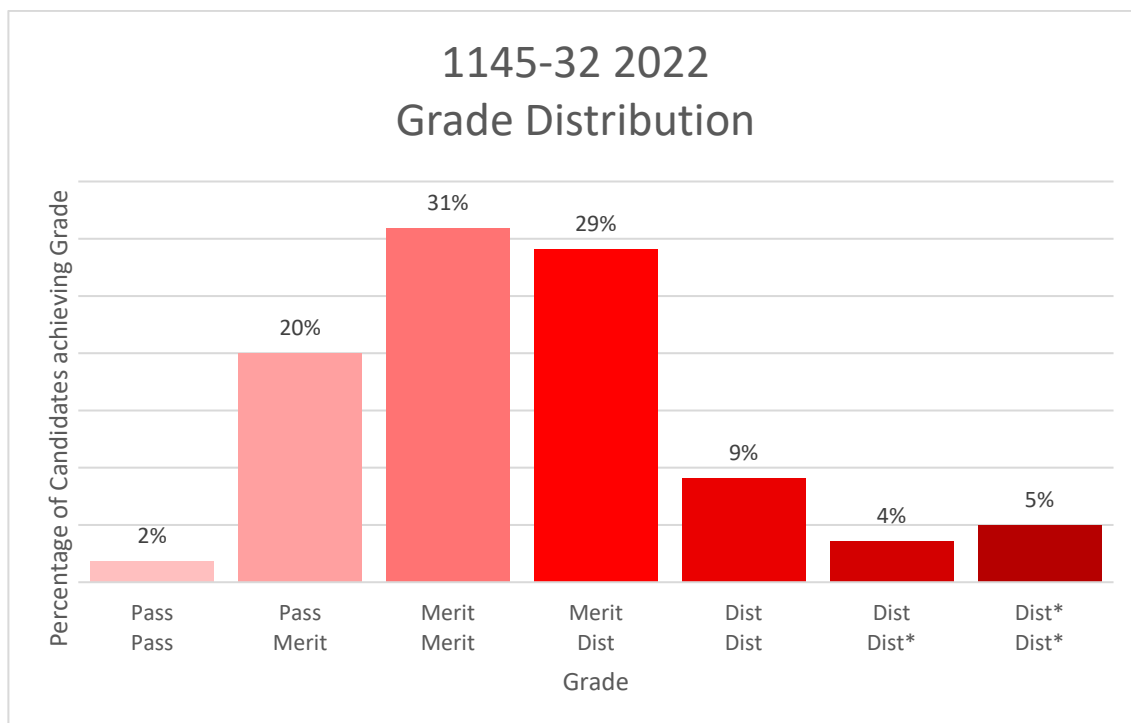
Given the circumstances, this is the best approach to take into account the disruption to teaching and learning across every learner in a fair and transparent way, and at the same time maintain the integrity and meaning of qualifications. This approach helps to level our Technical Qualifications awarding approach with that adopted for General Qualifications and other qualifications awarded in England and in the wider UK.

## Spring examination series 2022

Having taken this decision, we are also mindful of learners who have taken components in **Spring 2022** and believe they should also have access to the same level of generosity. For these learners, we wish to adopt a similar approach. Therefore, for learners taking Technical Qualification assessments in spring there will be similar generosity, through the addition of 5% of the maximum mark available for the assessment. It is a different mechanism to that we are using for the summer assessments but provides the same level of generosity to those learners taking assessments in the summer.

# Qualification Grade Distribution

The approximate grade distribution for this qualification is shown below:



This data is based on the distribution as of 16<sup>th</sup> August 2022.

Please note City & Guilds will only report qualification grades for candidates who have achieved all of the required assessment components, including Employer Involvement, optional units and any other centre assessed components as indicated within the Qualification Handbook. The grade distribution shown above could include performance from previous years.

