OCR
Oxford Cambridge and RSA

Friday 19 January 2024 – Morning

Level 3 Cambridge Technical in Engineering

05873 Unit 24: Project management for engineers

Time allowed: 2 hours
C307/2401

C307/2401

You must have:
- a calculator

0 5 8 7 3 – 2 4

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

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 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

HD Tyre Ltd is a UK-based manufacturer of heavy-duty industrial tyres. The company produces two very specialist types of tyre:

- aeronautical tyres for aircraft, e.g. airliners and helicopters
- agricultural tyres for farm machinery, e.g. tractors and combine harvesters.

Established for over 15 years, HD Tyre Ltd is a now a profitable company with sales in excess of £90 million a year. Its tyres are made from steel reinforced rubber. The company operates from three sites:

- Site 1: headquarters and rubber compound manufacture, based in the Midlands
- Site 2: aeronautical tyre assembly, based 80 miles southwest of Site 1
- Site 3: agricultural tyre assembly, based 120 miles northeast of Site 1.

Across its three sites the company's workforce totals 350: 280 production staff, 40 sales staff and 30 administrative workers.

HD Tyre Ltd's three directors have a strong social conscience and take corporate social responsibility very seriously. In addition to securing good returns for its shareholders, the company aims to be a responsible employer, an ethical trader and an environmentally friendly producer. Consequently, the directors ensure that the company:

- offers good rates of pay and looks after the welfare of its workforce
- donates 10% of all profits to local charities
- actively pursues ethical supply chain policies (such as sourcing materials from suppliers who are deemed to be good employers and reducing the number of miles raw materials travel)
- keeps its own production methods under constant review to minimise its impact on the environment.

The directors of HD Tyre Ltd have recently initiated a formal project with the explicit aim of further reducing the company's carbon footprint.

The project board comprises three company directors – Ben Hardy, the Managing Director and project sponsor; Sara Hughes, the Finance Director; and Jamal Kish, the company's Operations Director. The project is broad in scope. The budget is flexible, dependent on deliverables.

Charlie Crompton, one of six employees who applied for the role, has been assigned as the Project Manager. Charlie, a skilled engineer, is based at HD Tyre Ltd's headquarters. Charlie is a new employee; he has only been working for the company for 11 weeks.

Charlie is a good negotiator; however, his planning and decision-making skills would benefit from improvement. When managing a small project for his previous employer he was criticised for making key decisions based on information with limited validity and for failing to create a detailed contingency plan to deal with problems that might have arisen.

1 Refer to Text 1.

(a) In **Table 1**, identify with a tick (✓) at which stage of the project Charlie needs to do each of the following activities.

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

Table 1

	Project initiation	Project planning	Project implementation	Project closure
Identify project control strategies				
Monitor project quality				
Recognise project successes and failures				
Provide frequent updates regarding project execution				

[4]

(b) Describe **three** topics that Charlie needs to include in the outline plan.

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(c) 'Quality', 'Reliability' and 'Importance' are criteria used to judge the validity of information used in a project.

Draw a line linking each criterion to the definition that is most appropriate for Charlie in the context of this project.

You must only draw **three** lines.

	The information comes from a trusted source
Quality	The information is of the required standard
Reliability	The information obtained would be the same if the research method were repeated
Importance	The information is up to date
	The information is of significance because it matters to the business

[3]

(d) Risks related to physical, technological and human resource issues should be included in a contingency plan.

Outline **one** contingency plan that Charlie should make for each of these three areas of risk.

[6]

Physical .....

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Technological .....

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Human resource .....

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(e) Explain **one** reason why Charlie might need to negotiate with each of the following stakeholders during the project:

- Sara, the Finance Director

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- Ben, the project sponsor.

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[4]

Text 2

Charlie has been assigned three project team leaders – Leo, Alex and Jane. All three of the team leaders had applied for the role of project manager but were unsuccessful.

Leo is based at Site 1. He is a shift manager at the rubber compound manufacturing facility. Leo is the manager of the night shift. He works from 10 pm to 6 am. Leo is the only team leader to work at night (whereas Charlie, Alex and Jane work from 9 am to 5 pm). Leo has worked for the company for eight years. Leo enjoys a challenge and loves socialising.

