

# **Cambridge Technicals Engineering**

## **Unit 24: Project management for engineers**

Level 3 Cambridge Technical Certificate/Diploma in Engineering  
**05822 - 05825**

## **Mark Scheme for January 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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**Annotations**

<b>Annotation</b>	<b>Meaning</b>
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)

**Subject-specific marking instructions**

For Level of Response marked questions marked over 4 levels, the candidate can access at L1 or L2. In either case, they can analyse the point made and proceed directly to L3.

L3 analysis is required before L4 can be accessed.

Question			Answer	Marks	Guidance
1	(a)		<p>Responses include:</p> <ul style="list-style-type: none"> <li>• directive</li> <li>• supportive</li> <li>• collaborative</li> <li>• responsive.</li> </ul> <p>Exemplar response:</p> <p>Collaborative (1) – Oliver would discuss issues with his project team and make decisions together (1).</p>	3 x 2	<p>One mark for a correct identification up to a maximum of three identifications, plus one further mark for each of three descriptions.</p> <p>Also accept: autocratic, bureaucratic, democratic, charismatic and laissez-faire.</p> <p>Correct identification of leadership style required to award marks.</p>
1	(b)	(i)	<p>Indicative content:</p> <ul style="list-style-type: none"> <li>• GZ Aircraft plc.</li> </ul>	1	For one mark.
1	(b)	(ii)	<p>Responses include:</p> <p>The higher the market power of the customer:</p> <ul style="list-style-type: none"> <li>• the greater the impact on the project</li> <li>• steers project in direction the customer favours</li> <li>• greater power and influence</li> <li>• more likely to be involved in the project</li> <li>• direct relationship.</li> </ul> <p>Exemplar response:</p> <p>The greater the market power of a customer the more likely they will be able to influence the outcome of the project (1) so that it is steered in the direction that favours its operations (1).</p>	2	One mark for a correct identification, plus one mark for explanation.

Question			Answer	Marks	Guidance
1	(c)	(i)	Indicative content: 1 Customers 2 Ministry of Defence (MOD) 3 Royal Air Force (RAF) 4 Steering Committee 5 Company Shareholders 6 General Public	2	Award full (two) marks if all correct.  Award one mark for a maximum of one error or for listing in reverse.
1	(c)	(ii)	Indicative content: 1 Steering Committee 2 Customers 3 Royal Air Force (RAF) 4 Ministry of Defence (MOD) 5 Company Shareholders 6 General Public	2	Award full (two) marks if all correct.  Award one mark for a maximum of one error or for listing in reverse.
1	(c)	(iii)	Responses include: <ul style="list-style-type: none"> <li>• monitor</li> <li>• ignore</li> <li>• not concern himself.</li> </ul> Exemplar response:  Oliver should monitor the viewpoints and reactions of the general public (1) but should not spend time actively managing them (1).	2	One mark for a correct identification, plus one mark for explanation. Accept correct answer based on OFR.

Question			Answer	Marks	Guidance
1	(c)	(iv)	<p>Responses include:</p> <ul style="list-style-type: none"> <li>• project failure/halted</li> <li>• poor specification of product</li> <li>• lose out to competition/go to an alternative supplier</li> <li>• lower sales</li> <li>• lose deals</li> <li>• poorer profits</li> <li>• poor reputation.</li> </ul> <p>Exemplar response:</p> <p>Ignoring the opinions of the Ministry of Defence may lead to the company developing 'Mark 3' radar equipment which does not fully meet the needs of the MOD (1). This could lead to Dynamic Defence plc selling less radar equipment and making lower profits (1) because G Z Aircraft plc receives fewer orders for its planes than expected (1).</p>	3	<p>One mark for a correct identification, plus up to two marks for explanation.</p> <p>Consequence to the business required to award marks.</p>

Question		Answer	Marks	Guidance
1	(d)	<p>Responses include:</p> <ul style="list-style-type: none"> <li>• early detection of risks</li> <li>• reduce risks/likelihood of risk</li> <li>• avoid risk/remove problem</li> <li>• reduce severity of risks</li> <li>• manage hazards</li> <li>• advance warning of issues</li> <li>• proactive response</li> </ul> <p>Exemplar response:</p> <p>Oliver can pre-empt risks that may occur by keeping accurate records of the MOD and RAF consultants' viewpoints (CONT). (2).</p> <p>Oliver can be proactive in reducing negative effects of any risks (1).</p>	2	<p>Up to two marks for explanation.</p> <p>Award two marks for a contextual explanation.</p> <p>Award one mark for a non-contextual explanation.</p>

