W 2613

M.E. DEGREE EXAMINATION, JANUARY 2007.

First Semester

Industrial Engineering

IE 1603 — PRODUCTION AND INVENTORY MANAGEMENT

(Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is a production system?

2. What is Operations / Production Management?

3. How do you select a forecasting model?

4. What is multiple linear regression?

5. What is minimum constant production rate (MCP) plan?

6. What is low level coding?

7. What is long range capacity planning?

8. Differentiate between management by constraints and synchronous manufacturing.

9. What is selective inventory control?

10. List the major elements of Inventory carrying cost.

PART B — (5 × 16 = 80 marks)

11. (a) (i) How do companies compete in today's market and how manufacturing operations are important in that competitive advantage? (8)

(ii) A Hitech manufacturing company must select a process technology for one of its new products from among three different alternatives. The following cost data have been obtained for the three process technologies.

Cost	Process A	Process B	Process C
Fixed costs per year (Rs.)	3,00,000	5,00,000	11,40,000
Variable cost per unit (Rs.)	100	. 80	40

Find the range for the annual production volume in which each process will be preferred. If the expected production volume is 12,000 units, which process should be selected? (8)

Or

(b) (i) Differentiate between corporate strategy and manufacturing strategy. Briefly explain the importance of these strategies in the context of globalisation. (8)

(ii) Briefly explain how manufacturing flexibility is achieved through the latest manufacturing technologies. (8)

12. (a) (i) Explain any one method used for multi-item forecasting. (4)

(ii) A company manufacturers and distributes ice cream. It has currently 10 plants. The company wants to determine the relationship between the cost of production and sales volume. The data are given below :

Plant	Cost per thousand Liters (Rs.)	Thousands of Liters sold
1	1015	416
2	973	472
3	1046	250
4	1006	372
5	1058	238
6	1068	258
7	967	597
8	997	414
9	1044	263
10	1008	372

Develop a regression equation to forecast the cost per liter as a function of the number of liters produced and determine the coefficient of determination and the standard error of estimate. (12)

Or

(b) The number of heart surgeries performed in a private hospital has increased steadily over the years. The hospital is seeking the best method to forecast the demand for surgeries for the year 2006. The past demand is shown below. The forecast for the year 2001 was 41 surgeries and the estimated trend was an increase of 2 per year

Year	2001	2002	2003	2004	2005
Demand	45	50	52	56	58

The hospital is considering the following methods.

(i) Exponential smoothing with $\alpha = 0.6$

(ii) Trend adjusted exponential smoothing with $\alpha = 0.6$ and $\beta = 0.1$.

(iii) Regression model, Y = 2.6 +3.2 $\underline{X}$ where Y is the number of surgeries and X is the index for the year. (e.g. $\underline{X}$ = 1 for 2001, X = 2 for 2002, etc).

If MAD is the performance measure used by the hospital, which method they should select. (6 + 6 + 4)

13. (a) An aircraft company manufactures four-seater planes. The demand for the next four quarters is as follows :

