

MANUFACTURING ENGINEERING TRIPOS PART IIA

Thursday 3 May 2012 9 to 12

PAPER 3

Module 3P4: OPERATIONS MANAGEMENT
(Section A)

Module 3P5: INDUSTRIAL ENGINEERING
(Section B)

*Answer **all** questions from Sections A and B.*

Answers to sections A and B must appear in two separate booklets.

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.*

There are no attachments.

STATIONERY REQUIREMENTS

20 page answer booklet x 2

Rough work pad

SPECIAL REQUIREMENTS

Engineering Data Book

CUED approved calculator allowed

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

SECTION A

1 (a) Discuss the advantages and disadvantages for a manufacturer in holding finished goods in a single, centralized warehouse versus maintaining multiple, localized warehouses. [15%]

(b) Describe the *centre of gravity* method and outline how it is used for determining the best location of a warehouse or distribution centre. What are its limitations? [15%]

(c) A manufacturing company producing a small range of industrial equipment currently produces from four factories and distributes from a single warehouse. The location coordinates (X_i , Y_i) of the factories from a reference location and the number of items N_i produced monthly by each factory are given in Fig. 1. The warehouse location coordinates are (35,100)

	X_i [miles]	Y_i [miles]	N_i
A	20	120	200
B	15	130	150
C	50	110	270
D	40	105	320

Fig. 1: Factory location and monthly output

Due to growing demand, the company intends to invest in a further factory, Factory E, and a search has yielded three possible candidates whose locations are given in Fig. 2.

	X_i [miles]	Y_i [miles]
Option 1	65	105
Option 2	45	50
Option 3	80	90

Fig. 2: Location options for new factory

The proposed capacity for the new factory is 440 items per month.

(i) Use the centre of gravity method to determine which of the three factory options is most suitable given the warehouse location given above.

(ii) A more conservative plan would reduce the capacity of the proposed new factory by one half to 220 items per month. Would this affect the new factory option chosen in (i)? Why? [50%]

(d) With an additional factory operating it is estimated that the single warehouse will be close to capacity at times. Given that no additional warehousing options exist for the company, how might this limitation affect intermediate capacity planning for production which has traditionally been based on achieving level capacity throughout the year despite seasonal demand? [20%]

Final version

2 (a) State Little's Law and describe its relevance to inventory and production planning. [20%]

(b) You are the line manager for printed circuit boards at ARMADA, a Cambridge-based chip manufacturer. The production line you are responsible for currently produces 300,000 boards per day. The factory is operating two 8-hour shifts per day. The process comprises of three main stages: etching, drilling, and cutting. Etching and drilling each take half an hour, cutting takes 15 minutes. In a quest to improve the financial performance of ARMADA, the company board suggests cutting Work-in-Progress inventory to 15,000 units. Is that possible? Justify your answer, suggesting alternative approaches to improving the performance of ARMADA where needed. [20%]

(c) There are two fundamental approaches to scheduling production operations, *pull* and *push* scheduling.

(i) Outline the key differences between *pull* and *push* scheduling. [20%]

(ii) What is the role of inventory in a *pull*-scheduled production system? [10%]

(iii) What is the role of inventory in a *push*-scheduled production system? [10%]

(d) What are the financial implications of holding inventory? [20%]

SECTION B

3 You have been asked to organise the re-shoring of production of light electrical assemblies from Shanghai to Birmingham.

(a) What steps will you take to capture and analyse the current production methods in preparation for transfer? [30%]

(b) Explain how you will design the new manufacturing system in the light of the analysis of the existing facility. How will you make provision for variations in volume and variety? [50%]

(c) What contextual factors would you consider, in addition to method study and work measurement? [20%]

4 Lean production techniques offer the possibility of substantial improvements in manufacturing performance.

(a) What are the key wastes which lean production seeks to address? [30%]

(b) Describe Single Minute Exchange of Dies (SMED) and explain its significance in lean production [30%]

(c) What are the limitations of the lean production approach? Explain, with examples, where lean approaches might be less effective. [40%]

END OF PAPER