

CAMBRIDGE TECHNICALS LEVEL 3 (2016)

Examiners' report

ENGINEERING

05822–05825, 05873

Unit 24 Summer 2022 series

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Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

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Unit 24 series overview

This series examiners have read some thoughtful and contextually detailed responses to many of the questions on the paper. This shows that candidates have engaged well with the project scenario to improve the lighting across Lux Tiles plc's three factories. Those candidates who showed a sound understanding across the specification, coupled with an ability to think critically, analyse and evaluate did well on this paper.

<i>Candidates who did well on this paper generally did the following:</i>	<i>Candidates who did less well on this paper generally did the following:</i>
<ul style="list-style-type: none"> • answered questions contextually (especially when the question used the phrase 'this project') • analysed/evaluated their suggested channels of communication (extended response Question 1cii) • demonstrated an ability to interpret and use project management tools including critical path analysis (Questions 2di-v) and Gantt charts (Question 2c) • demonstrated numerical problem-solving skills (in Questions 3ciii and 4biii) • demonstrated the project management skill of task prioritisation (Question 4aiii). 	<ul style="list-style-type: none"> • left response spaces blank • gave brief responses to questions that required more developed explanatory responses • ended the extended response question abruptly, without making an overall judgement • demonstrated little knowledge of the stages of the project management process • demonstrated an inability to correctly handle large numbers e.g., in millions or correctly handle percentages, incurring power of ten errors.

The information given in Text 1 is fundamental to understanding the scenario on which the exam paper is based and, therefore, in giving contextually detailed responses to many of the questions. In their eagerness to start the paper, candidates should be encouraged to read and re-read the text. Underlining important points appears beneficial when candidates need to refer back to the text to find specific information. A firm grasp of the contextual detail, if used correctly, can significantly increase the number of marks examiners can award to candidate responses.

As always, the paper contained one high tariff, extended response question. Candidates needed to demonstrate the skills of analysis (Level 3) and evaluation (Level 4) to gain the highest marks. This series' question centred around channels of communication. Candidates did well on this question up to and including Level 2. Candidates were able to identify various channels and explain the benefits or drawbacks of most of them. However few candidates achieved Level 3 (analysis) or Level 4 (evaluation). For more details on how to achieve Level 3 and Level 4 marks, please see the tables below.

Analytical skill (Level 3)

Analysis requires candidates to develop their responses to include impacts on the project of their suggested channels of communication.

Examples appropriate for this paper include impacts on costs, cash flow, profit, decision-making, potential for confusion, time, availability of personnel, workload, project quality, project completion, etc.

It should be noted that phrases such as “this will impact on costs” or “this will affect the project’s quality” cannot be given because the direction of the impact is unclear. Candidates need to make explicit the direction of the impact i.e., higher costs or lower costs, improved quality or quality erosion.

Evaluative skill (Level 4)

Evaluation requires a reasoned decision that responds to the question i.e., the best channels of communication which Zand should include in the project’s communication strategy.

Candidates should be encouraged to reach decisions and give detailed justification to support their argument using contextual information. While an accurate judgement that applies to most businesses would achieve a Level 4 mark, a response which argues using the particular circumstances of the business scenario, in this case, Lux Tiles plc, was more highly rewarded. Specific references to time zones or language barriers were particularly sought after here.

Areas which caused most problems in this paper were advantages and disadvantages of external finance (Question 1b), the meaning of the term proactive adjustment (Question 4ai), and the use of issue logs as a means of measuring the success of a project (Question 4aiv). On the other hand, Question 2a explaining how to judge the validity of information used for decision-making during a project, Question 2c sketching a Gantt chart, and Question 4aii categorising external factors which affect project outcomes, were extremely well answered.

Question 1 (a)

1 Refer to Text 1.

(a) Which **two** of the following items should Zand include in the project proposal?

Circle your choices. You should only draw **two** circles.

project costings

project deliverables

risk analysis

quality control strategies

scope of project

time controls

[2]

This question tests whether candidates have a clear overview of the stages of the project management process. Approximately half of candidates scored full marks on this question.

Question 1 (b) (i)

(b) The project is to be funded using an external source of finance.

(i) State **one** advantage and **one** disadvantage for Lux Tiles plc of using external finance to fund this project.

Advantage

.....

Disadvantage

.....

[2]

This question was about using an external source of finance. Many candidates assumed that external sources of finance are synonymous with debt finance, this is not the case. The most common correct responses were the preservation of the firm's own funds and the time it takes to obtain such finance.

Misconception

 A common misconception among candidates appears to be that external sources of finance equates to debt finance. This is not the case. While many sources of external finance e.g., bank loans and mortgages are debt funded, other sources such as venture capital, or a share issue are equity funded.

