Version JD/3

EGT2
ENGINEERING TRIPOS PART IIA

Monday 20 April 2015 9.30 to 11

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
Single-sided script paper

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

10 minutes reading time is allowed for this paper.

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

1 (a) Define the theoretical capacity of a manufacturing line. Explain why the actual capacity of a manufacturing line is often different from its theoretical capacity. [20%]

(b) Explain and compare the three approaches to matching capacity and demand in a manufacturing line. [30%]

(c) A chocolate producer has two chocolate production factories and three chocolate distribution centres. Their supply and demand data is given as follows:

Factories		Distribution Centres	
Cardiff	200 tons	Norwich	100 tons
Birmingham	400 tons	London	250 tons
		Exeter	250 tons

The costs of delivery between each location are shown below:

	Norwich	London	Exeter
Cardiff	236 tons	153 tons	118 tons
Birmingham	156 tons	110 tons	167 tons

Find a transportation policy that minimises the cost of delivery from the factories to the distribution centres. [50%]

2 You are the operations manager at Crown Packaging, a UK based producer of metal packaging for cosmetics and pharmaceuticals for a wide range of customers. Part of your job as the operations manager is to purchase sheet metal rolls for use in the production facility. Crown Packaging uses 1,500 rolls of sheet metal per year. The order cost is £75 per order. The holding cost is 1% per month of the purchase cost of £500 per roll. The facility operates for 50 weeks per year, and lead time from the supplier is 1.5 weeks.

(a) (i) How many rolls of sheet metal should you order at one time? What is the reorder point? [20%]

(ii) What would be the change in total annual cost if Crown Packaging had storage space for only 50 rolls, and thus was forced to use an order quantity of 50? [15%]

(b) Discuss the assumptions of the EOQ model. [25%]

(c) Describe fixed-order quantity and fixed-time period ordering systems, and provide an example of each. What are the key differences between fixed-order quantity and fixed-time period ordering systems. [20%]

(d) A well-known pet food producer has approached you to inquire about supplying them with pet food cans. As the operations manager of Crown Packaging, you are thinking about tasking one of your suppliers, Metals Inc., with the production of pet food cans instead of producing them yourself. Discuss the advantages and disadvantages of doing so. What is your recommendation as the operations manager? [20%]

3 Manufacturing Requirements Planning (MRP) provides a means for scheduling the ordering of raw materials and parts.

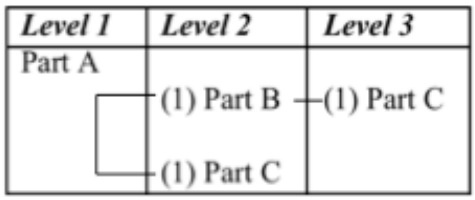
(a) (i) What are the main inputs to an MRP system? [10%]

(ii) How is a Bill of Materials used in MRP calculations? [10%]

(b) (i) Why is MRP called "push scheduling" and JIT is called "pull scheduling"? [15%]

(ii) Compare the purpose of inventory in an MRP system with that of a JIT system. [15%]

(c) Part of the Bill of Materials for a skateboard includes the following structure:



Part A has a lead time of 2 weeks and a Minimum Order Quantity of 50. Part B has a lead time of 1 week and Economic Order Quantity of 65. Part C has a lead time of 2 weeks and a fixed order period of 3 weeks, i.e. there are always 3 weeks between orders.

The gross requirements for Part A over the following 10 weeks are:

Weeks	1	2	3	4	5	6	7	8	9	10
Number of parts	40		30	60		20	80		70	30

In week 1, there are scheduled receipts of 50 of Part A, 65 of Part B and 165 of Part C.

Construct the MRP records for all three parts over the ten week planning horizon. [50%]

END OF PAPER