# Theory Exam

## Grade Boundaries

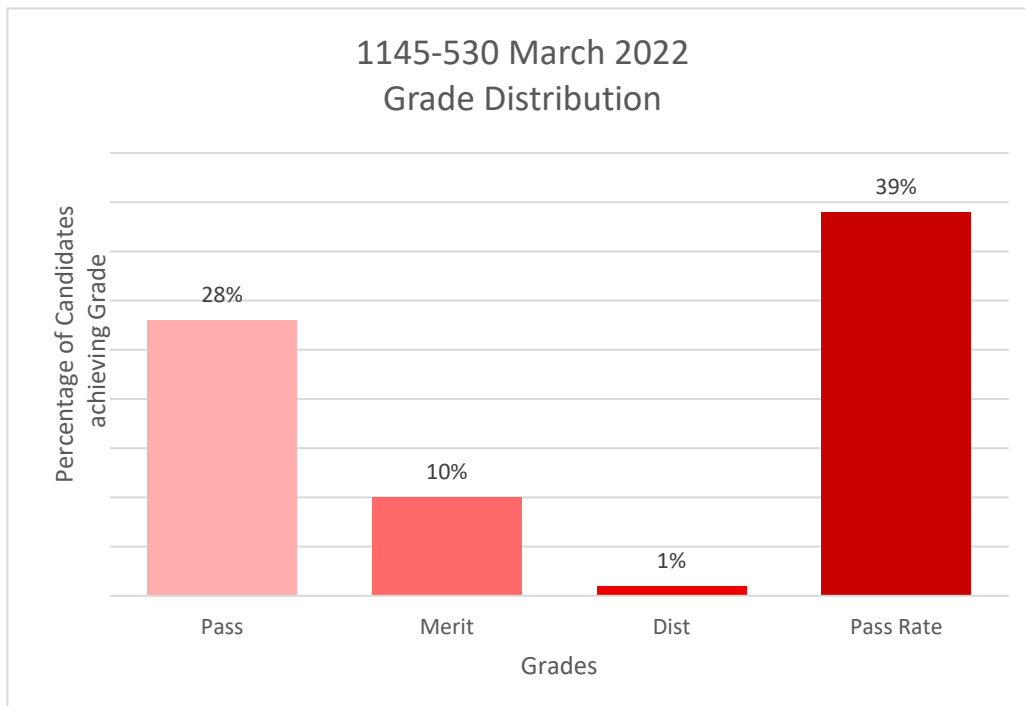
Assessment: **1145-530 Level 3 Engineering – Theory exam**  
Series: **March 2022**

Below identifies the final grade boundaries for this assessment, as agreed by the awarding panel:

<b>Total marks available</b>	<b>100</b>
Pass mark	40
Merit mark	55
Distinction mark	70

The generosity applied to the summer assessments will also retrospectively be applied to candidates who achieved their best result in spring. 5% of the base mark of the assessment will be added to their score rather than applied to boundaries.

The graph below shows the approximate distributions of grades and pass rate for this assessment, it does not account for any marks that have been amended due to generosity:

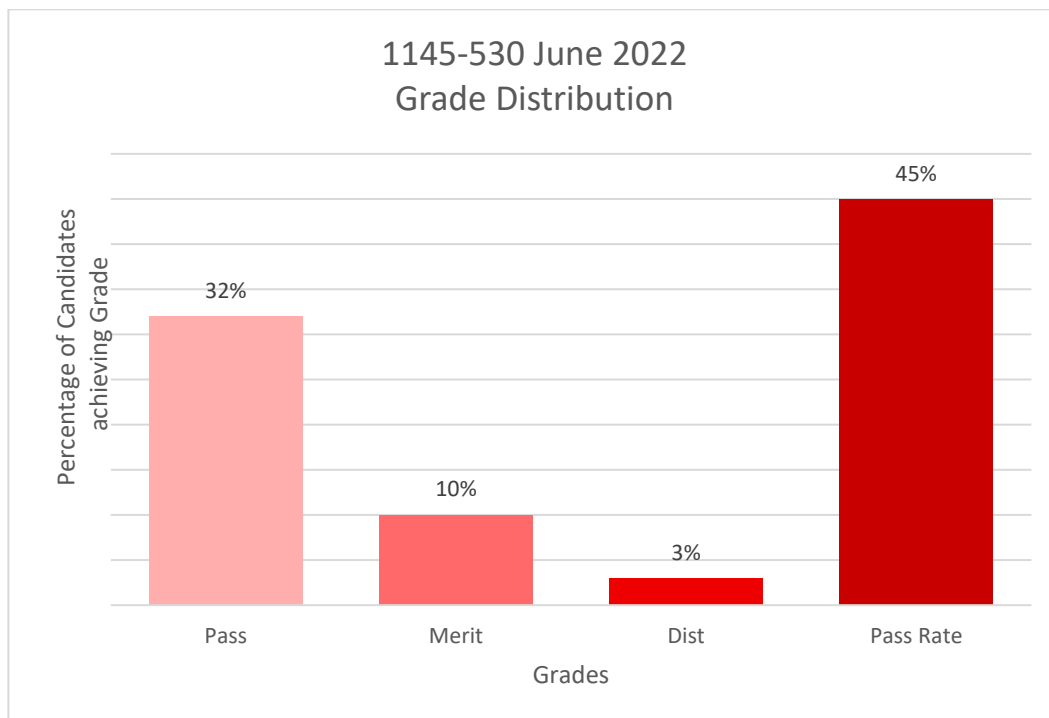


Assessment: **1145-530 Level 3 Engineering – Theory exam**  
Series: **June 2022**

Below identifies the final grade boundaries for this assessment.