Question		Answer	Marks	Guidance
1	(e)	<p>Responses include:</p> <ul style="list-style-type: none"> <li>• safety/security device</li> <li>• requirement of being fit for purpose</li> <li>• commercial necessity</li> <li>• key purchase consideration</li> <li>• no sales if performance inadequate</li> <li>• obtain more sales</li> <li>• command a higher price</li> <li>• built reputation on quality.</li> </ul> <p>Exemplar response:</p> <p>The 'Mark 3' radar equipment needs to function better than 'Mark 2' and better than any competitor products otherwise sales will be poor because the product is used for safety and surveillance (CONT), its performance is the key criteria for purchase (2).</p> <p>High quality products allow Dynamic Defence plc to charge higher prices (1).</p>	2	<p>Up to two marks for explanation.</p> <p>Award two marks for a contextual explanation.</p> <p>Award one mark for a non-contextual explanation.</p>



Question		Answer	Marks	Guidance
2	(a)	<p>Responses include:</p> <ul style="list-style-type: none"> <li>hardware – the physical equipment used for data processing e.g. antenna, transmit and receive modules, visual display unit (vdu)/monitor/screen, central processing unit (cpu).</li> <li>software – the coding used to direct the operations of computer hardware e.g. programs, utilities, interface, operating system.</li> </ul> <p>Exemplar response:</p> <p>The term 'hardware' refers to the physical computing equipment (1), for example the radar's monitor (1). Software refers to the coded instructions that a computer follows (1), for example its operating system (1).</p>	2 x 2	<p>One mark for each correct explanation up to a maximum of two explanations. One mark for each of two examples.</p> <p>NB: examples must be from Text 2.</p> <p>Do <b>not</b> award 'computer' as it is given in the question.</p> <p>'Program' can be awarded for the meaning of software, but REP if it is also the example.</p>
2	(b)	<p>Indicative content:</p> $E = \frac{O + 4M + P}{6}$ <p>O = 20</p> <p>P = 40 (20 x 2 = 40)</p> <p>M = 27 (20 x 135/100 = 27) 4M = 108 (OFR)</p> $E = \frac{20 + 108 \text{ (OFR)} + 40 \text{ (OFR)}}{6} = \frac{168}{6} = \mathbf{28 \text{ (OFR) months}}$	6	<p>Up to 6 marks.</p> <p>Award full marks (6 marks) for correct answer irrespective of working. Correct units required.</p> <p>1 mark for correct formula/method stated or applied.</p> <p>1 mark for each correct figure for O, P and M.</p> <p>Award 5 marks for an answer of '28' with incorrect units (or no units) given.</p> <p>Award equivalents e.g. 28 months = 2 years 4 months.</p>

Question		Answer	Marks	Guidance
2	(c)	<p>Use level of response criteria. Responses may include:</p> <ul style="list-style-type: none"> <li>• concurrent activities</li> <li>• earliest start time</li> <li>• latest finish times</li> <li>• float time</li> <li>• identification of critical path</li> <li>• can put additional resources on the critical path</li> <li>• minimum completion time</li> <li>• avoid workers being idle</li> <li>• minimise delays</li> <li>• manage unexpected delays</li> <li>• make adjustments</li> <li>• identify/avoid bottlenecks</li> <li>• (re)scheduling resources e.g. human, physical, technological</li> <li>• reduce wastage</li> <li>• efficient ordering of tasks</li> </ul>	12	<p>Level of response:</p> <p>Level 4: 10-12 marks Candidate evaluates the advantages to Dynamic Defence plc of Oliver using critical path analysis to monitor the project.</p> <p>Level 3: 7-9 marks Candidate analyses one or more advantages to Dynamic Defence plc of Oliver using critical path analysis to monitor the project.</p> <p>Level 2: 4-6 marks Candidate explains one or more advantages to Dynamic Defence plc of Oliver using critical path analysis to monitor the project.</p> <p>Level 1: 1-3 marks Candidate identifies one or more advantages to Dynamic Defence plc of Oliver using critical path analysis to monitor the project.</p> <p>L4 All types of summative evaluation are awardable.</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>

Question	Answer	Marks	Guidance
	<p>Exemplar response:</p> <p>Using critical path analysis will help Oliver sequence the activities in this very complex project (L1) so that the project can be completed in the shortest possible time (L2), minimising the human resource costs of the project (L3).</p> <p>Critical path analysis will also show Oliver which activities have float time (L1). Oliver can then move spare resources from these activities to activities on the critical path (L2), Helping to ensure that the project does not suffer undue delays (L3).</p> <p>Critical path analysis will allow Oliver to accurately predict when specific technological resources are required (L1), ensuring that orders are placed in time (L2) so that the production of the prototypes are not held up (L3).</p> <p>On the face of it critical path analysis will benefit Dynamic Defence plc significantly because it will help Oliver monitor time constraints and reduce costs. However, the critical control for this project is quality (CONT) and critical path analysis does not monitor this control. In fact, if anything pushing the project on to ensure that it finishes in the minimum amount of time may leave avenues unexplored. Whereas a little extra time may have led to the development of Mark 3 radar equipment which is more technologically stable, more accurate and with a longer range (L4).</p>		

