Version TM/2

MET 3

MANUFACTURING ENGINEERING TRIPOS PART IIB

Wednesday 30 April 2025 9:00 to 12:10

Paper 2

*Answer not more than **four** questions.*

Answer each question in a separate booklet.

All questions carry the same number of marks.

*The **approximate** percentage of marks allocated to each part of a question is indicated in the right margin.*

Write your candidate number not your name on the cover sheet of each booklet.

STATIONERY REQUIREMENTS

8 page answer booklet x 4

Rough work pad

SPECIAL REQUIREMENTS TO BE SUPPLIED FOR THIS EXAM

CUED approved calculator allowed

Engineering Data Book

10 minutes reading time is allowed for this paper at the start of the exam.

You may not start to read the questions printed on the subsequent pages of this question paper until instructed to do so.

You may not remove any stationery from the Examination Room.

Question 1

(a) Define *industrial policy*.

[15%]

(b) List, explain, and give examples of activities that occur within the four phases of the *policy process*.

[25%]

(c) You work at a government department responsible for increasing the productivity of UK manufacturing industry. You have been provided with a research report that shows how adopting digital technologies could help increase the productivity of manufacturing firms.

(i) Describe the process you would follow to manage a *change programme* to increase the adoption of digital technologies across UK manufacturing industry.

(ii) Discuss how you would ensure the involvement of manufacturing firms of all sizes and sectors in the design and delivery of any government activities to support the adoption of digital technologies.

(iii) Explain how you would assess the success of such an industry-wide *change programme*.

[60%]

Question 2

Castleton is a manufacturer of potato crisps. The firm is one of the major suppliers of crisps to supermarkets in the United Kingdom. The Chief Executive Officer (CEO) attended a conference on Artificial Intelligence (AI) embedded robotics technology. The CEO is keen to implement it in the firm to improve productivity and build a competitive advantage for Castleton. The CEO has heard at one of the conference sessions that the implementation of AI embedded robotics technology would require digital transformation.

(a) *'Digital transformation is most impactful when it leads to business model innovation.'* Discuss this statement.

[30%]

(b) Describe the potential benefits of embedding AI in robotics technology for the operations of a food manufacturing company such as Castleton.

[30%]

(c) Explain what the opportunities and challenges are for Castleton to implement AI embedded robotics technology to build competitive advantage.

[40%]

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Question 3

You have been hired as a consultant by a *technology contingent* company with about 30 employees. The company was formed around thirty years ago and manufactures a set of electronic commodity components selling them mostly to UK customers. Because it has been operating in a price competitive environment, the company is now in a precarious situation.

(a) To escape that situation, the company's executive team wants your help to implement roadmapping for developing a strategy. It also wants to approach external partners to collaboratively develop innovative product features, for which it plans to secure patent protection.

Describe what is meant by each of the following concepts, and at least one benefit the company could receive from implementing each one of them:

(i) *Roadmapping*

(ii) *Open innovation*

(iii) *Patent*

[30%]

(b) The company has just formed an innovation team. This team has enthusiastically initiated an informal collaboration with a research group from the local university. That research group has relevant Artificial Intelligence (AI) expertise. The collaboration quickly resulted in an innovative, AI-enabled product feature. However, it turns out that *foreground IP* ownership allocation was not clarified in a formal contract beforehand. While your company wants ownership for the patentable AI-enabled feature, the research group wants access to the training dataset as it plans to use it for further research. When the university's technology transfer team gets involved, they suggest to jointly share ownership for all *foreground IP*. The company turns to you for your advice.

(cont.

Should the company accept the joint-ownership offer? What alternative models would you suggest? Which arguments can you provide to the company so they can negotiate a more favourable *foreground IP* sharing model?

[30%]

(c) Meanwhile the company developed their *roadmap*. As part of this, the leadership team decided to implement a *technology intelligence system* that allows it to continuously collect information about relevant new technologies.

Which *sources of information* should this particular company consider? Evaluate different *sources of information* by comparing their pros and cons so that you can provide the company with a recommendation of the top three sources it should consider.

[40%]

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Question 4

Deliveraway, a logistics firm specialising in fulfilling customer orders from various businesses, is committed to becoming a customer experience-centric organization. The company seeks to manage and measure customer interactions to enhance its understanding of customer pain points and improve both customer experience and service quality. By leveraging Customer Experience (CX) data and Artificial Intelligence (AI), Deliveraway aims to gain deeper insights into customer frictions, encompassing attitudinal, emotional, and behavioural aspects. This data-driven approach is designed to refine customer interactions, increase satisfaction, and build long-term loyalty.

(a) Identify and explain the different types of CX data that Deliveraway can use, providing specific examples.

[40%]

(b) Discuss how Deliveraway can apply AI and analyse CX data to identify both attitudinal and behavioural issues among customers.

[30%]

(c) Propose and justify strategies for turning CX insights into actionable improvements to enhance customer satisfaction and loyalty.

[30%]

Question 5

(a) Describe what is meant by the *circular economy*. Discuss the benefits and challenges to implementing it, and explain how it differs from the current economic model. Use two specific examples in different sectors to support your answer.

[40%]

(b) A battery energy storage startup wants to participate in and encourage the circular economy. With reference to the *Ellen MacArthur Foundation Circular Economy Systems Diagram*, suggest what strategies the company could use.

[25%]

(c) Identify the four categories of *circular economy business models* and explain the types of business models which can be found in each category.

[35%]

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Question 6

You are the CEO of a medium-sized manufacturing firm working in the motorsports sector. Your firm provides critical mechanical components to racing car companies. Your firm has been using Additive Manufacturing (AM) technologies for many years to make prototypes but never final parts for the customer. Now, your Head of R&D believes that AM technologies could be used for some of the final products to be used by your customers. Your Head of Manufacturing is strongly opposed to this. He believes that none of the AM technologies currently available are suitable for the production of your high-performance final parts, and that this would be '*a total waste of time for my team, and for everyone else. We've got enough problems just responding to current customer demands for things we know our current machines can do'*.

(a) List and describe *technology management tools* your Head of R&D could use to assess the suitability of different AM technologies for final parts production, and to communicate this analysis to you and the Head of Manufacturing.

[25%]

(b) Describe the design and implementation of a *change management programme* to overcome the resistance of your Head of Manufacturing and get AM technology into use for final part production in your business.

[40%]

(c) You have met the founder of a small, early-stage technology firm that has developed and is selling specialist AM technologies for making final products for medical applications. That firm wants to diversify and enter new markets, including motorsport. You decide to set up a partnership to work with them to explore opportunities for the mutual exchange of AM experience and IP between medical and motorsports applications. Evaluate the potential challenges of managing such a partnership through its life cycle, and what you would do to address such challenges.

[35%]

END OF PAPER