

Wednesday 5 June 2019 – Afternoon

LEVEL 3 CAMBRIDGE TECHNICAL IN ENGINEERING

05873 Unit 24: Project management for engineers

Time allowed: 2 hours

C307/1906



You must have:

- a calculator

Please write clearly in black ink.

Centre number

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Candidate number

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First name(s)

Last name

Date of Birth

D	D	M	M	Y	Y	Y	Y
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INSTRUCTIONS

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

INFORMATION

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

FOR EXAMINER USE ONLY	
Question No	Mark
1	/20
2	/21
3	/22
4	/17
Total	/80

Answer **all** the questions.

Text 1

Industrial Robotics Ltd provides bespoke robotic solutions for the manufacturing industry. The company designs and creates robotic systems for manufacturers worldwide.

Technical innovation in industrial robotics has created a fast-moving market that is growing rapidly. Industrial experts predict that global demand will continue to increase. Like all companies in the industry, Industrial Robotics Ltd competes fiercely to be first to bring a new robotic function to market. This gives the company recognition of its technical innovation, bolsters its reputation and strengthens its brand, to help secure orders.

Industrial Robotics Ltd specialises in developing collaborative robotics (robots that can work safely alongside humans without needing to be guarded physically). For example, an injection moulding robot that slows down or stops when it senses the presence of an employee carrying out a product inspection.

Rachel Davidson, Managing Director of Industrial Robotics Ltd knows that the company must continue to innovate if it is to survive. To this end, Rachel has initiated a formal research and development project. Zhang Yuchen, a senior electronics engineer, has been assigned as project manager. His brief is to create the first robotic mobility system that will enable an industrial robot to go up and down stairs reliably and move on uneven surfaces without tumbling over.

The project team will use Industrial Robotics Ltd's patented joints and sensor systems to create and test prototype robotic limbs. Software to control the robotic limbs will also be required. Rather than develop the software in-house, the directors have instructed Zhang to use a specialist contractor to develop the software for the robotic mobility system.

The budget for the project is flexible but at the outset stands at £22 million. For commercial reasons Zhang must keep the project's scope and deliverables confidential. The company needs to bring the product to market before the competition. The critical control for the project is time.

Zhang has demonstrated good negotiation skills on the two other projects he has managed. However, both projects experienced considerable time creep. Feedback indicates that Zhang's poor project planning and time management skills were major contributory factors.

1 Refer to Text 1.

(a) In the table below, identify with a tick (✓) at which stage of the project Zhang should create each of the following documents.

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

Document	Stage			
	Project initiation	Project planning	Project implementation	Project closure
Risk analysis				
Feasibility study				
Variance analysis				

[3]

(b) Identify **three** pieces of information Zhang should include in the project schedule.

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

[3]

(c) Explain **one** likely consequence to the project if Zhang’s time management skills have not improved.

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.....[2]

(d) Explain the importance of a contingency plan to the success of the project.

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(e) Identify **two** reasons why the directors might have decided to use a specialist contractor to develop the software for the robotic mobility system.

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.....[2]

(f) Explain how each of the following could affect the project:

- competition

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- market conditions

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[6]

Text 2

The project needs to be completed in as short a time as possible, in the hope of keeping ahead of the competition. Zhang also knows that he needs to improve his project planning and time management skills.

The project team comprises Zhang and 16 team members. There are no project team leaders to support Zhang in his team management role.

Zhang decides to use a Gantt chart and PERT to plan and monitor the project. A Gantt chart of activities involved in the project, from initial prototype to director approval for product launch, is shown below.