Alex is based at Site 2. He is the production manager for aeronautical tyres. Alex has worked for the company for ten years. Alex has been a project manager for HD Tyre Ltd on two previous projects and is annoyed by Charlie's appointment. Alex thinks that when it comes to managing a project he knows best.

Jane is based at Site 3. She is the deputy production manager for agricultural tyres. Jane has worked for the company for five years. Jane is very ambitious and is disappointed never to have been appointed as a project manager. Jane dislikes being told what to do and prides herself on her innovative approach to problem-solving.

Charlie realises that motivating his three team leaders is essential to the successful management of the project. The project team also comprises 45 project team members: 15 carefully selected employees from each of the company's three sites.

2 Refer to Text 2.

(a) Charlie has been assigned three project team leaders.

(i) Describe the role of a project team leader.

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(ii) Evaluate **three** ways Charlie could motivate his project team leaders.

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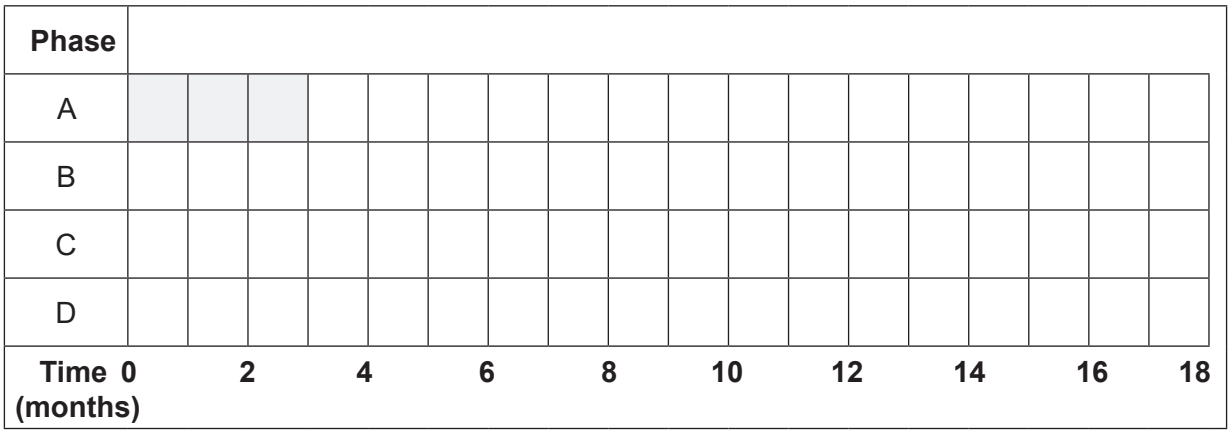
(b) Charlie intends to use Gantt charts to help manage the project. He begins by dividing the project into four phases. Details of the four phases are shown in **Table 2**.

Table 2

Phase	Description	Dependency*	Duration (months)
A	Research ways of reducing the carbon footprint	-	3
B	Discuss findings and agree which measures to take	A	4
C	Implement carbon reduction measures	B	10
D	Collect feedback and formally close the project	C	1

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

(i) Using the information in **Table 2** above, complete the Gantt chart below to illustrate the intended schedule for the four phases.



[6]

(ii) Explain **one** likely consequence to the outcome of the project if Charlie fails to compare actual timings with the intended schedule.

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Text 3

During Phase B of the project, it was agreed that the company would implement the following three carbon reduction measures:

- reduce water consumption at Sites 2 and 3 by installing a closed loop cooling system to capture and reuse the water used during the tyre assembly process
- install new heating systems at all three sites to run on liquified natural gas rather than oil
- use recycled steel, rather than virgin steel, to reinforce its tyres without compromising quality or performance.

Charlie is using critical path analysis to help manage the implementation of the three carbon reduction measures.

The project is now part-way through Phase C: Implement carbon reduction measures.

- The closed loop water cooling system has been installed at the first of two sites. Daily water consumption figures for the first week of operation at Site 2 are shown in **Table 3**.

Table 3

Week 1	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
Water consumption per aeronautical tyre (in litres)	1700	1560	1640	1420	1300	1380	1220

- New liquified natural gas heating systems have now been installed at all three sites. Charlie hopes that, in line with company aims to be a responsible employer, the heating system installed to lower carbon emissions has also had a positive impact on the internal working environment for employees. Charlie is awaiting the results of a survey he has commissioned.
- A business to supply HD Tyre Ltd with recycled steel has yet to be selected.

