Version FE/3

EGT2
ENGINEERING TRIPOS PART IIA

Thursday, 4 May 2023 2 to 3.40

Module 3E10

OPERATIONS MANAGEMENT FOR ENGINEERS

*Answer not more than **two** 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.*

STATIONERY REQUIREMENTS
Write on single-sided paper.

SPECIAL REQUIREMENTS TO BE SUPPLIED FOR THIS EXAM
CUED approved calculator allowed.

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.

1 Colour-Me-Mine is a Cambridge apparel store known for their sweaters with vibrant colours. The sweaters are all in the same style and size, but are sold in 10 different colours. The store is reviewing its ordering policy for the green sweaters.

In the past year, average sales for the green sweaters have been 500 per month. The sweaters are knitted in-house. The fixed cost of setting up the production is £500. The variable cost of production is £30 per sweater. The firm can knit sweaters at a rate of 1500 sweaters per month. The cost of keeping a sweater in stock is about 20% of its value per year.

(a) Find the optimal size of production run for green sweaters. How often does Colour-Me-Mine have to run production? [20%]

(b) Write the total cost function. How much does Colour-Me-Mine spend per year for green sweaters? [15%]

(c) What proportion of the cycle consists of uptime? [5%]

(d) What is the maximum level of on-hand inventory for green sweaters? [10%]

(e) State all your modelling assumptions in part (a). Discuss how each of these assumptions are unrealistic compared to the situation faced by the shop. [15%]

(f) Recently, Colour-Me-Mine executives are complaining about the inventory holding costs. Discuss how the store can reduce inventory. Justify your answer. [15%]

(g) Colour-Me-Mine executives are considering outsourcing production. Discuss the key advantages and disadvantages of outsourcing rather than keeping the production in-house. What are some factors they should consider for outsourcing? [20%]

2 (a) Explain the three basic strategies for long-term capacity planning. Discuss the advantages and disadvantages of each strategy. [20%]

(b) Explain the differences between the characteristics of service operations and manufacturing operations. Give examples as appropriate. To what extent do you think this distinction is valid? [20%]

(c) Explain the bullwhip effect in the context of global supply chain management. Discuss how its consequences may be reduced. Provide examples as appropriate. [20%]

(d) Discuss how Lean and Six Sigma complement each other. [20%]

(e) Consider the recent problems in long wait times in A&E departments in England. Using the basics of queueing theory, provide an explanation for long waiting times. [20%]

3 (a) Explain Fisher's supply chain matrix. Provide examples. [20%]

(b) Explain the difference betwen qualitative and quantitative approaches to forecasting. Discuss the problems accociated with each approach. [20%]

(c) What are the five performance objectives of operations management? Explain each one by providing examples. [20%]

(d) Discuss why a U-shaped assembly line may be easier to balance than a straight line. [10%]

(e) Describe the purpose of an MRP system. Discuss the inputs, components and outputs of an MRP system. [30%]

END OF PAPER