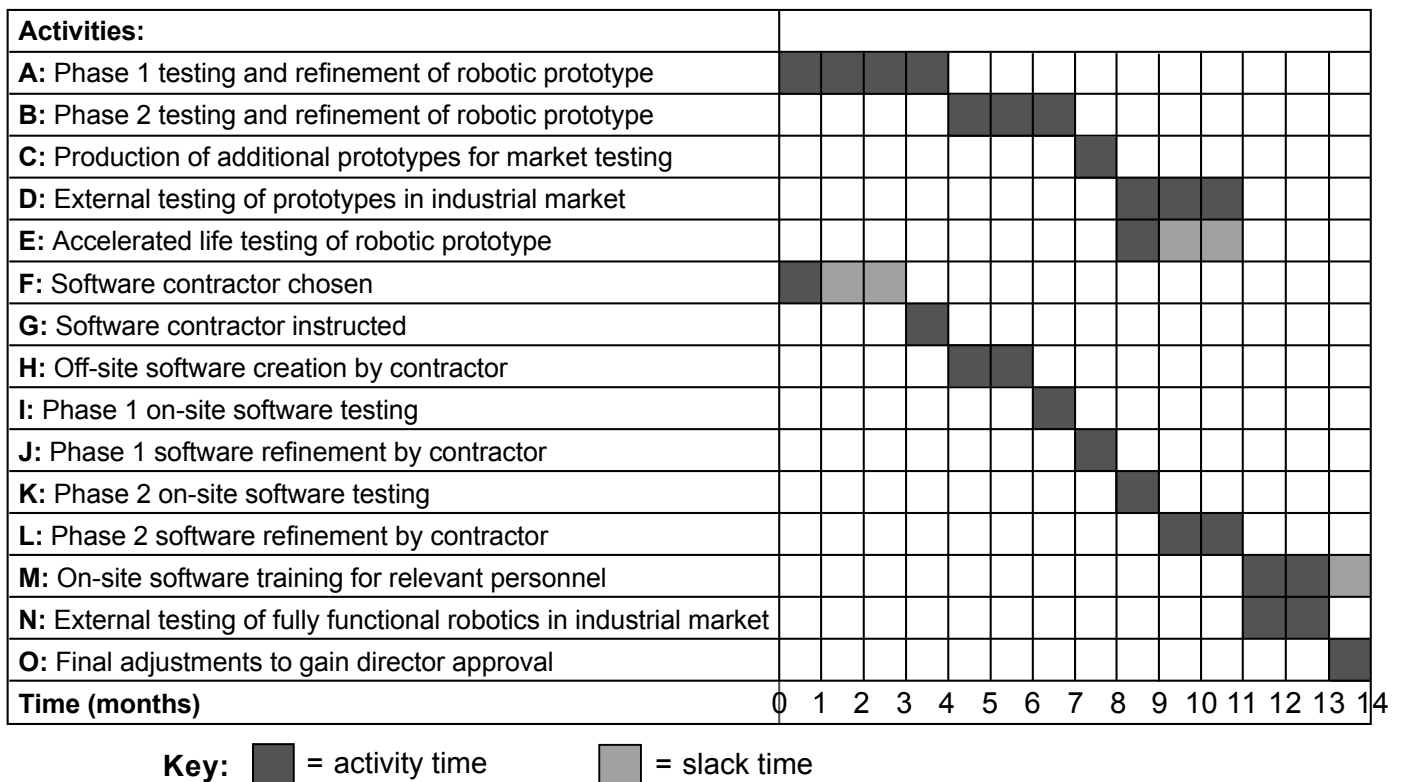


Fig. 1: Gantt chart for Robotic Mobility Project

2 Refer to Text 2.

(a) Zhang uses a Gantt chart and PERT to help time manage the project.

In the table below, circle the source of information used by each of these project management tools.

You should draw only **one** circle in each row.

Project management tool	Source of information	
	Internal	External
Gantt chart	Internal	External
PERT	Internal	External

[2]

(b) Refer to the Gantt chart shown in **Fig. 1**.

(i) How long is Activity D: External testing of prototypes in industrial market scheduled to take?

.....[1]

(ii) Which activities are concurrent with Activity K: Phase 2 on-site software testing?

.....[1]

(iii) Which activities are scheduled to take place in month 6?

.....[1]

(iv) State the activities that are critical to the project being completed in the shortest possible time.

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[1]

(v) What is the minimum completion time for the project if Industrial Robotics Ltd takes two months longer than expected to choose a software contractor?

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[1]

(c) Explain **three** disadvantages of using a Gantt chart to monitor the project.

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[6]

Text 3

At lunchtime on one particularly busy day, three issue logs appear in Zhang's inbox.

Extracts from the three issues logs are shown below.

Issue 1: Phase 2 on-site software testing, Activity K

'The software contractor cancelled all of the meetings we had scheduled over the last fortnight and has now cancelled tomorrow's meeting too. The contractor has not given a reason for cancelling at such short notice. Furthermore, we have no evidence that the contractor has completed the software refinements requested at Phase 1.'

Issue 2: Accelerated life testing of robotic prototype, Activity E

'The accelerated life testing of the robotic prototype has been delayed. Stress tests for metal fatigue and premature component failure have not yet taken place. Our Senior Defects Engineer has been on compassionate leave for the last three weeks. She is due back to work on the first day of next month.'

Issue 3: External testing of prototypes in industrial market, Activity D

'This morning, we held a focus group as planned. The 12 respondents, representatives from industry, were testing our three prototype robots when disaster struck. The robots' ability to walk on uneven surfaces was well received. However, the "safety monitored stop" function, which allows the robot to work safely alongside humans, malfunctioned in two of the three robots. In both cases a customised metal component in the joint failed, causing the joint to spin out of control rather than stop. The fingers of one of our engineers became trapped, and one of the industrial representatives was struck on the leg. The engineer's fingers require surgery and the industrial representative's leg wound needs stitching.'

3 Refer to Text 3.

- (a) Zhang cannot deal with all three issues at once.