Question		Answer	Marks	Guidance
3	(a)	<p>Responses include:</p> <ul style="list-style-type: none"> <li>• Advantage e.g. no debt, cheaper than borrowing, no interest to pay, will not affect gearing, can raise large sums, flexible, can have several share issues.</li> <li>• Disadvantage e.g. time consuming, bureaucratic, more dividends to pay, dilution of existing shareholder ownership.</li> </ul> <p>Exemplar response:</p> <p>One advantage of funding the project using a share issue is that it is cheaper than borrowing the money (1) because there is no interest to pay (1). This reduces the company's costs (1).</p> <p>One disadvantage of funding the project using a share issues is that it is time consuming to organise (1) because of the bureaucratic requirements of the London Stock Exchange (1). This will mean that Dynamic Defence plc's finance department has a greater workload and may be unable to monitor cashflow and investments as closely as it usually does (1).</p>	2 x 3	<p>One mark for an advantage, plus one mark for explanation and a further one mark for analysis.</p> <p>One mark for a disadvantage, plus one mark for explanation and a further one mark for analysis.</p> <p>In each case, the third mark must be analytical (rather than just more explanation).</p>

Question		Answer	Marks	Guidance
3	(b)	<p>Responses include:</p> <ul style="list-style-type: none"> <li>• Benefit e.g. better quality, increase functionality, detection over greater distances, ahead of competition, more likely to be purchased.</li> <li>• Drawback e.g. no proven reliability, training needs, complexity, expensive.</li> </ul> <p>Exemplar responses:</p> <p>One benefit of using advancing technologies in the Mark 3 radar equipment is that the device should outperform previous models (1), increasing the likelihood of sales (1).</p> <p>One drawback of using advancing technologies in the Mark 3 radar equipment is that the technology may prove unreliable (1), negatively affecting the reputation of Dynamic Defence plc (1).</p>	2 x 2	<p>One mark for a benefit, plus one mark for explanation.</p> <p>One mark for a drawback, plus one mark for explanation.</p>

Question		Answer	Marks	Guidance
3	(c)	<p>Responses include:</p> <ul style="list-style-type: none"> <li>probability indicates the proportion of gold bars out of tolerance</li> <li>the probability of being out of tolerance for thickness is 0.25</li> <li>the probability of being in tolerance for thickness is 0.75</li> <li>the probability of being out of tolerance for length is 0.3</li> <li>the probability of being in tolerance for length is 0.7</li> <li>probability of gold bar working accurately is only 45% (or inaccurately 55%)</li> <li>this statistical data will help Oliver decide whether the problem is at an acceptable or unacceptable level</li> <li>will help Oliver decide what steps need to be put in place to improve the accuracy of the dimensions of the gold bars.</li> </ul>	3	<p>Up to three marks.</p> <p>1 mark for knowledge/understanding of what probability means.</p> <p>1 mark for probability helping to identify the seriousness of the task.</p> <p>1 mark for using probability calculation:  e.g. <math>0.25 + 0.3 = 0.55</math>; <math>P = 1 - 0.55 = \mathbf{0.45}</math> or <b>45%</b>  <math>\frac{1}{4} + \frac{3}{10} = \frac{5}{20} + \frac{6}{20} = \frac{11}{20}</math>; <math>P = 1 - \frac{11}{20} = \frac{9}{20}</math> (or equivalents)</p> <p>E.g. 1 in 4 gold bars are out of tolerance for thickness (1).</p>

Question			Answer	Marks	Guidance
3	(d)		<p>Responses include:</p> <ul style="list-style-type: none"> <li>• swift diagnosis of problems</li> <li>• swift rectification of problems</li> <li>• ability to think logically</li> <li>• ability to think laterally</li> <li>• use of others to solve problems</li> <li>• saves time/avoids time creep</li> <li>• saves money/avoids budget overrun</li> <li>• better use of resources e.g. physical, technological, human.</li> </ul> <p>Exemplar responses:</p> <p>Oliver should be able to identify the cause of the problem with some of the gold bars promptly (1). This should allow him to focus human resources on what needs to be done (1) minimising additional costs to the project (1).</p> <p>Having excellent problem solving skills should mean that Oliver can find a solution quickly (1). This means that the prototype can be developed on schedule (1), increasing the likelihood that Dynamic Defence plc will bring its Mark 3 radar equipment to market ahead of the competition (1).</p>	2 x 3	<p>One mark for a correct identification up to a maximum of two identifications, plus up to two marks for each of two explanations.</p> <p>In each case: for full marks, the answer must be contextual.</p> <p>Do <b>not</b> award repetition.</p>
4	(a)	(i)	<p>Indicative content:</p> <ul style="list-style-type: none"> <li>• Type of information: Quantitative (1)</li> <li>• Source of information: Internal (1)</li> </ul>	2	One mark for each correct identification.