3 **Refer to Text 3**.

(a) Explain **one** benefit to Charlie of identifying the critical path for Phase C of the project.

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(b) Charlie hopes to be able to report to the project board that the company's water consumption for the assembly of aeronautical tyres is now below the industrial average of 1960 litres per tyre.

Using the data in **Table 3** in **Text 3**, calculate, by how many litres, HD Tyre Ltd's average consumption of water per aeronautical tyre in Week 1, was below the industrial average.

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(c) **Table 4** shows the results just received of a survey Charlie commissioned into the impact of the newly installed heating systems on the internal working environment.

Table 4

	Industrial standard acceptable levels	Before installing the new heating system	One week after installing the new heating system
Carbon monoxide levels (mg/m³)	<7	1	0
Nitrogen dioxide levels (mg/m³)	<0.4	0.35	0.1
Relative humidity (%)	30–70	40	40
Employee perception of comfort (%)	>70% of employees satisfied	90	72
Employee perception of odour (%)	<20% of employees believe they can smell an odour	35	5

(i) Circle the type of research undertaken by this survey.

You should only draw **one** circle.

Primary research **Secondary research**

[1]

(ii) Identify **one** piece of objective feedback and **one** piece of subjective feedback provided by this survey (refer to **Table 4**).

Objective feedback .....

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Subjective feedback .....

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(iii) Assess, using the data in **Table 4**, whether the newly installed heating systems are consistent with the company's aim to be a responsible employer.

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(d) **Table 5** gives details of four businesses that are able to supply HD Tyre Ltd with recycled steel at the correct specification and at the same price as its current steel supplier, but with a much lower carbon footprint.

Table 5

	Chinese business	**German business**	**Turkish business**	**American business**
Approximate distance from UK	5200 miles	600 miles	1700 miles	4500 miles
CO_2 emissions per 1 tonne of steel	1.47 tonnes	1.68 tonnes	1.55 tonnes	1.72 tonnes
Reputation for looking after the welfare of employees	Poor	Very good	Poor	Good
Proportion of profits donated to charity	0%	5%	10%	0%
Local purchasing power of average wage as a percentage of UK average wage	42%	108%	35%	128%

Recommend which supplier of recycled steel should be chosen, taking into account the organisational aims and ethical policies of HD Tyre Ltd.

Give reasons for your choice.

Recommended supplier .....

Reasons .....

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Text 4

The project has now entered Phase D: Collect feedback and formally close the project.

Charlie is eagerly awaiting performance statistics for the three carbon reduction measures that were implemented just over three weeks ago. He intends to include these statistics in the final project report.

4 Refer to Text 4.

(a) Charlie has just received performance statistics for the first three weeks of operation of the new carbon reduction measures. He begins by conducting a variance analysis.

(i) Finalise the variance analysis by completing the **six unshaded** boxes in **Table 6**.

Table 6

Carbon reduction measure:		**Expected reduction in CO_2 emissions**	**Actual reduction in CO_2 emissions**	**Percentage variance**	**Adverse or favourable?**
Reduce water consumption	**Site 2**	14%	16%	2%	
	Site 3	%	10%	2%	Adverse
Install new heating system	**Site 1**	20%	%	4%	Favourable
	Site 2	28%	32%	%	Favourable
	Site 3	28%	%	4%	Adverse
Use recycled steel	**All orders**	66%	58%	8%	

[6]

(ii) Charlie intends to use the first three weeks' carbon reduction performance statistics to forecast HD Tyre Ltd's carbon reduction for the coming year.

Explain **one** benefit and **one** drawback of using the first three weeks' performance statistics for this purpose.

Benefit .....

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Drawback .....

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[4]

(b) To obtain further feedback for the final project report, Charlie intends to chat with Leo in Site 1's canteen.

(i) Identify whether chatting with a colleague in the canteen is a formal or informal feedback method.

Give a reason for your answer.

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(ii) Explain **one** advantage and **one** disadvantage to Charlie of using chat to collect feedback at the end of a project.

Advantage .....

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Disadvantage .....

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(iii) Explain **one** way Ben, the project sponsor, could use the contents of the final project report to drive business improvement.

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END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.