

Cambridge Technicals Engineering

Unit 24: Project management for engineers

Level 3 Cambridge Technical Certificate/Diploma in Engineering
05873

Mark Scheme for June 2022

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING

TRADITIONAL

Before the Standardisation meeting you must mark at least 10 scripts from several centres. For this preliminary marking you should use **pencil** and follow the **mark scheme**. Bring these **marked scripts** to the meeting.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the traditional 40% Batch 1 and 100% Batch 2 deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or by email.
5. **Crossed Out Responses**
Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

Rubric Error Responses – Optional Questions

Where candidates have a choice of questions across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. (The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)

Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate). When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. (The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)

Short Answer Questions (requiring a more developed response, worth **two or more marks**)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional lined pages if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add an annotation to confirm that the work has been seen.
7. If there is nothing written in an answer space award 0 marks and annotate the space to confirm that it has been seen.
8. Assistant Examiners will email a brief report on the performance of candidates to your Team Leader (Supervisor) by the end of the marking period. Your report should contain notes on particular strength displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

9. Annotations

Annotation	Meaning
Tick	Valid point, mark awarded
Cross	Incorrect
Question mark	Response unclear
BOD	Benefit of doubt (mark awarded)
TV	Too vague (mark not awarded)
REP	Repetition (no additional marks awarded)
NAQ	Not answered question (incorrect focus)
L1	Level 1 response (identification)
L2	Level 2 response (explanation)
L3	Level 3 response (analysis)
L4	Level 4 response (evaluation)
CONT	Context (required for high L4 award only)

10. Subject specific marking instructions

For Level of Response marked questions marked over 4 levels. L1 can be analysed to move the point directly to L3.

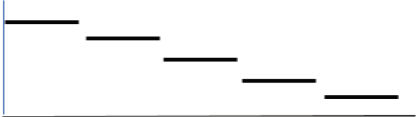
L3 analysis is required before L4 can be accessed.

Question			Answer	Marks	Guidance
1	(a)		<p>Indicative content:</p> <p>project costings project deliverables risk analysis</p> <p>quality control strategies scope of project time controls</p>	2	<p>One mark for each correct identification, to a maximum of two identifications.</p> <p>Accept ticks and other indicators of choice, so long as the selection is clear.</p> <p>Contradictory response rule applies. If more than two answers are selected, award a mark of zero for this question.</p>
1	(b)	(i)	<p>Responses include:</p> <p>Advantage e.g., positive impact on cash flow, does not deplete company reserves, potential to access greater amounts of finance <u>than available internally</u>.</p> <p>Disadvantage e.g., costly, time-consuming application process, more complex, external regulation.</p>	2	<p>One mark for a correct advantage. One mark for a correct disadvantage.</p> <p>NB The question is comparing internal/external funding, not equity/debt funding.</p> <p>Do not award interest charges, borrowing, no risk, etc.</p>
1	(b)	(ii)	<p>Responses include:</p> <ul style="list-style-type: none"> • bank loan • debentures • share issue • grants • venture capital. 	2	<p>One mark for each correct identification, to a maximum of two identifications.</p> <p>Do not award short-term sources of finance because this project is expected to take at least four years.</p> <p>Do not award crowd-funding.</p> <p>Bank, shareholders, investors, sponsors, TV</p>

Question			Answer	Marks	Guidance
1	(c)	(i)	<p>Responses include:</p> <ul style="list-style-type: none"> to avoid miscommunication to communicate well/in a timely manner <p>Exemplar responses:</p> <p>An effective communication strategy is important for to ensure there is no miscommunication between the three (CONT) factories each (2).</p> <p>An effective communication strategy is important to ensure that messages about tasks to be done can be passed on quickly (1).</p>	2	<p>Two marks for a contextual answer.</p> <p>One mark for a non-contextual answer.</p> <p>Do not award benefits to project outcomes e.g. better quality, within budget, on time, etc.</p>