Question			Answer	Marks	Guidance
4	(a)	(ii)	<p>Indicative content:</p> <p>Points: (110,20); (115,22); (120,26); (125,4).</p>	3	<p>Up to two marks for correctly plotting the values. One mark for joining points using a straight line.</p> <p>Award two marks for plotting values if all four values are correct. Award one mark for plotting values if three of the four values are correct.</p> <p>OFR for joining points i.e. 1 mark to be awarded if straight line drawn between points, even if all points are plotted incorrectly.</p> <p>Ruled lines are not required so long as it is clear the lines are meant to be straight point to point.</p>



Question			Answer	Marks	Guidance
4	(a)	(iii)	<p>Responses include:</p> <ul style="list-style-type: none"> <li>skew – negative skew, skewed to the left</li> <li>explanation – longer tail to the left, more data to the right, mean is to the left of the mode, mean is lower than the median, data loaded towards high values, not symmetrical, not a bell curve, not a normal distribution, most radars did pleasingly well in tests, most radars performed better than previous 105km range, good news for Dynamic Defence plc.</li> </ul> <p>Exemplar response:</p> <p>The data has a negative skew (1). This means the data is loaded to the higher values (1). This is good news for Dynamic Defence plc as the greater the range its radars have the better (1).</p>	3	<p>One mark for a correct identification of skew, plus up two marks for explanation.</p> <p>Accept mathematical or business explanation.</p> <p>Skew must be identified to award marks.</p>
4	(b)	(i)	<p>Responses include:</p> <ul style="list-style-type: none"> <li>based on opinion</li> <li>based on beliefs</li> <li>based on attitudes</li> <li>based on reputation</li> <li>incapable of being proven or disproven</li> <li>not scientific fact.</li> </ul>	1	One mark for a correction identification.

Question			Answer	Marks	Guidance
4	(b)	(ii)	<p>Responses include:</p> <ul style="list-style-type: none"> <li>formal feedback e.g. official, on the record, recorded, bureaucratic, purposed, systematic, structured, planned <ul style="list-style-type: none"> <li>meetings, questionnaires, reports.</li> </ul> </li> <li>informal feedback e.g. unofficial, off the record, not recorded, casual, spontaneous, outside of the official structure, independent of formal mechanisms, unplanned <ul style="list-style-type: none"> <li>chat, media coverage, pop-ins, working breakfast/lunch, casual conversation, online reviews.</li> </ul> </li> </ul> <p>Exemplar response:</p> <p>Formal feedback is planned and recorded (1) for example taking minutes at a formal meeting (1). Informal feedback tends to be more spontaneous and not recorded (1) such as chatting with a colleague over a cup of coffee in the work's canteen (1).</p>	4	<p>One mark for explaining meaning of formal feedback. One mark for example of formal feedback. One mark for explaining meaning of informal feedback. One mark for example of informal feedback.</p> <p>Do not award 'asking someone for verbal feedback' or 'short conversation' as these could be formal or informal methods depending on the situation.</p>

Question			Answer	Marks	Guidance
4	(b)	(iii)	<p>Responses include:</p> <ul style="list-style-type: none"> <li>benefit e.g. focused, factual, objective, specific, data already exists, readily obtainable, clarifies issues.</li> <li>drawback e.g. does not consider the positives, unlikely to be constructive, unbalanced viewpoint.</li> </ul> <p>Exemplar response:</p> <p>One benefit of using complaints analysis as a feedback method is that the information is readily available (1) and, therefore, no extra effort is required to collect the data, saving Oliver's time (1).</p> <p>One drawback of using complaints analysis as a feedback method is that Oliver will only be focussing on the negatives (1), which may give him a false impression of how the project went (1).</p>	2 x 2	<p>One mark for a benefit, plus one mark for explanation.</p> <p>One mark for a drawback, plus one mark for explanation.</p> <p>The explanation should explain a benefit to Oliver (personally or in his role as project manager) rather than benefits solely to the business.</p>

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