<b>Total marks available</b>	<b>100</b>
Pass mark	34
Merit mark	49
Distinction mark	64

The graph below shows the approximate distributions of grades and pass rate for this assessment using the above boundary marks:



Assessment: **1145-532 Level 3 Engineering – Theory exam (2)**

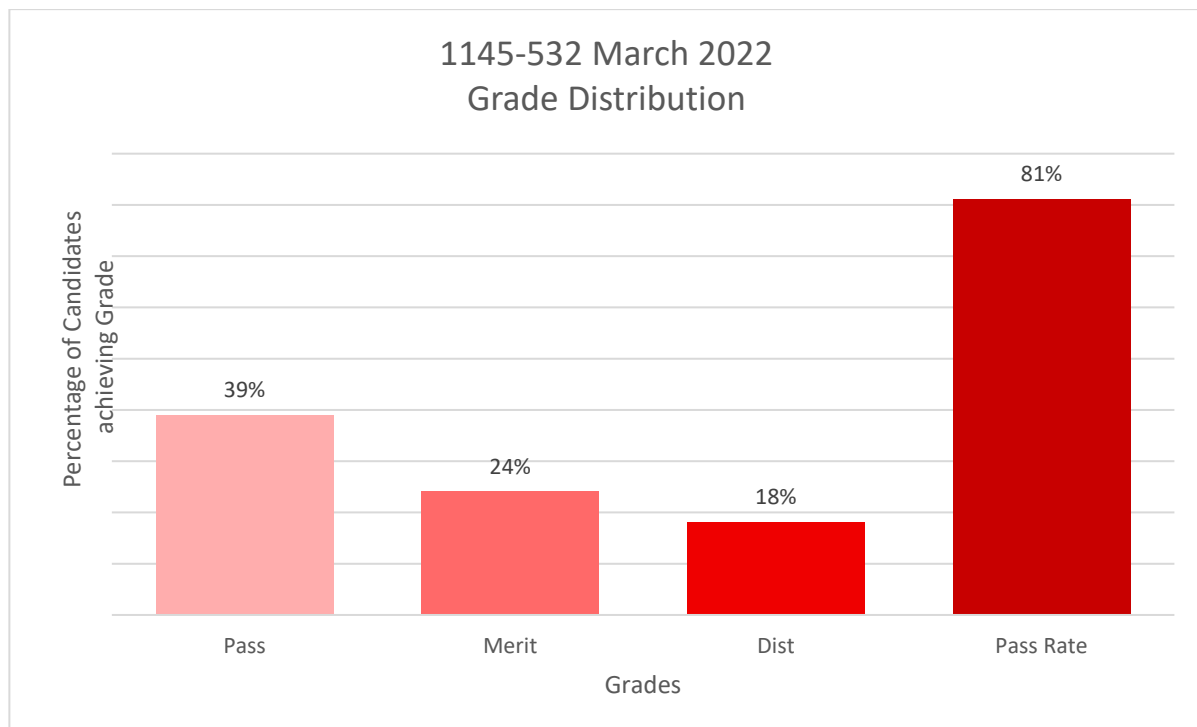
Series: **March 2022**

Below identifies the final grade boundaries for this assessment, as agreed by the awarding panel:

<b>Total marks available</b>	<b>60</b>
Pass mark	23
Merit mark	31
Distinction mark	40

The generosity applied to the summer assessments will also retrospectively be applied to candidates who achieved their best result in spring. 5% of the base mark of the assessment will be added to their score rather than applied to boundaries.

The graph below shows the approximate distributions of grades and pass rate for this assessment, it does not account for any marks that have been amended due to generosity:

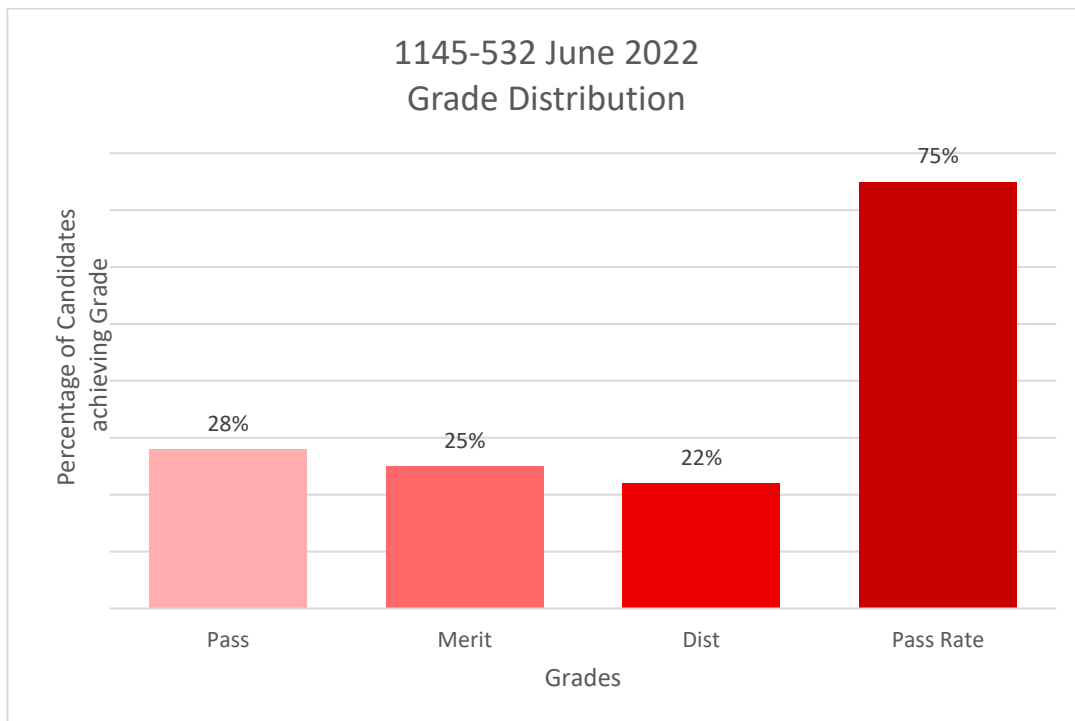




Below identifies the final grade boundaries for this assessment.

<b>Total marks available</b>	<b>60</b>
Pass mark	20
Merit mark	28
Distinction mark	36

The graph below shows the approximate distributions of grades and pass rate for this assessment using the above boundary marks:



# Chief Examiner Commentary

**Assessment component: 1145-530 Level 3 Engineering – Theory exam**

**Series 1 – March 2022**

The paper met the requirements of the specification and were pitched appropriately for this level. The question paper and the mark scheme are valid to the specification and appropriate.

There were strengths demonstrated in relation to the engineering design, a knowledge of design criteria and computer aided design (CAD).

A notable proportion of candidates' responses showed weak subject knowledge and understanding in comparison to previous series. These areas of weakness are outlined below:

Question relating to induction hardening, showed a mixture of performance. Some candidates were able to demonstrate a knowledge of the induction hardening process, however when asked to demonstrate understanding around why induction hardening may be used over case hardening, the cohort struggled, and the question was not answered well. A high proportion of candidates described carburising rather than induction hardening, and only a small proportion of candidates demonstrated evidence of understanding of the role of magnetism. There were a number of technical errors present in the responses.

There was a distinct lack of knowledge relating to stereolithography, only a very small proportion of the cohort managed to obtain marks on this question. A notable proportion of candidates described 3D printing or fused deposition modelling rather than stereolithography. A small proportion of candidates did not attempt this question.

The performance on unit 306 Engineering mathematics and statistics was particularly poor, as with previous series, the maths questions were not answered well, and many candidates did not fully show their workings.

Most candidates used the incorrect calculation when determining frequency from a graph which showed the plot of the relative position of a mechanical linkage with time.

A high proportion tried to answer the logarithms question without using logarithms, which was a requirement explicitly stated in the question.

When asked to apply algebra to a practical engineering problem by expressing the mathematical relationship shown in a graph, a high proportion of candidates attempted to describe the relationship in words, rather than the requested mathematical relationship. This was a requirement explicitly stated within the question.

Very few candidates gave a full response to the question on differentiation.

The extended response questions (there are two within this paper) produced a good spread of responses and acted as the main differentiator for the paper. The full spread of marks were achieved and there was a distribution across all marking bands. The responses to the longer synoptic questions would have benefited in many cases from consideration of both the direct and secondary impacts of the various factors on the question topics.

There was a noted weakness in the examination technique for a large majority of the cohort, where candidates were asked to explain, a proportion gave simple statements without detail of the explanation. This demonstrated no depth of understanding and prevented access to higher marks.

## **Series 2 – June 2022**

The paper met the requirements of the specification and were pitched appropriately for this level. The question paper and the mark scheme are valid to the specification and appropriate.

The performance of this cohort was weaker in comparison to Spring, which is to be expected due to a large proportion of the cohort resitting the examination. The majority of these candidates were low scoring in the Spring series, therefore the drop in performance was to be expected.

