



Oxford Cambridge and RSA

Thursday 15 June 2023 – Morning

Level 3 Cambridge Technical in Engineering

05873 Unit 24: Project management for engineers

Time allowed: 2 hours

C307/2306



You must have:

- a calculator



Please write clearly in black ink. **Do not write in the barcodes.**

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 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.

Text 1

Sykes Components Ltd is a British manufacturer of plastic components; it uses computer-aided design (CAD) software coupled with modern injection moulding processes to produce custom-made parts for the automotive industry.

Zac Sykes formed the company in 2002. The company now has three directors, including Zac its Managing Director, who is a leading member of the UK Injection Moulding Society. This is a prestigious trade organisation which seeks to promote innovation in the plastics industry.

Employing 37 people, the company uses three different production processes, each with their own production cells.

- GAIM (Gas assisted injection moulding) × 6 cells.
A fast process for producing hollow components or ones with complex shapes, e.g. car door handles and fuel level sensors.
- MMIM (Multiple material injection moulding) × 2 cells.
A process used when two or more materials with different properties are needed, e.g. soft touch CD buttons or arm rests.
- RIM (Reaction injection moulding) × 4 cells.
A slower process which produces lightweight but solid components, e.g. steering wheels and bumpers.

Sykes Components Ltd has a reputation for excellence in design and for the production of superior, high precision, components. However, this level of customer service and quality comes at a high price.

In recent years production costs have been too high and company profits have been falling. An investigation found that the use of robots to load and unload the cells would cut production times and lower wastage, thus reducing production costs.

This matter is now urgent. A new project has been commissioned. The required deliverables are three robots (one to serve each of the three production processes). The objective is to reduce overall production cost by at least 3.5%. The three directors comprise the project board.

Nina Dixon, the company's newly appointed Robotics Engineer, has been assigned as project manager. Nina was recruited straight from university and has a degree in robotic engineering. Nina is keen to do well in her first job. She is not a born leader, however, and is risk averse. She has never been part of a project before, nor has she been trained in project management.

The managers of each of the three production processes have been assigned as project team members. All are fully qualified engineers who have worked for the company for many years:

- Kofi (GAIM) – approaching retirement, prefers traditional production methods, dislikes robotics
- Jamal (MMIM) – eager to change, but busy preparing to speak at an engineering conference
- Amir (RIM) – project manager last year, is disappointed not to be project manager again.

1 Refer to Text 1.

(a) Explain **one** benefit to Nina of reading company documentation from previous projects before managing this project.

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..... [2]

(b) Explain **one** purpose of each of the following plans that Nina needs to produce:

- resource plan

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- quality plan

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- project schedule.

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[6]