Question 1 (b) (ii)

(ii) State **two** external sources of finance Lux Tiles plc could use to fund this project.

1

2

[2]

The most common correct responses were loans, grants and venture capital. Candidates who gave vague responses e.g., investors could not be rewarded.

Question 1 (c) (i)

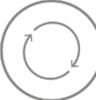
(c) Zand needs to write a communication strategy for this project.

(i) Explain why having an effective communication strategy is important for this project.

.....
.....
.....
..... [2]

The question was testing the purpose of a communication strategy, rather than the benefits of effective communication. The most common correct response was 'to avoid miscommunication'. To gain full marks the candidate's response need to explain the importance to this specific project (note the wording of the question 'for this project'). Contextual responses gained full marks.

Assessment for learning

 Centres are advised to make sure candidates understand that a question which includes the phrase 'for this project' is wanting a response specifically tailored to the project outlined in the text of the examination paper. Wherever possible the candidate should apply their response to the specific project being managed and support their response with contextual detail.

Question 1 (c) (ii)

- (ii) Evaluate channels of communication which Zand could include in the communication strategy for this project.

[12]

The extended response question on this unit is always level of response marked. The type of response examiners were looking for is shown in the exemplar response in the published mark scheme. This question centres around channels of communication.

The question is marked over 4 Levels each with an allocated band of marks. The candidate is given a mark within the highest mark band they achieve. The 4 Levels are as follows:

Level 1 – knowledge

Level 2 – understanding

Level 3 – analysis

Level 4 – evaluation.

Suggested communication methods were required for Level 1. The most common correct responses were email, virtual meetings, face to face meetings and phone calls.

To move up the levels candidates needed to explain or analyse the benefits or drawbacks of their suggested methods. An example – they could meet on Zoom (Level 1) this would mean that Zand did not have to travel (Level 2) reducing the costs of the project (Level 3). Such a response would score 7 of the available 12 marks solely for discussion of this one method of communication.

Once Level 3 has been achieved, a selection of one or more methods with appropriate justification as to why they are the most suitable methods for Zand to use was given Level 4. Those candidates who gave a contextual justification achieved a minimum of 11 marks.

Fewer than a quarter of candidates attempted to make such a decision i.e., which would be the best communication for Zand to use. Those who did, and gave a valid reason for their choice, gained a Level 4 mark.

Question 2 (a)

Text 2

Zand is confident at planning and scheduling. He intends to use a range of project management tools, as appropriate, to monitor the progress of the project.

Zand begins by dividing the project into five phases as shown in **Table 1**, below.

Table 1

Phase:
1: Research and selection of lighting system
2: Implementation in the UK
3: Implementation in Peru
4: Implementation in Thailand
5: Project closure

Zand is less confident about his team building skills. His most significant weakness on previous projects has been his inability to establish rapport with project team members.

Eager to establish a good rapport with project team members on this project, Zand sends them a welcome message. He also attaches a document that he has found on a lighting manufacturer's website. The document is entitled: 'How our LED lighting could brighten up your home in 2017'.

2 Refer to Text 2.

(a) For each of the criteria given below, explain why the document distributed by Zand might be deemed invalid for decision-making on this project.

[6]

- relevance;

.....

.....

.....

.....

- bias of source;

.....

.....

.....

.....

- currency.

.....

.....

.....

.....

This question focused on LO4.4 of the specification, i.e., testing the validity of information used in an engineering project. This question was generally well answered with most candidates achieving at least half marks. Relevance and currency proved more accessible than bias of source which was slightly more subtle.

Question 2 (b)

- (b) State **two** likely impacts on this project if Zand fails to establish rapport with his project team members.

1

.....

2

.....

[2]

The question required impacts on the project rather than impacts on Zand. Candidates that suggested impacts on the project scored highly.

Question 2 (c)

- (c) Zand uses a Gantt chart to give an overview of the five phases of the project, shown in **Table 1**.

The phases will be completed in sequence. None of the phases are concurrent.

Draw a rough sketch of what the Gantt chart would look like. Clearly label both axes.



