

Friday 5th May 2023 9:00 to 10:40

Paper 6

MODULE 3P10: CONTEMPORARY ISSUES IN MANUFACTURING

*Answer **all** questions.*

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 and at the top of each answer booklet.

Use a separate answer booklet for each question.

STATIONERY REQUIREMENTS

8 page answer booklet x 3

Rough work pad

SPECIAL REQUIREMENTS TO BE SUPPLIED FOR THIS EXAM

CUED approved calculator allowed

Engineering data books

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) A wind turbine is one way of generating electricity from a renewable source, but turbines themselves carry an environmental footprint.

(i) Describe how you would carry out an eco-audit to assess the lifetime carbon footprint of a 2MW wind turbine, across its lifecycle. Limit your analysis to the wind turbine itself, excluding installation infrastructure (e.g. cables, transformers). Include in your answer details of what data you would require and what result you would expect from this analysis. Explain and justify any assumptions that you make.

[50%]

(ii) Describe what is meant by the 'Energy Payback Period' as applied to wind turbines.

[5%]

(iii) The main materials in turbine manufacture and installation are concrete (for foundations) and mild steel (mainly for the tower). Comment on the environmental impact of these materials, and how this might be reduced.

[10%]

(b) A government think-tank is tasked with encouraging a shift away from individual automotive ownership, and increasing the use of public transport together with more walking and cycling.

(i) Discuss what environmental benefits could arise from moving from individual car ownership to a Product Service System (including eco-leasing) for cars.

[20%]

CONT)

- (ii) Taxation and moral suasion are two available policy tools that can be applied in the context of influencing personal transport choices. For each policy tool, give one example of a measure that can be used to encourage a shift away from individual automotive ownership. Explain in your answer how the measures would be expected to influence choice and note any potential negative consequences.

[15%]

TURN OVER

Question 2

(a) A waste management firm based in Germany plans on collecting medical devices that have been used and disposed of in German hospitals. They want to sort the devices, identify which can be re-used, then re-sterilise and repackage these devices to sell them back to the German healthcare sector.

(i) Describe the challenges you anticipate the waste management firm will face as they try to carry out their plan. Illustrate your answer using specific examples of medical devices.

[40%]

(ii) Researchers have recently discovered that a new microwave technology will sterilise a wide range of materials much more quickly than existing sterilisation techniques. Describe any two challenges the waste management firm would face if they decide to develop and adopt this new sterilisation technique.

[20%]

(b) A tissue engineering product is being developed where a bioceramic scaffold is used to grow teeth (which are made up of a form of connective tissue). These will be used instead of prosthetic teeth in the future.

(i) Explain the process steps in creating a tissue for implanting.

[20%]

(ii) Describe two considerations relating to materials and/or manufacturing when designing a bioceramic scaffold for tissue engineering.

[20%]

Question 3

- (a) A customised framework to manage scale-up is used by a firm that creates technologies for the space industry. The framework uses a standard phase-gate process to manage each project, combined with tracking Technology Readiness Levels and Manufacturing Readiness Levels.
- (i) Describe what happens at a gate in a standard phase-gate process. [20%]
- (ii) Explain the terms *Technology Readiness Level* and *Manufacturing Readiness Level*. [15%]
- (iii) What do you anticipate are the benefits of this customised framework? [20%]
- (iv) What advice would you offer to the firm if they asked how to further develop their customised framework? [15%]
- (b) Explain the role of government in supporting emerging technology scale-up, illustrating your answer using specific examples. [30%]

END OF PAPER

THIS PAGE IS BLANK