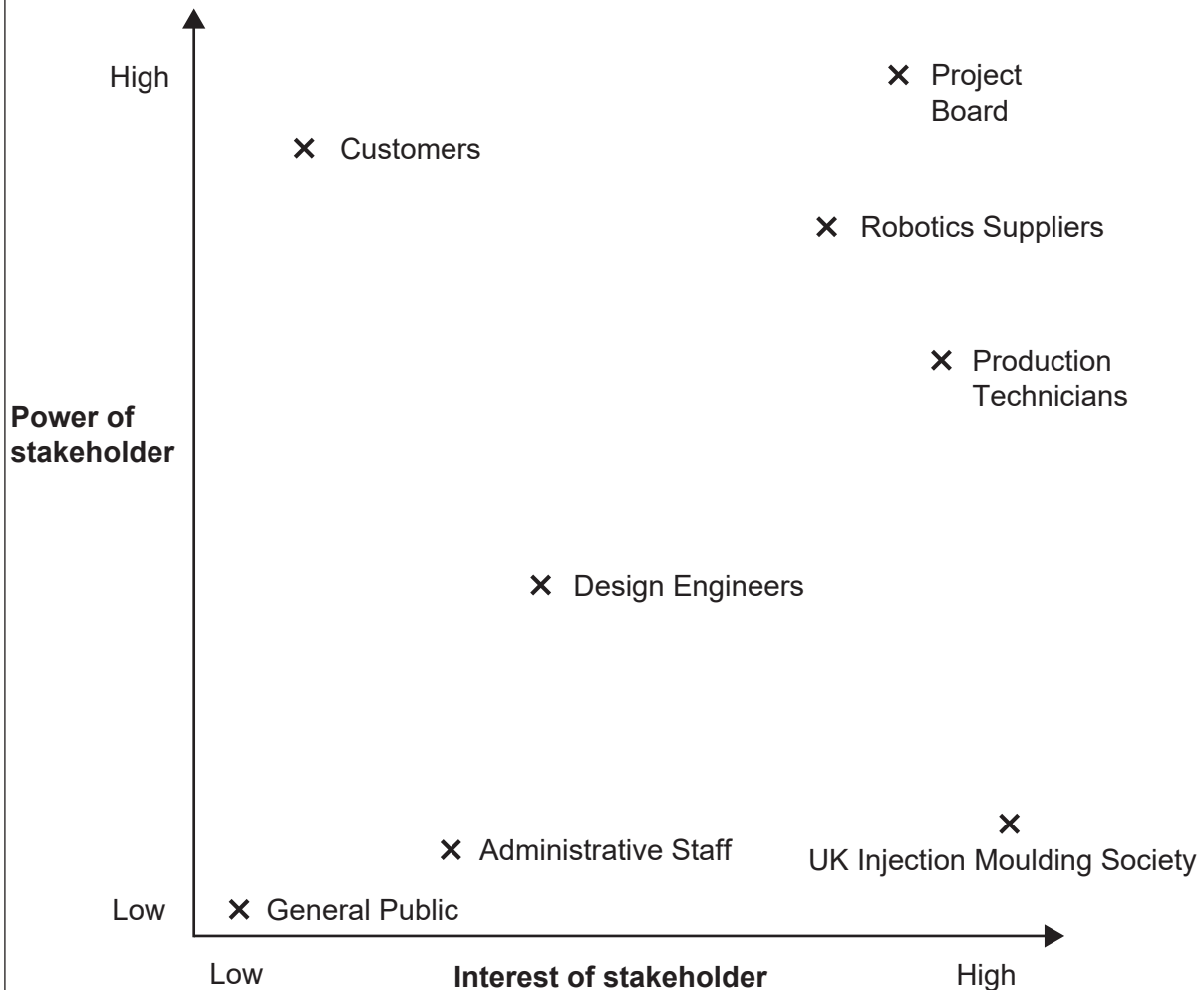
A series of horizontal dotted lines spanning the width of the page, intended for writing.

Text 2

Nina is considering how to manage the project's stakeholders. A graph showing the levels of power and interest of project stakeholders is shown in **Fig. 1**.

Fig. 1

Graph showing project stakeholders according to their levels of power and interest



2 Refer to Text 2.

(a) Fig. 1 shows the power and interest levels of internal and external stakeholders.

Complete the unshaded cells in the table below to advise Nina how to manage each of the four **external** stakeholders shown in **Fig. 1**.

	External stakeholder	Level of power? (high, medium or low)	Level of interest? (high, medium or low)	How should this external stakeholder group be managed?
1				
2				
3				
4				

[12]

(b) Nina realises that an effective project manager needs to be able to motivate the team. Analyse **two** ways Nina could motivate her project team members.

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[6]

(c) Details of the activities in the implementation stage of the project are shown in **Table 1**, below.

