



Oxford Cambridge and RSA

# Friday 17 January 2020 – Morning

## Level 3 Cambridge Technical in Engineering

05873 Unit 24: Project management for engineers

Time allowed: 2 hours

C307/2001



**You must have:**

- a calculator

Please write clearly in black ink.

Centre number

Candidate number

First name(s) \_\_\_\_\_

Last name \_\_\_\_\_

Date of birth

### INSTRUCTIONS

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

### INFORMATION

- The total mark for this paper is **80**.
- The marks for each question are shown in brackets [ ].
- This document has **20** pages.

### ADVICE

- Read each question carefully before you start your answer.

FOR EXAMINER USE ONLY	
Question No	Mark
1	/19
2	/21
3	/23
4	/17
<b>Total</b>	<b>/80</b>

Answer **all** the questions.

### Text 1

Cuando plc is a multimillion-pound company that produces tablet computers, manufacturing under license for most of the leading brands on the market.

Cuando plc operates from three sites: its headquarters in London, its manufacturing site in North Wales and its research site in Plymouth.

Cuando plc is known in the industry for its innovative approach. Its 250 research engineers are all based in Plymouth; employees are encouraged to think creatively 'outside the box'.

Cuando plc's Aftersales Manager has recently reported a 1.8% rise in complaints. Most of these complaints relate to problems when charging the tablets. As the complaints span several brands and models, it is thought that the most likely cause is a manufacturing fault rather than a design fault.

Cuando plc's Chief Executive Officer has initiated a formal project to identify the cause of the recent problems and to take proactive action before complaints start to affect the business or anyone is seriously hurt.

Senior management at Cuando plc require the project's purpose to remain confidential for commercial reasons. To protect the company's reputation, any communication with customers, computer retailers, end-users or the media must be of the highest quality. For this reason Cuando plc's Public Relations Manager, Anvi Bulsara, has been assigned as Project Manager. Anvi has worked at Cuando plc headquarters since leaving university four years ago. This is the first engineering project that Anvi has ever managed. The budget for the project is £4 million.

Project team leaders have been assigned – both are long-serving employees of Cuando plc with considerable engineering expertise and both have managed engineering projects in the past.

The project initiation and project planning stages are already complete.

Anvi begins the project implementation stage by instructing the two team leaders as follows:

- Si Dylan, Senior Defects Engineer (based at the research site in Plymouth), is initially tasked with testing thousands of tablets to isolate any faults.
- Faz Maan, Floor Manager (based at the manufacturing site in North Wales), is initially tasked with checking the production process.

Anvi chooses to use a directive leadership style to manage this project, as this is her preferred leadership style when working under pressure.

**1 Refer to Text 1.**

**(a)** Anvi has already produced documentation for the initiation stage of the project. This documentation has four sections.

In the table below, identify with a tick (✓) which section should contain each of the following pieces of information:

- How and when information is to be shared
- The financial justification for the project.

You should place **one** tick in each row.

	Section			
	Project proposal	Feasibility study	Project controls	Communication strategy
<b>How and when information is to be shared</b>				
<b>The financial justification for the project</b>				

[2]

**(b)** Anvi has also produced the project planning documentation.

State **three** pieces of information which Anvi should have included in the outline plan for the project.

- 1 .....
- 2 .....
- 3 .....

[3]

**(c)** Identify **two** internal stakeholders in the project.

- 1 .....
- 2 .....

[2]



.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**Turn over for the next question**

**BLANK PAGE**

**PLEASE DO NOT WRITE ON THIS PAGE**

**Text 2**

Testing by Si Dylan and his team of 100 research engineers reveals that there is a problem with the built-in battery pack in some of the tablets.

This means that Cuando plc is responsible for the problem, since it manufactures the battery pack on its own machines.

Further investigation reveals that some of the individual lithium-ion battery cells are slightly too large and become damaged as they are sealed into the battery pack casing, causing a problem with one corner of some of the cells. If left standing upside down to charge, affected cells can cause the battery pack to short circuit or, occasionally, catch fire.

Faz Maan and his team of 30 industrial engineers are now checking the entire production process to identify the cause, or causes, of the defective battery packs. This includes testing the company's four Vacuum Oven Press (VOVP) machines. If one of these machines needed replacing it would cost about £6 million.

**2 Refer to Text 2.**

(a) The performance of the VOVP machines is to be tested during production runs.

(i) Identify the 'type of information' provided by the testing.