One strength of this cohort was demonstrating an understanding of complex numbers with a high proportion of the cohort being able to add complex numbers accurately. Candidates also demonstrated understanding of how to calculate an average measurement, however significantly struggled to determine the standard deviation. Candidates continue to struggle with the more challenging maths problems.

Each series there is a question which gives candidates a context and asks them to select a suitable material for that context giving justification for why they have made that selection. Candidates were able to apply their knowledge to the context and give suitable suggestions, however their answers often lacked detail around why they had chosen that material based on the information provided.

Candidates again demonstrated weakness with exam technique. When candidates were asked to explain a topic, they would only state recalled knowledge, not providing the supporting explanation expected, which would have demonstrated full understanding. Additionally, when candidates were asked to explain multiple points, a proportion of candidates stated and explained only a single point.

As mentioned, this cohort showed weakness in comparison to Spring, and had noticeable weakness in the following areas:

### **Unit 301 - Engineering Materials:**

Candidates struggled with basic recall of fundamental concepts. These questions focused on properties and characteristics of engineering materials, which candidates have previously performed well in. These questions provided candidates with a definition and asked them to recall the technical term. Areas of significant weakness were seen in the understanding of how solution hardening impacts metals and how superconductors conduct electricity. However, candidates did show stronger knowledge and understanding around the mechanical testing methods used to test specified properties.

### **Unit 304 - Manufacturing Methods in Engineering:**

Most candidates were not able to define the Lean term of 'Poka Yoke', and most failed to give an example of this concept. Candidates were asked to describe abrasive water jet cutting, however many candidates described plasma cutting instead. There was better knowledge demonstrated relating to the difference between bespoke and large-batch manufacturing, however this was limited in depth.

### **Unit 305 - Engineering Design:**

Candidates were unable to recall the methods of representing designs. They were asked to identify the documents that detailed specific information but were unable to name these. The documents assessed within the examination should have been covered in the accompanying synoptic assignment and any practical work the candidates would have undertaken.

### **Unit 306 - Engineering Mathematics and Statistics:**

Questions around mathematics tended to be answered poorly, which is in line with previous series. In particular, candidates showed a lack of knowledge when asked about BODMAS simultaneous equations, standard deviation, integration and differentiations.

The extended response questions (there were two within this paper) produced a good spread of responses and acted as the main differentiator for the paper. The full spread of marks was achieved and there was a distribution across all marking bands.

For the first synoptic question, which asked about social and economic development a proportion of the cohort only answered social or economic development and not both, so therefore struggled to achieve higher marks. The same issue occurred on the second synoptic question where candidates were asked about the design and manufacture of components, but some candidates would only answer in relation to design or manufacture and not both. The responses to the longer synoptic questions would have benefited in many cases from consideration of both the direct and secondary impacts of the various factors on the question topics.

## Assessment component: 1145-532 Level 3 Engineering – Theory exam

### Series 1 – March 2022

The paper met the requirements of the specification and were pitched appropriately for this level. The question paper and the mark scheme are valid to the specification and appropriate.

There were strengths demonstrated in relation to innovation and market research, as well as health and safety.

A notable proportion of candidates' responses showed a broad range of subject knowledge, although this lacked depth of detail in a few areas. In some questions where candidates were asked to explain a topic, a high proportion of candidates recalled knowledge but did not give the depth of explanation to demonstrate a full understanding of all the stated points.

The areas of weakness are outlined below:

Candidates struggled on the question asking them to describe the process of cutting steel using oxy-fuel cutting. This is a practical process that candidates should have completed regularly during their course of learning, and the question asked them to recall that process. Answers to this question were often brief with candidates not going into the expected level of detail in order to access the full range of marks available – they would reference 'fuels' rather than naming which fuels, and often would not recall the appropriate terminology relating to the equipment.

Another area of weakness were questions relating to low carbon technologies. Although candidates were able to gain some marks on these questions, it showed that candidates had a lack of process knowledge and understanding of the specific type of low carbon technology that would have allowed candidates to access the higher marks by being able to explain what was asked in these questions.

When asked to describe the process relating to a specific low carbon technology, candidates were trying to pull in knowledge from other low carbon technologies in a non-targeted approach, so they were generally only able to access the lower marks. When comparing the named process with another low carbon technology, candidates demonstrated they knew what pyrolysis is, however, due to the lack of understanding of gasification shown in the earlier part of the question, most candidates did not have the depth of knowledge to access the higher marks by being able to explain the difference that the question asked for.

When asked a more general question on low carbon technologies and their impact, candidates answered slightly better than the previous more specific questions. This gave candidates an opportunity to display what knowledge they did have. Although this question was answered better than the other parts, it still had the same issues relating to examination technique with candidates not going into enough detail or explanation to reach the higher marks.