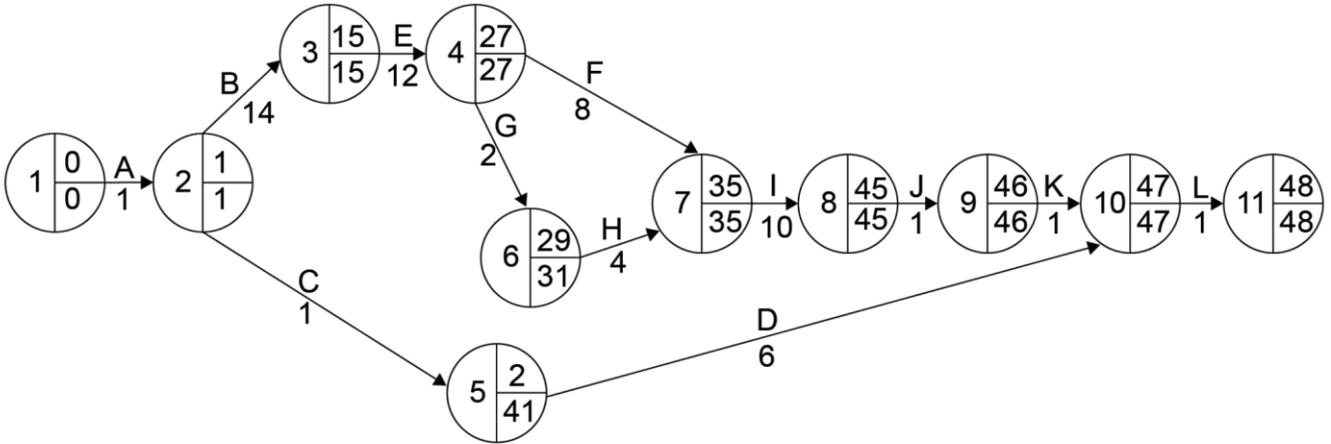
[4]

This question was well answered. The vast majority of candidates were able to sketch a Gantt chart and correctly label the axes. Where full marks were not achieved the mistake was, invariably, to have overlapping rather than sequential phases.

Question 2 (d) (i)

(d) Zand wants to use a series of critical path network diagrams to closely monitor the progress of each phase of the project.

Below is a network diagram for **Phase 2: Implementation in the UK**.



Activity key:	
A: Phase 2 briefing	G: Selection of light bulb supplier
B: Internal audit	H: Lead time for delivery of light bulbs
C: Selection of new electricity supplier	I: Installation of lighting by contractor
D: Lead time for new electricity supply	J: System testing and adjustment
E: System design and technical drawings	K: Operative and maintenance training
F: Selection of installation contractor	L: Phase 2 review
Duration: All timings are in weeks	

Refer to the network diagram.

(i) What is the earliest start time for 'Activity E: System design and technical drawings'?
 [1]

Question 2 (d) (ii)

(ii) What is the latest finish time for 'Activity G: Selection of light bulb supplier'?
 [1]

Question 2 (d) (iii)

(iii) During 'Activity I: Installation of lighting by contractor' and 'Activity J: System testing and adjustment' the UK factory will be operating at reduced capacity.

If all goes to plan, how long will the UK factory be operating at reduced capacity?

..... [1]

Question 2 (d) (iv)

(iv) Calculate the float time for 'Activity D: Lead time for new electricity supply'.

.....
..... [1]

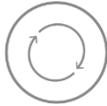
Question 2 (d) (v)

(v) State how the minimum completion time for Phase 2: Implementation in the UK would be affected if 'Activity H: Lead time for delivery of light bulbs' took three weeks longer than planned.

.....
..... [1]

Questions (i) to (v) required an accurate interpretation of the network diagram. This question dichotomised candidates with a tendency to gain all 5 marks or none. Critical path analysis is a key tool in monitoring the progress of a project. Candidates need to be able to 'read' a diagram and interpret implications of changes to the schedule.

Assessment for learning

 Centres are advised to give candidates plenty of practice interpreting and completing critical path network diagrams. This could be done as a starter to any lesson as a quick reminder of the importance of this tool to project management.

Question 2 (e)

- (e) Zand intends to use local contractors in each country to do the installation work.

Explain how the use of different contractors in each country is likely to affect the monitoring of the project.

.....

.....

.....

..... [2]

Generally, well answered. Most candidates' responses indicated that the monitoring would become more difficult in some way and were able to give an explanation of why this might be the case. Such responses scored full marks. Of those candidates who were less successful, the most common error was to discuss the benefits or drawbacks of using local contractors, rather than explain how this impacts on monitoring the project.

Question 2 (f)

- (f) Other than a Gantt chart and critical path analysis, name **one** project management tool that Zand could use to monitor the progress of the project.

..... [1]

Correctly answered by the majority of candidates.

Question 3

Text 3

All three of Lux Tiles plc's factories are to be refitted with energy-efficient, digitally controlled LED lighting systems. The technical specifications for each refit will vary depending on the particular needs of each factory.

Zand wants to find out what staff at each factory think about the current lighting and how it can be improved.