**Circle** the correct answer below.

Actual	Forecasted
--------	------------

[1]

(ii) Identify the 'source of information' provided by the testing.

**Circle** the correct answer below.

Internal	External
----------	----------

[1]

- (b) One of the many tests performed on the VOVP machines is a check on the thickness of the battery cells they produce.

The thickness of the battery cells is measured with a micrometer giving the results in mm, correct to the nearest 0.02 mm.

The results of the testing from machine VOVP1, the company's oldest VOVP machine, are shown in **Table 1** below.

Thickness, $x$	Frequency, $f$	$fx$
1.56	25	
1.58	50	
1.60	100	
1.62	300	
1.64	25	
<b>SUM</b>	$\Sigma f = 500$	$\Sigma fx =$

**Table 1**

- (i) Complete **Table 1** by using the thickness and frequency data to calculate the  $fx$  values for each row and calculate the SUM.

[2]

- (ii) Calculate the mean thickness in mm of the battery cells produced by VOVP1.

mean thickness = ..... mm [1]

- (iii) The control limits for the thickness of the battery cells are:

- minimum of 1.56 mm
- maximum of 1.62 mm.

According to the data, what percentage of the battery cells were found to be outside the control limits?

percentage = ..... % [1]







**BLANK PAGE**

**PLEASE DO NOT WRITE ON THIS PAGE**

**Turn over for the next question**

**Text 3**

Tension is running high within the project team. If the news that the company is at fault reaches the media, there is a risk that the company would lose its excellent reputation within the industry. Some team members are frustrated by the time it is taking to complete the testing of the production process. Other team members are eager to blame, when what is needed is solutions.

In addition, the number of customer complaints continues to rise; there have been isolated reports in the press of tablets catching fire whilst charging, and the issue has taken hold on social media. Representatives of the leading brands and Cuando plc's trade customers are concerned and demanding that Cuando plc takes action quickly, or face losing a significant number of future orders. Thankfully, Anvi has excellent conflict management skills.

Faz Maan reports that the defective battery packs have been caused by the malfunctioning of two pieces of equipment, both uneconomical to repair. Machine VOVP1 and a lithium laminator (LL3) both need replacing. Both of these machines can only be sourced from abroad. Both have a significant lead time i.e. the amount of time it takes from ordering the machine to receiving delivery.

**3 Refer to Text 3.**

**(a)** Explain the importance to the outcome of the project of Anvi's excellent conflict management skills when:

- managing tension within the project team;

.....

.....

.....

.....

.....

.....

- dealing with tension between external stakeholders.

.....

.....

.....

.....

.....

.....

**[6]**

**(b)** Faz Maan’s report suggests that two machines, VOVP1 and LL3, need replacing.

- (i)** A replacement for LL3 will cost £1 million to purchase and a further £0.2 million in running costs, over its scheduled lifetime. During this time it is expected to laminate 113 million battery cells.

Calculate the unit cost per battery cell, of the replacement machine. Give your answer in pence (p) to two decimal places.

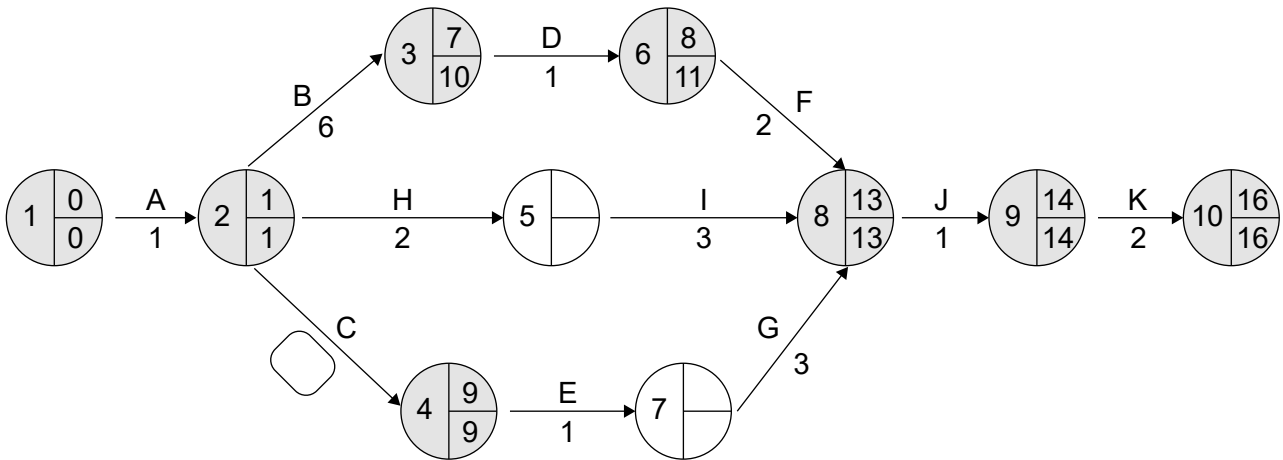
unit cost = ..... p **[2]**

- (ii)** Identify **one** reason why Anvi needs to check that she has the support of senior management before going ahead and ordering new machines to replace VOVP1 and LL3.