A better performance was expected when dealing with low carbon technologies due to how topical this subject currently is within the industry. Whilst there was some demonstration of knowledge, there was very limited understanding shown with most candidates providing very limited and brief explanations. This may also be down to a lack of examination technique.

The question which asked candidates to describe what is meant by hybrid cloud computing was not answered well. Answers to this question showed a lack of knowledge on this topic. Candidates were able to advise that cloud data was data stored on the cloud and accessible globally, however could not get the second mark, which relates to the hybrid part of the question where the data is stored in a hybrid model (some local to the machine other within the cloud).

This is purposefully on the specification as it helps with Augmented Reality and Virtual Reality, as both are used by production engineers. This question followed on from a question on

Augmented Reality in which candidates were only able to provide generic responses and could not relate this back to how the technology is used within an engineering context.

The extended response question produced a good spread of responses and acted as the main differentiator for the paper. There was distribution across all marking bands. A notable proportion of candidates discussed the aims of research and development generally during product development, rather than specifically relating to the context of new manufacturing processes of PPE as specified in the question. Some candidates focussed on a single aim, rather than considering the potential range and variety of aims. The best answers included analysis and evaluation of how the discussed aims could affect outcome achieved. This is a good indication of candidates' responses to the paper overall. They were able to show some knowledge but generally lacked depth.

The response to the longer synoptic question would have benefited in many cases from consideration of both the direct and secondary impacts of the various factors on the question topic. A small proportion of candidates would also have benefited from mapping out or structuring their response to avoid duplication of points and ensure a broad response.

## **Assessment component: 1145-532 Level 3 Engineering – Theory exam**

### **Series 2 – June 2022**

The paper met the requirements of the specification and were pitched appropriately for this level. The question paper and the mark scheme are valid to the specification and appropriate.

There were strengths shown in the understanding of effective uses of augmented reality within engineering. Other areas of strengths included the identification of key stakeholders relating to engineering projects, as well as sound understanding of health and safety regulations and their impact on working practice within the industry.

A notable proportion of candidates' responses showed breadth of subject knowledge, although this often lacked the depth of understanding expected at this level. In some questions where candidates were asked to explain a topic, a high proportion of candidates recalled knowledge relating to the topic but did not give full explanations. This resulted in candidates being unable to demonstrate understanding and therefore they could not access all the available marks. Additionally, where candidates were asked to explain multiple points, a proportion of candidates stated and explained only a single point.

The areas of weaknesses are outlined below:

#### **Unit 307 - Engineering workshop practice:**

An early question in the paper asked about the typical uses of equipment found within an engineering workshop. This question was basic recall and the answers provided were general and did not give specific examples of how the equipment is used. A second area of weakness in this topic area was recalling the typical use of three types of cables.

#### **Unit 308 - Innovation and new technologies:**

Candidates showed an awareness of innovation and new technologies explored in the paper, however they struggled to demonstrate they understood the impact these technologies were having on the industry. An example of this is how rapid prototyping can support the development of innovative products. A significant number of candidates were able to describe what rapid prototyping was but did not go on to explain how it is used to support product innovation. There was a lack of knowledge regarding the process of carbon capture, although some questions on carbon capture on this question paper were answered well, a significant proportion of candidates were unable to explain this process using an example from the engineering world to support their answer.

There was also a lack of knowledge when candidates were asked about the infrastructure required to support an application of augmented reality. Candidates were able to provide good examples of what augmented reality would be used for but were not able to connect these examples to what infrastructure would be required. The performance on cloud computing was not as good as it had been in previous series. In this series there was a very mixed response with candidates drawing on more generalised knowledge.

The extended response question asked candidates to discuss the influence of enablers on innovation. Responses would, in many cases, have benefited from consideration of both the direct and secondary impacts to innovation. A high proportion of candidates would also have benefited from mapping out or structuring their response to avoid duplication of points and ensure a broad response. A notable proportion of candidates did not use examples to illustrate their answers.