Because Lux Tiles plc operates in different countries, Zand thinks that it is important to make use of the knowledge and skills of each of the project team leaders by delegating tasks to them, where possible.

Zand is also thinking about the physical resource requirements of the new lighting system. He wants to make sure that nothing is missed, not even the supply of LED bulbs.

3 Refer to Text 3.

- (a) Zand has decided to use one-to-one interviews to obtain staff opinions on the current lighting at each of the three factories.

Explain **one** benefit and **one** drawback to the project of Zand's decision to use one-to-one interviews to conduct this primary research.

Benefit

.....

.....

.....

.....

.....

Drawback

.....

.....

.....

.....

[4]

Many candidates scored 2 marks on this question. Candidate identification of two relevant points was good, but only a few candidates went on to give any form of explanation (as required by the wording of the question). The most commonly seen correct benefit related to the amount of detail information that could be collected. The most commonly seen correct drawback related to the large amount of time that it would take to collect this data. Few candidates attempted to extend their responses beyond a basic statement. Examples of explanatory responses are shown in the exemplar response section of the published mark scheme.

Question 3 (b)

(b) An electricity supplier needs to be selected for each country.

Zand intends to delegate this task to each of the project team leaders based at the factories in England, Peru and Thailand.

Explain **one** likely benefit to each of the following of Zand delegating this task to project team leaders.

Benefit to Zand

.....

.....

.....

.....

Benefit to the success of the project

.....

.....

.....

.....

[4]

In contrast with Question 3(a) this question was well answered. The vast majority of candidates gave accurate responses and detailed explanations. In the main, candidates were able to distinguish between personal benefits to Zand and benefits to the project.

Question 3 (c) (i)

(c) The new lighting system will use LED bulbs.

(i) Bulbs are a type of physical resource.

Explain why these are classified as 'consumables'.

.....

.....

.....

..... [2]

This question tested candidate knowledge of one specific type of resource i.e., a consumable. Most candidates scored at least one mark on this question, with many giving comprehensive responses scoring the full 2 marks. Of those that did less well on this question, by far the most common error was to assume that a consumable is so named because it consumes electricity.

Question 3 (c) (ii)

(ii) Refer to **Text 1** on page 2.

Identify **one** company objective of Lux Tiles plc and explain how it could affect the choice of LED bulb supplier.

.....

.....

.....

..... [2]

Candidates demonstrated a good grasp of the link between company objectives and the choice of light bulb supplier. The vast majority of candidates gained full marks. Occasionally the response was left entirely blank.

Question 3 (c) (iii)

- (iii) To manage the project effectively, Zand needs to ensure that sufficient LED bulbs are available for each factory.

Zand estimates that the factory in England is likely to need 300 light fittings, each requiring 32 LED bulbs.

Due to vibration caused by the manufacturing of ceramic tiles, he estimates that the probability of a LED bulb failing during its first year of operation is 0.25, rising to 0.55 during its second year of operation.

Assuming the estimates are correct, calculate the total number of LED bulbs that Zand needs to order to cover the initial installation at the factory in England and those that are likely to need replacing during the first two years of operation.

Show your workings.

Total number of LED bulbs to order =

[5]

This question did not have a formula that candidates could access to help work out the response. Instead, they needed to apply logic to the information and data given and work out the response for themselves. While very few candidates scored full marks, the vast majority made a good attempt. The number of bulbs in the initial installation (9600) and the amount that failed in the first year (2400) were accurately calculated by most candidates. Many others proceeded to correctly calculate the amount of 2-year-old bulbs that failed in the second year (3960). Very few candidates considered that 25% of the 2400 bulbs replaced in year 1 would also need replacing in year 2 (600). This oversight was the most common error.

Question 4 (a) (i)

Text 4

Phase 2: Implementation in the UK and Phase 3: Implementation in Peru are completed on schedule. Both factories report improvements in the quality of the lighting, and CO₂ reductions.

Phase 4: Implementation in Thailand is now in its 14th month. Zand knew from his scheduling that this phase would take longer than the others due to the size of the factory in Thailand. He also anticipated that its 15-metre high ceiling would pose additional challenges in terms of lighting quality and compliance with health and safety regulations. However, Zand failed to anticipate the problems that would be caused by cultural differences and unfavourable exchange rates. Zand is concerned about whether the project's energy cost objective will be met.

However, before Zand has time to analyse any data, Tetsu, the project team leader in Thailand, sends three issue logs to him:

- Issue A: Humidity levels in the factory are causing ceramic dust to stick to the new light fittings reducing the quality of the lighting – a reactive adjustment is required.
- Issue B: The switchover to our new electricity supplier has been delayed by two weeks due to a communication error between our current and new supplier.
- Issue C: Installation contractors are not following health and safety regulations for working at heights, the scaffolding is insecure and lacks toe boards and guard rails.

