OCR
Oxford Cambridge and RSA

Thursday 16 June 2022 – Morning

Level 3 Cambridge Technical in Engineering

05873 Unit 24: Project management for engineers

Time allowed: 2 hours
C307/2206

C307/1/2206

You must have:
- a calculator

0 5 8 7 3 – 2 4

Please write clearly in black ink.

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

Date of birth | D | D | M | M | Y | Y | Y | Y |

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 page 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	/20
2	/20
3	/17
4	/23
Total	**/80**

Answer **all** the questions.

Text 1

Lux Tiles plc manufactures ceramic floor tiles. It has factories in England, Peru and Thailand.

Ceramic tiles are made from natural ingredients – clay, sand and water. Lux Tiles plc has strong environmental objectives, and Tina Peng, the company's Chief Executive Officer, believes that greater environmental awareness is driving sales. To support this trend, Lux Tiles plc aims to be at the forefront of sustainable manufacturing, reducing its carbon footprint and minimising waste wherever possible.

The fluorescent lighting at all of its factories was installed over twenty years ago and is below today's standards. In addition, moisture from the manufacturing process has corroded many of the light fittings over the years.

Tina has initiated a formal project to upgrade the company's lighting at all three factories. Whilst this is the primary purpose of the project, Tina also sees an opportunity to enhance the company's environmental profile and take control of spiralling energy costs. Consequently, the project's objectives also include reducing annual CO_2 emissions by at least 250,000 kg and reducing the overall energy cost for lighting by at least 45 %. To achieve these objectives, new energy suppliers may be required. The project is expected to take at least four years to complete. The budget for the project is £6 million and will be funded by external finance.

Zand Hidalgo, a senior engineer at the factory in England, has been appointed as Project Manager.

Communication across the three sites will not be easy. Peru and Thailand are both located approximately 6,000 miles from the factory in England; the factories are also in different time zones, with Peru being five/six hours behind UK time and Thailand being six/seven hours ahead of UK time (depending on the time of year). Zand is fluent in English and Spanish (the language spoken in Peru) but does not know Thai.

To help manage the project teams in each country, three project team leaders have been appointed to assist Zand:

Elise, based at the factory in England, speaks fluent English and Thai;
Piero, based at the factory in Peru, only speaks Spanish;
Tetsu, based at the factory in Thailand, speaks fluent Thai and basic English.

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]

(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 .....

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Disadvantage .....

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[2]

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

1 .....

2 .....

[2]

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

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

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

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

[12]

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Turn over for the next question

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;

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- bias of source;

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- currency.

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

1 .....

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2 .....

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[2]

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

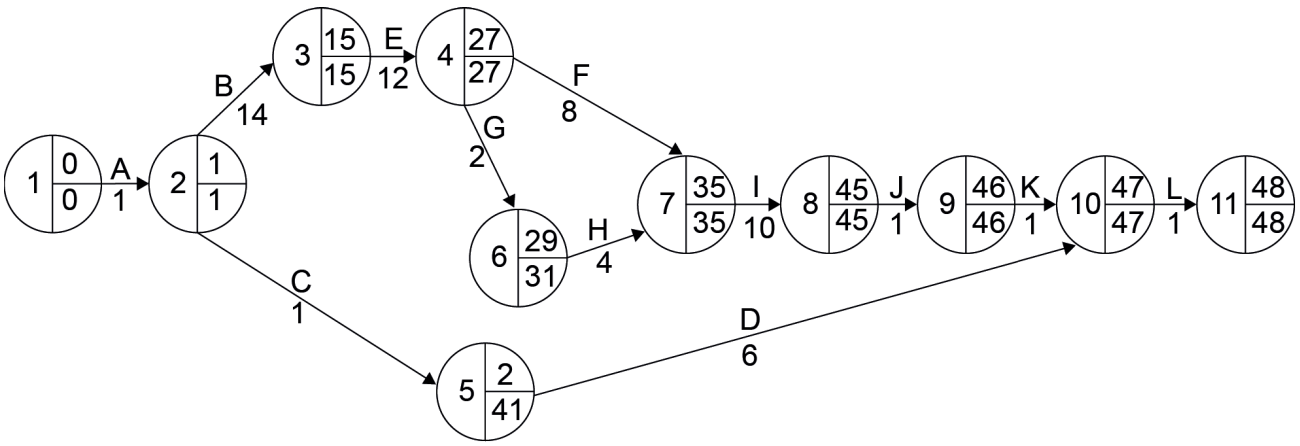
The phases will be completed in sequence. None of the phases are concurrent.

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

[4]

(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]**

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

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

(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]**

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

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

(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.

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

(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.

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

(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]**

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 .....

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Drawback .....

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[4]

(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 .....

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Benefit to the success of the project .....

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[4]

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

(i) Bulbs are a type of physical resource.

Explain why these are classified as 'consumables'.

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

(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.

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

(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]

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Turn over for the next question

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 CO_2 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]**

(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.

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

[3]

(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]

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

1 .....

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2 .....

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[4]

(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.

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

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

Benefit .....

.....

Drawback .....

.....

[2]

(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]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

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