# Synoptic Assignment

## Grade Boundaries

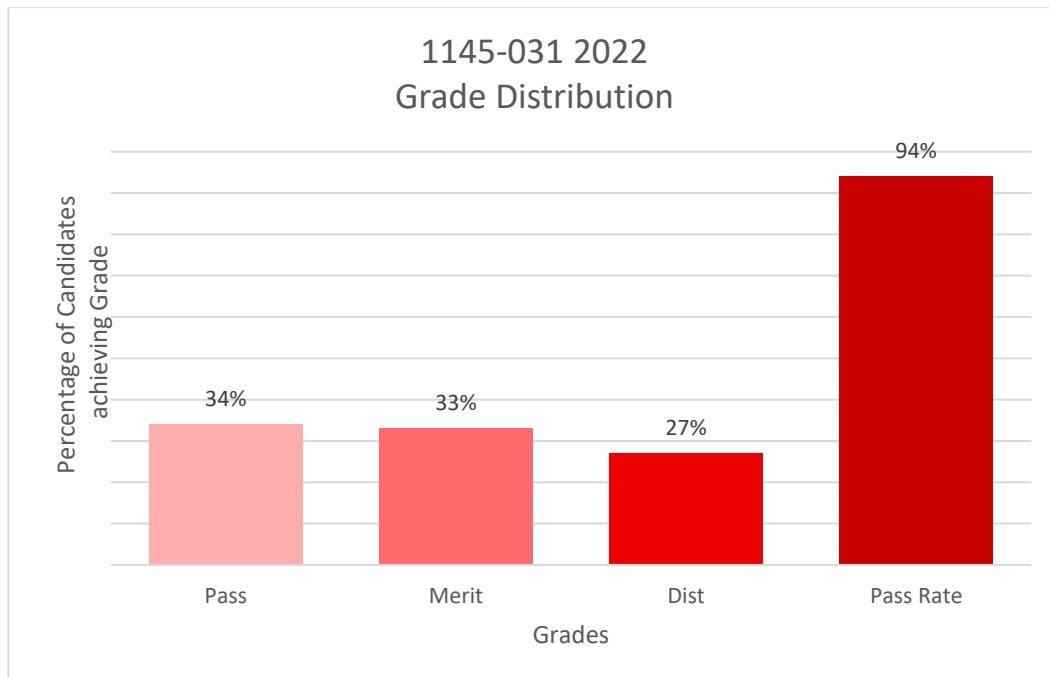
Assessment: 1145-031

Series: 2022

Below identifies the final grade boundaries for this assessment:

<b>Total marks available</b>	<b>60</b>
Pass mark	22
Merit mark	32
Distinction mark	42

The graph below shows the approximate distributions of grades and pass rate for this assessment using the above boundary marks:





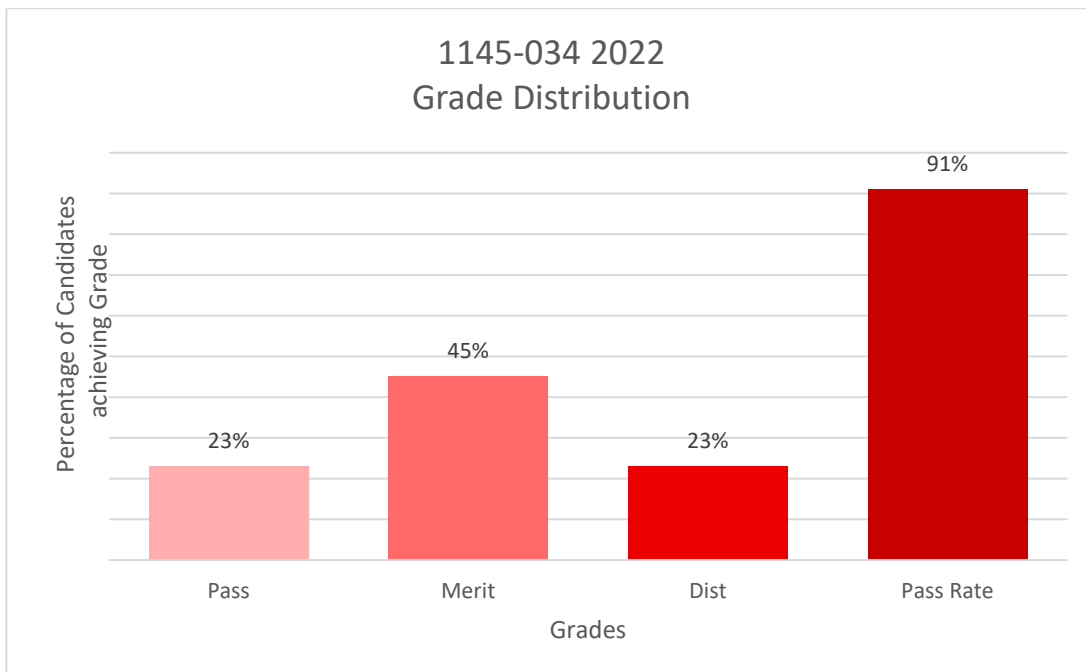
Assessment: 1145-034

Series: 2022

Below identifies the final grade boundaries for this assessment:

<b>Total marks available</b>	<b>60</b>
Pass mark	21
Merit mark	30
Distinction mark	40

The graph below shows the approximate distributions of grades and pass rate for this assessment using the above boundary marks:



## Principal Moderator Commentary

### Assessment component: 1145-031 Level 3 Engineering – Synoptic assignment (1)

The assignment met the requirements of the specification and was comparable to the previous series. It was pitched appropriately for this level.