Question			Answer	Marks	Guidance
1	(c)	(ii)	<p>Use level of response criteria.</p> <p>Responses may include:</p> <ul style="list-style-type: none"> • email • text messages • messaging/messenger/group caht • faxes • intranet • mail • phone calls • Skype/Teams/Zoom calls • social media channels • video conferences • face-to-face meetings. <p>Exemplar response:</p> <p>One channel of communication that Zand could include is phone calls (L1). Phone calls allow instantaneous, two-way conversation without the need to travel (L2), reducing the cost of communication (L3).</p> <p>Another channel of communication that Zand could use is meeting face to face (L1). This method has the benefit of allowing the distribution of written documentation and technical drawings to facilitate discussions. (L2). Potentially increasing the quality of decision-making (L3).</p> <p>The most useful channel of communication for this project is likely to be email. Email can be received almost instantly and, by using attachments, detailed lighting specifications (CONT) and technical drawings can be transmitted with ease.</p>	12	<p>Level of response:</p> <p>Level 4: 10-12 marks Candidate evaluates channels of communication which Zand could include in the communication strategy for this project.</p> <p>Level 3: 7-9 marks Candidate analyses channels of communication which Zand could include in the communication strategy for this project.</p> <p>Level 2: 4-6 marks Candidate explains channels of communication which Zand could include in the communication strategy for this project.</p> <p>Level 1: 1-3 marks Candidate identifies channels of communication which Zand could include in the communication strategy for this project.</p> <p>Award 10 marks for a justified overall judgement with no context.</p> <p>Award 11 marks for a justified overall judgement which mentions context.</p> <p>Award 12 marks for a detailed justified overall contextual judgement which uses context.</p> <p>Do not award surveys/questionnaires, etc.</p>

Question		Answer	Marks	Guidance
		Furthermore, communicating by email is more environmentally-friendly than air travel, an important consideration for a company with strong environmental aims and objectives (CONT) (L4).		
2	(a)	<p>Responses include:</p> <p>Relevance e.g., for the home/domestic, needs to be suitable for industrial/factory use.</p> <p>Bias of source e.g. on lighting manufacturer's website, written by the manufacturer, positive spin, likely to be marketing material, designed to persuade, one person's opinion, advantages not disadvantages, disadvantages not stated.</p> <p>Currency e.g. from 2017, written five years ago, out-of-date, not up-to-date-, technology will have advanced since 2017 .</p> <p>Exemplar responses:</p> <p>The document is of limited relevance because it is about domestic lighting (1), whereas Lux Tiles plc's factories will need a lighting system suitable for industrial use (1).</p> <p>The document is likely to be biased because it was written by the manufacturer of a certain brand of lighting (1). It is likely to emphasise the positive points whilst avoiding the negatives (1).</p> <p>The document was five years ago (1) which means that better systems may now be available (1).</p>	3 x 2	Up to two marks for each of three explanations.

Question		Answer	Marks	Guidance
2	(b)	Responses include: <ul style="list-style-type: none"> time creep reduced project quality/failing to meet project aims and objectives higher costs. 	2	One mark for each correct identification, to a maximum of two identifications. NB Question requires impacts on the <u>project</u> itself. Do not award personal impacts on Zand (e.g. may gain less co-operation from members of team) or corporate impacts on the business (e.g. lower profits). Do not award impacts on <u>product</u> quality.
2	(c)	Indicative content:  Vertical label: Phases (accept Stages/Tasks/Activities, etc.) Horizontal label: Time (accept Months/Years, etc.)	4	Award: One mark for horizontal bars/blocks. One mark five non-overlapping consecutive phases. One mark for correct labelling of vertical axis. One mark for correct labelling of horizontal axis.
2	(d)	(i)	Indicative content: Week 15	1 For one mark. '15' sufficient for the mark, 'week' not required.
2	(d)	(ii)	Indicative content: Week 31	1 For one mark. '31' sufficient for the mark, 'week' not required.
2	(d)	(iii)	Indicative content: 11 weeks	1 For one mark. Units required.

Question			Answer	Marks	Guidance
2	(d)	(iv)	Indicative content: Float time for activity D = $47 - 6 - 2 = 39$ weeks	1	For one mark Units required.
2	(d)	(v)	Responses include: <ul style="list-style-type: none"> • will take one additional week • minimum completion time now 49 <u>weeks</u>. 	1	One mark for a correct identification.
2	(e)		Responses include: <ul style="list-style-type: none"> • harder to monitor • more monitoring required • monitoring more time consuming • monitoring more complex • monitoring non-standard • negative impact on monitoring. <p>Exemplar responses:</p> <p>Using local contractors will make the monitoring more difficult (1) because of the language barriers that will exist (1).</p> <p>Using a different contractor in each country will increase the amount of monitoring required (1) because each contractor will be working on the project for the first time (1).</p>	2	One mark for a correct identification plus one further mark for explanation
2	(f)		Indicative content: <ul style="list-style-type: none"> • PERT (Program Evaluation and Review Technique) 	1	One mark for a correct identification. Also accept PD (Precedence Diagramming), AD (Arrow Diagramming) and branded software names.