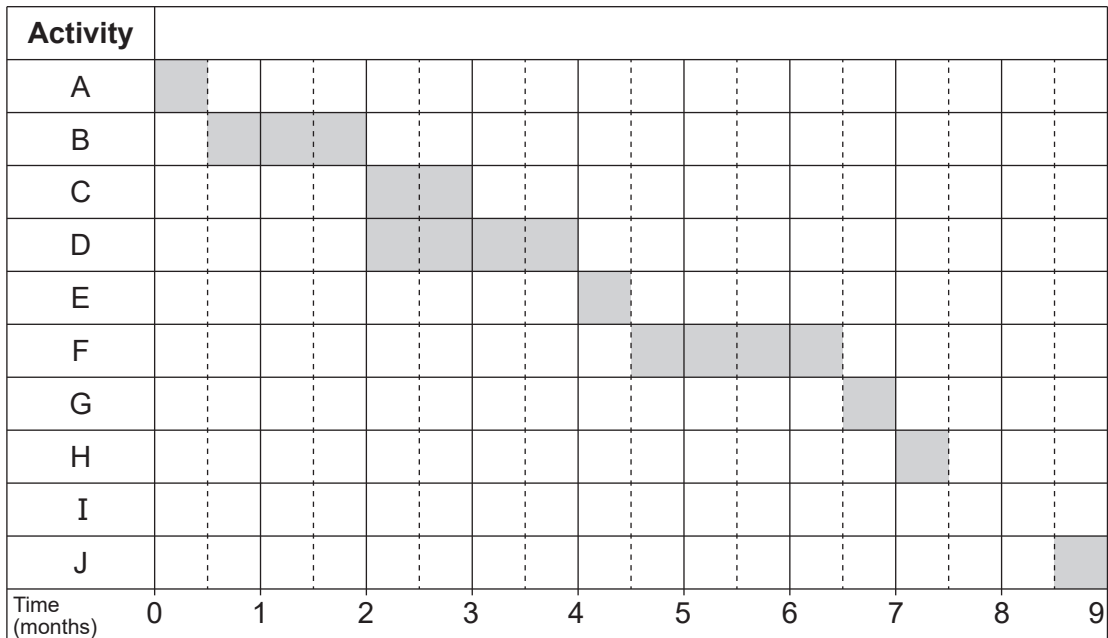
Table 1

Activity	Description	Dependent activities*	Duration of activity (months)
A	Kick-off meeting to agree parameters		0.5
B	Assess technical feasibility	A	1.5
C	Finalise functionality specifications	B	1
D	Negotiate with robotic suppliers	B	2
E	Select preferred robotic supplier and confirm order	C, D	0.5
F	Lead time for supply of three robots	E	2
G	Delivery, installation and commissioning of robots	F	0.5
H	On-the-job training of production technicians	G	0.5
I	Live testing of robots in GAIM, MMIM and RIM	H	1
J	Give feedback to supplier and confirm obligations	I	0.5

* **Finish to start dependency – activity to start when predecessor finishes.**

Nina has produced a Gantt chart for the implementation stage of the project, see **Fig. 2**, below.

Fig. 2



Key: = activity time = slack time

- (i) Complete the Gantt chart, **Fig. 2** on the previous page, by:
- shading in the activity time for ‘Activity I: Live testing of robots in GAIM, MMIM and RIM’
 - shading in the slack time for ‘Activity C: Finalise functionality specifications’.
- [2]**

- (ii) Nina thinks that ‘Activity C: Finalise functionality specifications’ is a critical activity. Explain whether Nina is correct.
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- **[2]**

- (iii) Nina knows that depending on which supplier is chosen, the duration of ‘Activity F: Lead time for supply of three robots’ may need to be adjusted. Calculate the minimum completion time for the implementation stage of the project if the duration of ‘Activity F: Lead time for supply of three robots’ needs to be increased to 5 months.
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- **[2]**

- (d) Nina is concerned about a number of factors that could significantly affect the outcome of the project.

In the table below, identify with a tick (✓) whether these factors are internal factors or external factors.

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

Factor	Internal factor	External factor
Nina's own lack of skills as a project manager		
Sykes Components Ltd's policies and procedures		
Market dynamics in the robotics industry		
The scope of the project		

[4]

- (e) Identify **one** control technique that could help Nina keep the project on track.

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 [1]

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Turn over for the next question

Text 4

Sykes Components Ltd's preferred robotic supplier is The Kaashawi Corporation in Japan. Nina had insisted that any purchase be subject to a free exchange if the model failed to deliver the required cost reductions during testing. The Kaashawi Corporation was the only supplier willing to agree to this requirement.

The Kaashawi Corporation has worked alongside Sykes Components Ltd's engineers to help them understand the capabilities of its range of robots. Sykes Components Ltd eventually chose model CH6P, a compact high-performance robot. The CH6P robot is capable of servicing the production cells at high speed across 6-axes, with a tolerance of less than 0.02 mm. The combined cost for three CH6P robots is £150 000. The purchase has been funded by debt finance.

The three CH6P robots are currently being tested.

4 Refer to Text 4.

- (a) State what is meant by the term 'debt finance'.

.....
 [1]

- (b) 'Activity I: Live testing of robots in GAIM, MMIM and RIM' is now complete. Cost data for before and after the introduction of the three robots is shown in the table below.

- (i) Complete the '% reduction in average unit cost' column in the table below.