4 Refer to Text 4.

(a) Phase 4: Implementation in Thailand has proved to be the most problematic so far.

- (i) Due to the challenging height of the ceiling at the Thailand factory, Zand made a proactive adjustment to the lighting specification to ensure that the quality of the lighting was not compromised.

State what is meant by the term **proactive adjustment**.

.....

..... [1]

This question was not as well answered as might have been expected. Many responses were vague or incorrectly referred to proactive adjustments being temporary modifications or instant fixes. The key to gaining the mark was that the adjustment is made before an actual problem occurs. Those candidates who expressed this were given the mark.

Misconception



IA common misconception among candidates appears to be that a proactive adjustment refers to a change that is made quickly after a problem occurs. This is not the case. This would be a reactive adjustment (done in a timely fashion). A proactive adjustment is pre-emptive i.e., the modification is made before an issue occurs to prevent a problem from occurring.

Question 4 (a) (ii)

(ii) In the table below, categorise the external factors which have affected this phase of the project.

You should only place **one** tick (✓) in each row.

External factor:	Category				
	Political	Economic	Social	Technological	Legal
Health and safety regulations					
Cultural differences					
Exchange rates					

[3]

Generally, well answered with most candidates scoring full marks. Even candidates who did less well invariably got the categorisation of the health and safety regulations correct. Cultural differences and exchange rates were sometimes incorrectly categorised as political factors.

Question 4 (a) (iii)

(iii) Zand needs to choose in what order to deal with the three issues reported to him.

Complete the table below to show how Zand should prioritise these issues.

In each case, give a reason for your decision.

Priority	Issue A, B or C?	Reason
High		
Medium		
Low		

[6]

The vast majority of candidates were able to identify that Issue C was of highest priority. The most common correct reasons related to the risk of death/injury or the risk of being sued if these events occurred. Candidates did less well at realising that Issue B was low priority because it was self-rectifying and had no serious consequences, all Zand needed to do was wait for the two weeks to pass. To gain marks for the reason Issue A was of medium priority the candidate needed to explain both why it was lower priority than Issue C and higher priority than Issue B. Those candidates able to do this invariably scored the full 6 marks.

Question 4 (a) (iv)

(iv) Explain **two** drawbacks to Zand of using issue logs to measure the success of the project.

1

.....

.....

.....

.....

2

.....

.....

.....

[4]

This question was not answered well. Most candidates got little further than stating that issue logs concentrate on the negatives. Please see the published mark scheme for suggested correct responses to this question.

Question 4 (b) (i)

(b) Zand will prepare a final project report to confirm if all of the project's aims and objectives have been met.

(i) State why the final project report needs to be distributed to project stakeholders.

.....

..... [1]

Examiners were looking for the reason project stakeholders needed to see the final report. The most common correct responses were to obtain feedback from them or to judge project outcomes. A simple statement was all that was required to achieve the mark.

Question 4 (b) (ii)

- (ii) State **one** benefit and **one** drawback to Zand of including objective feedback in the final project report.

Benefit

.....

Drawback

.....

[2]

Most candidates suggested two valid responses. The most common given benefits related to being measurable and based on facts. The most common mark given for drawback related to it not conveying opinions. Candidates who did less well on this question tended to score 0 marks. It was evident that in some cases candidates had confused the term 'objective feedback' with 'subjective feedback' and given virtually direct opposites of the correct responses.

Question 4 (b) (iii)

- (iii) Zand is concerned about whether the project's objective to reduce the company's overall energy cost for lighting by at least 45 % will be met.

By analysing the data in the table below, calculate the percentage cost reduction which needs to be achieved at the factory in Thailand in order to meet the company's overall objective.

Show your workings.

Factory location:	Annual energy cost for lighting before upgrade (converted to £s)	Percentage reduction in cost achieved by the upgrade
UK	£1.6 million	38%
Peru	£1.4 million	47%
Thailand	£2.0 million	

Percentage cost reduction needed at the factory in Thailand =

[6]

This calculation question saw the full gamut of responses with about a quarter of candidates scoring full marks and an equal proportion scoring zero. Of the remainder total cost (£5m) and 45% cost saving (£2.25m) were mostly calculated correctly gaining 2 marks. The UK upgrade savings (£0.608m) and Peru upgrade savings (£0.658m) were seen less frequently. The saving needed in the Thailand upgrade (£0.984m) was rarely seen.

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