Question		Answer	Marks	Guidance
3	(a)	<p>Responses include:</p> <p>Benefit e.g., in-depth feedback, two-way communication, can probe for more information, can clarify any confusion, can explain in detail, no peer pressure manipulating responses,</p> <p>Drawback e.g., time consuming, expensive, opportunity cost, requires timetabling, feedback will be subjective, no direct written record.</p> <p>Exemplar responses: Using interviews will allow the project team to gain detailed feedback on what can be improved (1) because they can ask employees for further information on comments that interest them (1).</p> <p>Interviewing members of staff is far more time consuming than issuing a questionnaire (1) limiting the number of staff opinions that can be collected (1).</p>	2 x 2	<p>One mark for a correct benefit plus one further mark for explanation; AND/OR One mark for a correct drawback plus one further mark for explanation.</p> <p>Do not award answers relating to honesty.</p>

Question		Answer	Marks	Guidance
3	(b)	<p>Responses include:</p> <p>Benefit to Zand e.g., more time, less stress, reduced workload, less tired, greater focus, improved work-life balance, better health.</p> <p>Benefit to the success of the project e.g., improved decision-making, better choice of supplier, better understanding of local culture and customs, fewer language barriers.</p> <p>Exemplar responses: Delegating the choice of electricity suppliers to project team leaders would free up some time for Zand (1), helping him maintain better mental health (1).</p> <p>Delegating the choice of electricity supplier could mean that a better decision is made (1) because the project team leaders are likely to better understand the technical language of the various contracts written in their local languages (1).</p>	2 x 2	<p>One mark for a correct benefit to Zand, plus one further mark for explanation.</p> <p>AND/OR</p> <p>One mark for a correct benefit to the success of the project, plus one further mark for explanation.</p> <p>Benefits to Zand must be personal.</p> <p>Quick/efficient TV</p>

Question			Answer	Marks	Guidance
3	(c)	(i)	<p>Responses include:</p> <ul style="list-style-type: none"> • needs constant replacement • gets used up/cannot be reused • inexpensive everyday item • day-to-day running cost. <p>Exemplar responses:</p> <p>When light bulbs stop working they are used up (1) and need to be replaced (1).</p> <p>Consumables are inexpensive physical resources that are used up in day-to-day business use (1), for example stationery.</p>	2	One mark for a correct identification plus one further mark for explanation.

Question			Answer	Marks	Guidance
3	(c)	(ii)	<p>Lux Tiles plc objectives include:</p> <ul style="list-style-type: none"> • to reducing its carbon footprint • to minimising waste wherever possible • to be at the forefront of sustainable manufacturing • reduce overall <u>energy</u> cost for <u>lighting</u>. <p>Choice of LED bulb supplier, affected by the need to:</p> <ul style="list-style-type: none"> • minimise air miles/transportation • use carbon offsetting • use sustainable transport • use environmentally-friendly production methods • minimise waste • have an eco-friendly supply chain • produce bulbs made from recyclable plastic • produce durable light bulbs • energy efficient light bulbs • use recyclable packaging • use minimal packaging <p>Exemplar answer:</p> <p>One aim is for Lux Tiles plc to reduce its carbon footprint (1), LED bulb supplier chosen will need to use sustainable transport (1).</p>	2	One mark for a correct identification of company objective plus one further mark for explaining the impact on the choice of supplier.

Question			Answer	Marks	Guidance																								
3	(c)	(iii)	<p>Indicative content:</p> <p>Initial installation 300 x 32 bulbs i.e. 9600</p> <p>In first year, 0.25 x 9600 bulbs fail i.e. 2400</p> <p>In second year, 0.55 x (9600-2400) bulbs fail i.e. 3960 and 0.25 x 2400 bulbs fail i.e. 600</p> <p>Total number of LED bulbs to order = 9600 + 2400 + 3960 + 600 = <u>16560</u> bulbs.</p>	5	<p>Up to five marks.</p> <p>Award full marks (5 marks) for correct answer '16560'.</p> <p>Else award one mark for each of the following: Initial installation = 9600 Failure in first year = 2400 Failure in second year (2-year-old bulbs) = 3960* Failure in second year (1-year old bulbs) = 600* *award two marks for 4560 if seen instead of 3960 and 600.</p>																								
4	(a)	(i)	<p>Responses include:</p> <ul style="list-style-type: none"> • a change made in advance of a problem occurring • a pre-emptive modification • making an alteration before something goes wrong • a deliberate intervention to prevent an issue occurring. 	1	<p>One mark for a correct identification.</p> <p>No context required.</p> <p>Accept 'adjustment' so long as the explanation is proactive.</p>																								
4	(a)	(ii)	<p>Indicative content:</p> <table border="1"> <thead> <tr> <th>External factor:</th> <th>Political</th> <th>Economic</th> <th>Social</th> <th>Technological</th> <th>Legal</th> </tr> </thead> <tbody> <tr> <td>Health and safety regulations</td> <td></td> <td></td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>Cultural differences</td> <td></td> <td></td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>Exchange rates</td> <td></td> <td>✓</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	External factor:	Political	Economic	Social	Technological	Legal	Health and safety regulations					✓	Cultural differences			✓			Exchange rates		✓				3	<p>One mark for each correct identification, to a maximum of three identifications.</p> <p>Contradictory response rule applies to each row of the grid (see preamble item 5) e.g. two ticks in the same row, scores 0 for that row.</p>
External factor:	Political	Economic	Social	Technological	Legal																								
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Exchange rates		✓																											