The assignment involved the design and manufacture of a programmable access system for an area, which included two electronically controlled door locks. This assignment was carried out as a series of structured tasks.

Centres should note the minimum evidence required for each of the tasks is listed within the assignment and can be found under the headings ***What you must produce for marking' and 'Additional evidence of your performance that must be captured for marking'***. The centre should direct all candidates to complete each task and to produce **all** the evidence listed. When work is submitted to City & Guilds, for moderation or additional evidence is requested, the centre should submit **all** work completed by the candidate in conjunction with all the synoptic assignment recording forms.

In general, most candidates made good attempts at all tasks in the assignment.

AO1 (recall of knowledge) was generally well evidenced, with the design specification, investigation into potential designs, technical drawings, circuit diagrams and evaluation all using appropriate technical terms.

AO2 (understanding) was generally appropriately evidenced. The main differentiator between the performance of different candidates was the level of explanation and annotation provided during the design activities. The best evidence that was submitted included reasons for the criteria in the design specification and reasons for the selection of the materials. For a proportion of candidates, evidence could have been improved slightly by including increased annotation on the microcontroller programme, to indicate clear understanding of the sequence of activities being carried out.

AO3 (practical skill) was typically appropriately evidenced, with relevant commentary on the practical observation form and pictures of the manufacturing operations in progress and the finished article. Most candidates provided effective and useful pictorial evidence of the completed item, in some cases supported by videos of testing. For a small proportion of candidates this could have been supported further by additional 'close up' images showing specific features.

AO4 (bringing it all together) was, in general, well evidenced, particularly in the factors considered when creating the design ideas and the evaluation.

AO5 (attending to detail) was typically evidenced well, with good use of supporting videos by a high proportion of candidates. Whilst the evaluations carried out by the candidates were mainly subjective in nature, these were reinforced by comments by the tutor assessors on the practical observation form. In some cases, this could have been improved by including a test record sheet for the finished product, ideally with objective testing.

Overall, it was clear that markers had considered awarding marks across the full range of AOs in all tasks which is to be commended. It would assist moderation if centres could make or add comments to illustrate where assessment criteria were being specifically addressed.

## Assessment component: 1145-034 Level 3 Engineering – Synoptic assignment (2)

The assignment met the requirements of the specification and was similar in level to the previous series. It was pitched appropriately for this level.

The assignment involved the design and manufacture of a robotic vehicle. This was carried out as a series of structured tasks.

Centres should note the minimum evidence required for each of the tasks is listed within the assignment and can be found under the headings ***What you must produce for marking' and 'Additional evidence of your performance that must be captured for marking'***. The centre should direct all candidates to complete each task and to produce **all** the evidence listed. When work is submitted to City & Guilds, for moderation or additional evidence is requested, the centre should submit **all** work completed by the candidate in conjunction with all the synoptic assignment recording forms.

Most candidates made good attempts at all tasks in the assignment.

AO1 (recall of knowledge) was generally well evidenced, with the design specification, investigation into potential designs, circuit drawings, programs and evaluation all using appropriate technical terms.

AO2 (understanding) was typically appropriately evidenced, but not as well as AO1. There was good evidence of understanding in the consideration of the design criteria, design sketches and evaluation. However, evidence could have been improved by including further statements explaining the reasons for choices or the implications of alternative options and annotation on the microcontroller programme, to indicate clear understanding of the sequence of activities being carried out.

AO3 (practical skill) was typically appropriately evidenced, with pictures of produced items and relevant commentary on the practical observation form. Most candidates provided effective and useful pictorial evidence of the completed item, in most cases supported by videos of testing. For a small proportion of candidates this could have been supported further by additional 'close up' images showing specific features.

AO4 (bringing it all together) was, in general, appropriately evidenced, particularly in the justification of the final design idea and the evaluation.

AO5 (attending to detail) was typically not evidenced well. The evaluations carried out by the candidates were mainly subjective in nature; these were reinforced by subjective comments by the tutor assessor on the practical observation form. This could have been improved by including a test record sheet for the final product, ideally with objective testing of its dimensions and performance.

Overall, it was clear that markers had considered awarding marks across the full range of AOs in all tasks which is to be commended. It would assist moderation if centres could make or add comments to illustrate where assessment criteria were being specifically addressed.