Prioritise the **three** issues as low, medium or high in the table below.

For each issue, explain your decision.

Issue	Priority? Low, medium or high	Explanation
Issue 1		
Issue 2		
Issue 3		

[9]

- (b) **Issue 3** requires a more durable component to be procured. Zhang needs to find a supplier for the upgraded component and needs to amend the resource plan accordingly.

Identify **two** criteria which Zhang should include in the amended resource plan to source the upgraded component.

1.....

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[2]

- (c) Analyse **two** potential benefits to the project of Zhang having good negotiation skills when dealing with suppliers.

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[6]

(d) The durability of the upgraded component has been tested. The results are given in the frequency table shown in **Fig. 2**.

(i) Complete the cumulative frequency column in **Fig. 2**.

Durability of upgraded component (n cycles, in millions)	Frequency	Cumulative frequency
$n \leq 3.0$	0	0
$3.0 < n \leq 3.5$	8	
$3.5 < n \leq 4.0$	30	
$4.0 < n \leq 4.5$	36	
$4.5 < n \leq 5.0$	16	
$5.0 < n \leq 5.5$	10	100

Fig. 2

[2]

(ii) Complete the cumulative frequency graph shown in **Fig. 3**.

[2]

(iii) Indicate on the graph the median value.

[1]

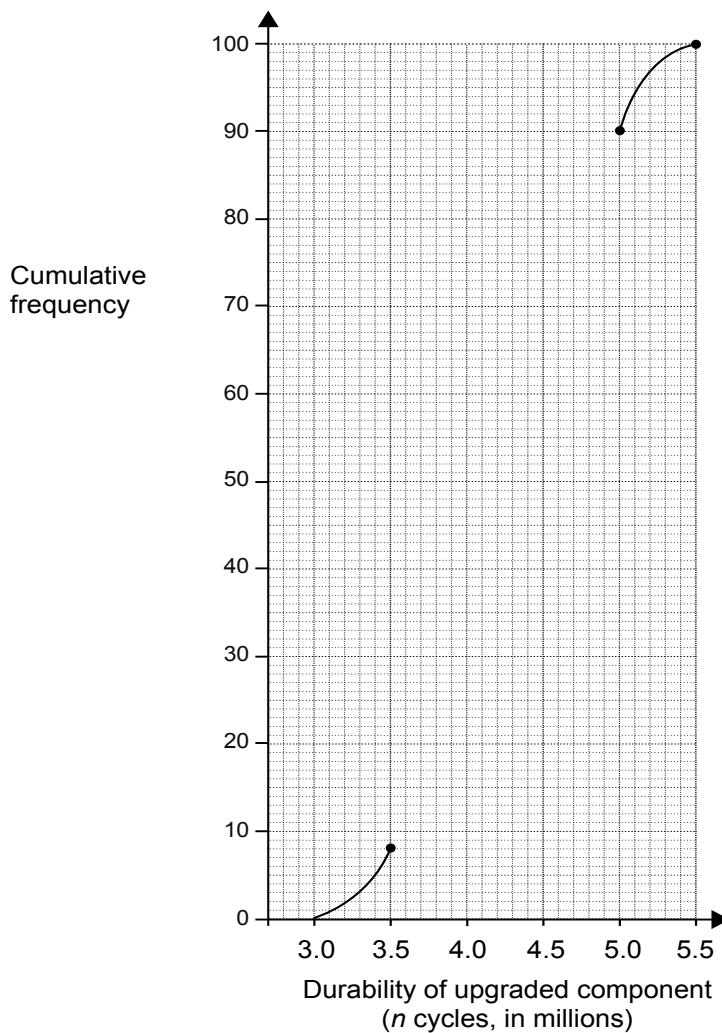


Fig. 3

Text 4

Despite the setbacks, Zhang is still hoping that Industrial Robotics Ltd will be able to launch its new robotic mobility system ahead of the competition. Although the end of the project is still several months away, his thoughts turn to the closure of the project.

Zhang understands the importance of obtaining feedback on the project's successes and failures. He wants to obtain feedback from internal and external stakeholders. He plans to include objective and subjective feedback in the final project report.

Zhang is particularly interested in reviewing his own personal performance as project manager. Once the project is complete, he intends to collect as much detailed feedback as possible. He hopes that the feedback he receives will be far more positive than the feedback he received at the end of the previous two projects he managed.

4 Refer to Text 4.

(a) Identify **two** external stakeholders in the project.

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

[2]

(b) Explain the importance of obtaining feedback from **all** relevant stakeholders on project successes and failures.

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[3]

(c) Evaluate feedback methods Zhang can use to review his own performance as manager of the project.

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END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined pages. The question number(s) must be clearly shown – for example 2(b)(i) or 3(c).

Lined area for providing answers to questions.

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

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