Question			Answer	Marks	Guidance
4	(a)	(iii)	<p>Responses may include:</p> <ul style="list-style-type: none"> • High: Issue C e.g. dangerous, chance of harm, possible injury, human life, potential legal action, liability, negative impact on reputation. • Medium: Issue A e.g. serious rather than urgent action required but not immediately • Low: Issue B e.g. self-rectifying, no action required, nothing that can be done, just need to wait, not critical to the completion of the project on time, plenty of float time, minor issue, no legal/serious repercussions. 	3 x 2	<p>For each priority, award: One mark for identification of the correct issue plus one further mark for an appropriate reason.</p> <p>Issue C – do not award ‘health & safety’.</p> <p>Issue A – explanation needs to show why less urgent than Issue C <u>and</u> more urgent than issue B.</p>

Question			Answer	Marks	Guidance
4	(a)	(iv)	<p>Responses may include:</p> <ul style="list-style-type: none"> emphasises the negatives/ignores strengths/negatively skewed viewpoint time consuming/large quantity of data/difficult to analyse/summarise partial coverage/only operational aspects covered/does not cover all project outcomes e.g. budget, time creep. <p>Exemplar responses:</p> <p>Another drawback of using issue logs to measure the success of the project is the amount of time which would be needed to collate all of the issues, especially as there with three (CONT) factories (2).</p> <p>One drawback of using issues logs to measure the success of the project is that they will concentrate on what went wrong, giving an unduly negative impression of how the project went (1).</p>	2 x 2	<p>In each case, award:</p> <p>Two marks for a contextual answer.</p> <p>One mark for a non-contextual answer.</p> <p>Do not award 'does not provide solutions'.</p>
4	(b)	(i)	<p>Responses include:</p> <ul style="list-style-type: none"> to <u>evaluate/judge</u> project outcomes/stakeholder satisfaction to obtain feedback to obtain final acceptance of project completion. 	1	<p>One mark for a correct identification.</p> <p>No context required.</p> <p>Do not award 'to see how successful the project has been', 'to identify improvements' or 'to identify strengths', etc.</p> <p>Do not award answers relating to informing stakeholders.</p>

Question			Answer	Marks	Guidance
4	(b)	(ii)	<p>Responses include:</p> <p>Benefit e.g., measurable, based on facts, capable of being proven/disproven, not based on opinion, verifiable, avoids subjectivity.</p> <p>Drawback e.g., does not convey opinions, may lack depth, may lack insight, superficial, limited scope, qualitative judgments often overlooked.</p>	2	<p>One mark for the identification of a benefit. One mark for the identification of a drawback.</p> <p>No context required.</p> <p>Do not award 'takes time' as this is about data collection. The question is about the inclusion of the data in the report.</p>
4	(b)	(iii)	<p>Indicative content:</p> <p>Total cost before upgrade $\text{£}1.6\text{m} + \text{£}1.4\text{m} + \text{£}2\text{m} = \text{£}5$ million</p> <p>45% Objective requires a saving of $\text{£}5\text{m} \times 0.45 = \text{£}2.25$ million</p> <p>Saving achieved in UK upgrade $\text{£}1.6\text{m} \times 0.38 = \text{£}0.608$ million Saving achieved in Peru upgrade $\text{£}1.4 \times 0.47 = \text{£}0.658$ million</p> <p>Saving required in Thailand upgrade $\text{£}2.25\text{m} - \text{£}0.608 - \text{£}0.658 = \text{£}0.984$ million</p> <p>Percentage cost reduction needed at the factory in Thailand = $\frac{\text{£}0.984\text{m}}{\text{£}2\text{m}} \times 100 = \underline{49.2\%}$ Accept 49%</p>	6	<p>Up to six marks.</p> <p>Award full marks (6 marks) for correct answer irrespective of working.</p> <p>Else award one mark for each of the following: Total cost before upgrade = $\text{£}5$ (million) 45% saving objective = $\text{£}2.25$ (million) UK upgrade savings = $\text{£}0.608$ (million) Peru upgrade savings = $\text{£}0.658$ (million) Saving needed in Thailand upgrade = $\text{£}0.984$ (million)</p> <p>Percentage sign not required.</p>

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