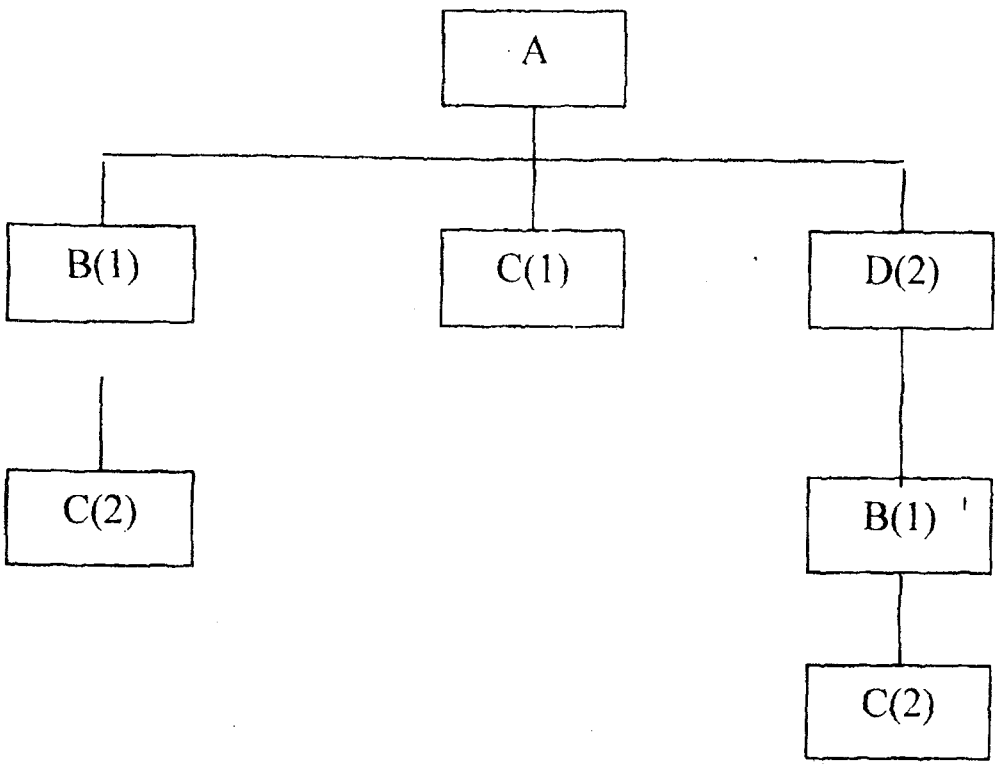
Quarter	1	2	3	4
Demand	234	208	128	162

The company proposes to use two alternative aggregate capacity plans : level capacity with backlog and matching demand. It costs Rs. 18,500 for each plane back ordered per quarter. The cost to hire an employee is Rs. 41,000 and the cost to lay-off an employee is Rs. 19,000. The labour standard is 158 hours per plane, the company produces airplanes 8 hours per day, 62 days per quarter, 59 workers were employed at the end of the 4th quarter of the previous year and the beginning backlog in the first quarter is zero. Which aggregate plan would you recommend? Compute the total cost of each plan. (8 + 8)

Or

(b) (i) Describe the process of Manufacturing Resources Planning. (6)

(ii) The BOM for Product A and the inventory status are given below



Inventory status

Item	Lead time (weeks)	Scheduled receipt	Inventory on hand
A	2	Nil	Nil
B	1	Nil	0
C	1	2000 (week 1)	200
D	3	Nil	0

The Master Production Schedule for Product 'A' is 500 units in week 6. Develop material requirements plan for items B, C and D. (10)

6)

4. (a) (i) Explain how a decision tree can be used as a capacity planning tool. (6)

(ii) A company produces kites and wind socks. Relevant data on a bottleneck operation in the shop for the upcoming fiscal year are given below :

	Kites	Windsocks
Demand forecast units/year	30,000	12,000
Lot size (units)	20	70
Standard Processing time (hours/unit)	0.30	1.0
Standard set up time (hours/lot)	3.0	4.0

The shop works two shifts per day, eight hours per shift, 200 days per year. There are currently 4 machines and a 25 per cent capacity cushion is desired. How many machines should be purchased to meet the upcoming years' demand without resorting to any short term capacity solutions? (10)

Or

(b) The drill press is a bottleneck operation in a production system. Currently, five jobs are waiting to be processed. Following are the available operations data. Assume that the current date is week 5 and that the number of remaining operations and the shop time remaining include the operation at the drill press.

Job	Processing time	Due data	Operations remaining	Shot time remaining (wk)
1	4	10	3	4
2	8	16	4	6
3	13	21	10	9
4	6	23	3	12
5	2	12	5	3

(i) Specify the priority for each job if the shop floor control system uses each of the priority rules SPT, S/RO, EDD and CR.

(ii) For each priority rule calculate the average flow time per job.

(iii) Which of these priority rules work best for priority planning with an MRP System? Why? (16)

15. (a) (i) Explain the periodic review inventory control system. (4)

(ii) A large book seller has a constant demand of 16000 books per year. The cost of placing an order is Rs. 20 and the annual cost of holding is Rs. 4 per book. Stock is received 6 working days after placing the order. No back order is allowed. Assume 300 working days per year.

(1) What is the optimal order quantity?

(2) What are the number of optimal orders placed per year?

(3) What is the optimal interval (in working days) between orders?

(4) What is the reorder point? (12)

Or

(b) (i) Explain ABC analysis and its importance. (6)

(ii) A company sells 1200 flat bed scanners per year, ordering cost Rs. 300 and annual holding cost is 16 per cent of the items price. The company offers the following price discount.

Order quantity	Price per unit (Rs.)
0 - 11	520.00
12 - 143	500.00
144 or more	400.00

What order quantity minimizes total annual costs? (10)