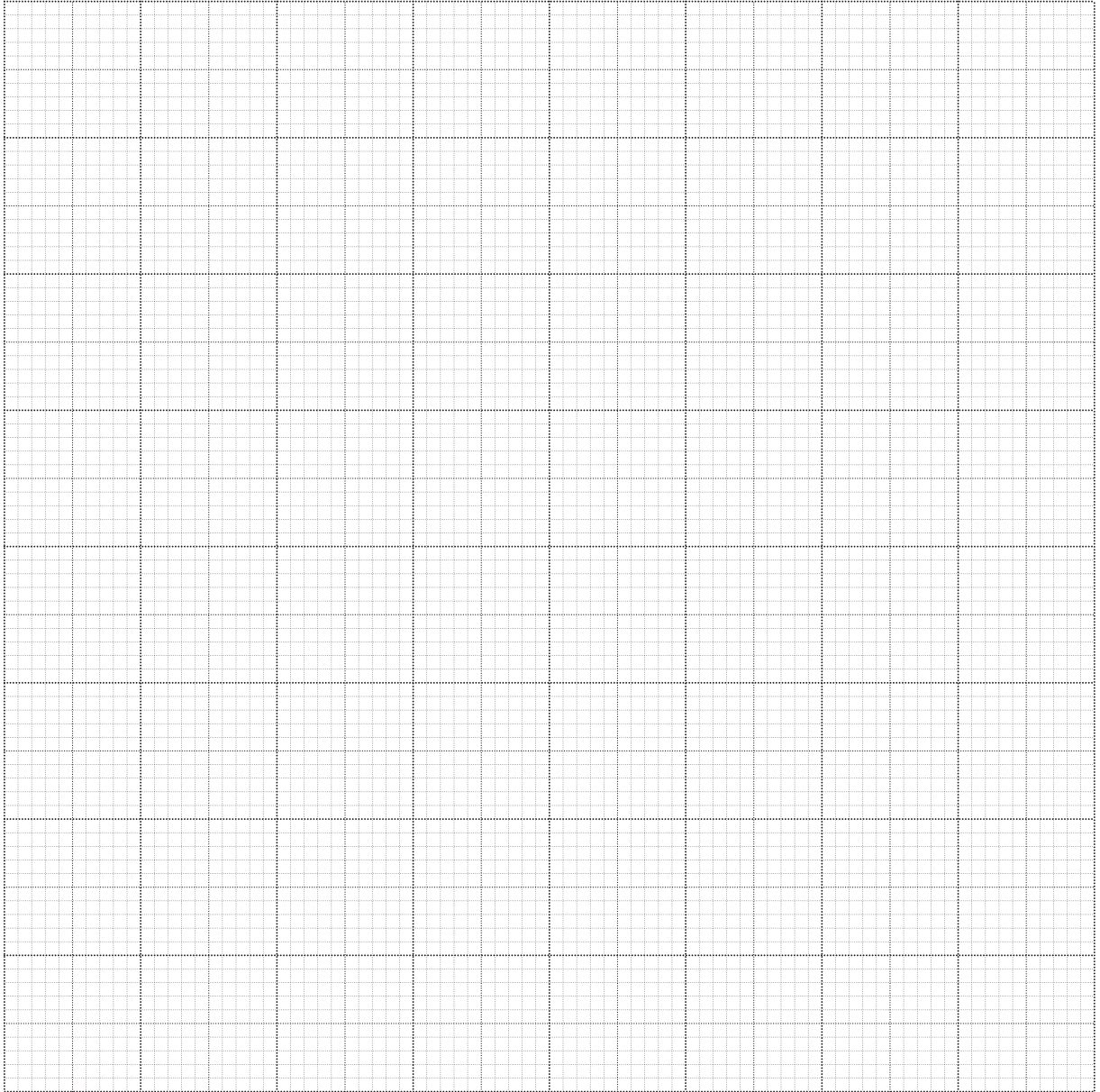
Give your answers correct to one decimal place.

Production process	Average unit cost of production <u>before</u> the introduction of robot CH6P	Average unit cost of production <u>after</u> the introduction of robot CH6P	% reduction in average unit cost (correct to 1 d.p.)
GAIM	2p	1.88p	
MMIM	16p	15.44p	
RIM	150p	148.50p	

[3]

- (ii) Produce a bar chart for Nina to include in the final project report. The bar chart should show the percentage cost reduction achieved for each of the three production processes.

You should draw, and fully label, your bar chart on the graph paper below. Use a scale that demonstrates the required degree of accuracy.



[3]

(c) Project monitoring has revealed an adverse variance on the budget spend for the three robots.

Identify **two** economic factors that may have affected the outcomes of the project.
For each factor, explain how it may have contributed to this adverse variance.

Economic factor 1

Contribution to adverse variance

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Economic factor 2

Contribution to adverse variance

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[6]

(d) At project closure Nina intends to collect as much feedback as possible.

(i) Identify the types of feedback shown in the table below.

Show your answer by **circling** your choices.

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

Feedback	Type of feedback	
Opinions of project board members	Objective	Subjective
Issue logs	Objective	Subjective
The reputation of Sykes Components Ltd as perceived by the UK Injection Moulding Society	Objective	Subjective

[3]

(ii) Identify **one** formal method which Nina could use to obtain feedback from the company's production technicians.

Explain **one** advantage to Nina of using this method.

Method

Advantage

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[3]

(iii) Identify **one** reason why it is important to review lessons learned at the end of a project.

.....

[1]

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(c) or 4(b)(iii).

A large vertical rectangular area containing 25 horizontal dotted lines for writing answers.



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