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

(c) Anvi uses critical path analysis to co-ordinate the replacement of the two machines.

The schedule for the replacement of the two machines is shown in the critical path network diagram, **Fig. 1**, below.



Activity key:	
<b>A:</b> Orders communicated to both suppliers	<b>G:</b> Installation of new VOVP
<b>B:</b> Lead time for supply of new LL	<b>H:</b> Off-site LL training
<b>C:</b> Lead time for supply of new VOVP	<b>I:</b> Off-site VOVP training
<b>D:</b> Delivery and unloading of new LL	<b>J:</b> On-site briefing and training
<b>E:</b> Delivery and unloading of new VOVP	<b>K:</b> Test production
<b>F:</b> Installation of new LL	<b>Duration:</b> All timings are in weeks.

**Fig.1**

(i) Complete the critical path network diagram, **Fig.1**, by inserting:

- the EST (earliest start times) for nodes 5 and 7;
- the LFT (latest finish times) for nodes 5 and 7;
- the expected duration of activity C.

[5]

(ii) If all goes to schedule, what is the minimum amount of time in which all of the tasks shown on the network diagram could be completed?

.....

.....[1]

(iii) The lead time for the supply of the new LL machine, Activity B, has been extended by two weeks.

Using the schedule, calculate how many weeks this will add to the entire process.

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

(iv) Identify **all** of the activities which are critical to the project being completed in the shortest possible time.

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

(d) Anvi understands the importance of keeping the schedule shown in **Fig. 1** updated when adjustments are required.

Explain **two** possible impacts on the project if Anvi failed to update this schedule.

1 .....

.....  
.....  
.....  
.....  
.....

2 .....

.....  
.....  
.....  
.....  
.....

[6]

**Text 4**

The two new machines have been installed successfully and are performing well. Cuando plc has organised a product recall on behalf of all brands affected. They plan to check the battery packs of tablets made during the time period identified as having machine problems, and replace where necessary.

Anvi has received final acceptance from senior management that the primary objective of the project, which was to investigate and deal with the problems before they escalated, has been achieved. Despite some quality erosion and a significant budget overrun the project is a success.

Realising the importance of feedback, Anvi wishes to collect detailed objective feedback on the successes and failures of the project. Furthermore, she has instructed both project team leaders to give each of their team members detailed feedback on their personal performance during the project.

**4 Refer to Text 4.**

(a) Anvi uses project control completion figures to help measure the success of the project.

(i) State what is meant by the term 'quality erosion'.

.....[1]

(ii) Describe **two** economic factors that may have contributed to budget overrun.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(iii) Other than project control completion figures, state **two** objective feedback methods Anvi could use to help evaluate the project.

1 .....

2 .....

[2]



(iv) Feedback should help identify project failures as well as project successes.

Explain **two** reasons why it is important to recognise project failures.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(b) The primary objective of the project would not have been achieved without the efforts of the 130 team members engaged on the project.

(i) Explain **one** key responsibility of a team member during this project.

.....

.....

.....

.....

[2]

(ii) Explain **two** benefits to project team members of receiving detailed feedback on the strengths of their personal performance during this project.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

**END OF QUESTION PAPER**

**ADDITIONAL ANSWER SPACE**

If additional answer space is required, you should use the following lined pages. The question numbers must be clearly shown – for example, 1(d) or 4(b)(ii).

A vertical line on the left side of the page is followed by 25 horizontal dotted lines, providing a ruled area for writing answers.

A series of horizontal dotted lines for writing, spanning the width of the page.



Oxford Cambridge and RSA

**Copyright Information:**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website ([www.ocr.org.uk](http://www.ocr.org.uk)) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, OCR (Oxford Cambridge and RSA Examinations), The Triangle Building, Shaftesbury Road, Cambridge CB2 8EA.

OCR is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.