

GANPAT UNIVERSITY
M.TECH AMT SEM. I (MECHAICAL)
CBCS REGULAR EXAMINATION NOV/DEC - 2013
3ME102- PRODUCTION AND OPERATION MANAGEMENT

Time: 3 Hours

Total Marks: 70

Instructions:

- 1). All questions are **compulsory**.
- 2). Figures to the **right** indicate full marks.
- 3). Answers to the two sections must be written in **separate** answer books.
- 4). Assume all necessary data.

Section - I

- Q.1 (A) What is sensitivity analysis? Discuss the effect of (3)
 i) Variation of Right hand side Value b_j , ii) Variation of C_j .
- (B) A company manufactures three products A, B and C using three types of inputs X, Y and Z in different proportions. The following matrix gives requirements of various inputs (in Kg.) per unit production (one Kg.) of the three products. (8)

| Product | X | Y | Z |
|---------|---|---|---|
| A | 4 | 8 | 8 |
| B | 4 | 6 | 4 |
| C | 8 | 4 | 0 |

The per unit profits for the three products are Rs. 20, Rs.40, and Rs.10 respectively. The company has 800kg. of input X, 1800 kg. of input Y and 500 kg. of input Z. the following final simplex table gives the optimal solution.

| | | C_j | 20 | 40 | 10 | 0 | 0 | 0 |
|-------|-------|----------------|-------|-------|-------|-------|-------|-------|
| C_B | Basis | Solution Value | X_1 | X_2 | X_3 | S_1 | S_2 | S_3 |
| 10 | X_3 | 75/2 | -1/2 | 0 | 1 | 1/8 | 0 | -1/8 |
| 0 | S_2 | 900 | -2 | 0 | 0 | -1/2 | 1 | -1 |
| 40 | X_2 | 125 | 2 | 1 | 0 | 0 | 0 | 1/4 |
| | | C_j | -55 | 0 | 0 | -5/4 | 0 | -35/4 |

- a) Determine the ranges for the capacities of inputs,
- b) Determine the ranges for the contribution of A, B and C over which the present products mix remains optimal.
- c) A new product D is proposed to be added. The input requirements for it are 3 of X, 4 of Y and 6 of Z, and the unit profit is Rs.25. is it worthwhile adding this product?

OR

- Q.1 (A) What do you mean by sensitivity analysis? Discuss it with respect to (3)
 i) Change in constraint matrix ii) Addition of a new constrain.

- (B) Find the optimal solution for the problem: (8)

$$\text{Maximize } Z = 3X_1 + 4X_2 + X_3 + 7X_4$$

Subject to constrain,

$$8X_1 + 3X_2 + 4X_3 + X_4 \leq 7$$

$$2X_1 + 6X_2 + X_3 + 5X_4 \leq 3$$

$$X_1 + 4X_2 + 5X_3 + 2X_4 \leq 8$$

$$\text{And } X_1, X_2, X_3, X_4 \geq 0$$

- Find the optimal solution of given problem.
- Discuss the effect on the optimal solution of the LP problem of adding an additional constrain $2X_1 + 3X_2 + X_3 + 5X_4 \leq 4$.

- Q.2 (A) Determine the optimum number of mechanics for 100 semi-automatic machine tools. (6)
The operation the machine tools is automatic and warrants attention of the mechanics only when there is break down. The breakdowns have been seen to occur at the following times:

| | | | | | | | | | |
|-------------|---|-----|-----|-----|-----|-----|-----|-----|-----|
| Break down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Time (hour) | 0 | 1.2 | 2.1 | 2.4 | 2.6 | 3.8 | 4.3 | 5.1 | 6.0 |

The repair times for the machine tools have been observed to be according to the following distribution:

| | | | | | | | | | |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Time of repair (hour) | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
| Time (hour) | 50 | 110 | 210 | 350 | 105 | 70 | 50 | 45 | 10 |

The wage of a mechanic is Rs. 18 per hour. Down time cost of the machine is Rs. 5 per hour. Calculate whether two or three mechanics should be employed. Use random numbers: 105, 159, 885, 989, 657, 888, 729, 285 and 530.

- (B) The data on the running costs per year and resale price of equipment A whose purchase price is Rs 2,00,000 are as follows: (6)

| | | | | | | | | |
|-------------------|---|---------|--------|--------|--------|--------|--------|---------|
| Year | : | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Running cost (Rs) | : | 30,000 | 38,000 | 46,000 | 58,000 | 72,000 | 90,000 | 110,000 |
| Resale value (Rs) | : | 100,000 | 50,000 | 25,000 | 12,000 | 8,000 | 8,000 | 8,000 |

- What is optimum period of replacement?
- When equipment A is two year old, equipment B which is a new model for the same usage is available. The optimum period for replacement is 4 years with an average cost of Rs 72,000. Should equipment A changed with equipment B? If so, when?

OR

Q.2 (A) The following table gives the activities in a small project and other relevant information. (8)

| Activity | Duration (days) | Immediate Predecessor | Operators | Mechanics. |
|----------|-----------------|-----------------------|-----------|------------|
| A | 3 | - | 2 | - |
| B | 2 | A | 2 | 2 |
| C | 4 | A | 4 | 4 |
| D | 6 | A | 5 | 5 |
| E | 3 | B | 2 | 2 |
| F | 2 | E | 2 | - |
| G | 6 | C | - | 2 |
| H | 4 | D | 2 | 2 |
| I | 4 | G | 4 | 2 |
| J | 2 | D | 2 | - |
| K | 2 | J | 2 | 2 |
| L | 4 | F,H,I | 4 | 4 |

- Draw the network, compute earliest start time and latest finish time for each of the activities and find out the project completion time and identify the critical path.
- Draw the time-scaled diagram with resource accumulation table. Comment on demand for the operators and mechanics for the entire project duration and suggest the method of smoothing the resources.

- (B) Worker come to tool storage room to receive special tools (required by them) for accomplishing a particular project assigned to them. The average time between two arrivals is 60 seconds and the arrivals are assumed to be in Poisson distribution. The average service time (of the tool room attendant) is 40 seconds. Determine. (4)
- Average queue length.
 - Average length of non-empty queues.
 - Average number of workers in the system including the worker being attended.
 - Mean waiting time of an arrival.
 - Average waiting time of an arrival (worker) who waits, and
 - The type of policy to be established. In other words, determine whether to go in for an additional tool storage room attendant which will minimize the combined cost of attendant's idle time and the cost of worker's waiting time. Assume the charges of a skilled worker Rs. 4 per hour and that of tool store room attendant Rs. 0.75 per hour.

- Q.3 (A) Find the optimal sequence for the following sequencing problem of Seven jobs and four (4) machines (when passing in not allowed) of which processing time (in hrs) is as follows.

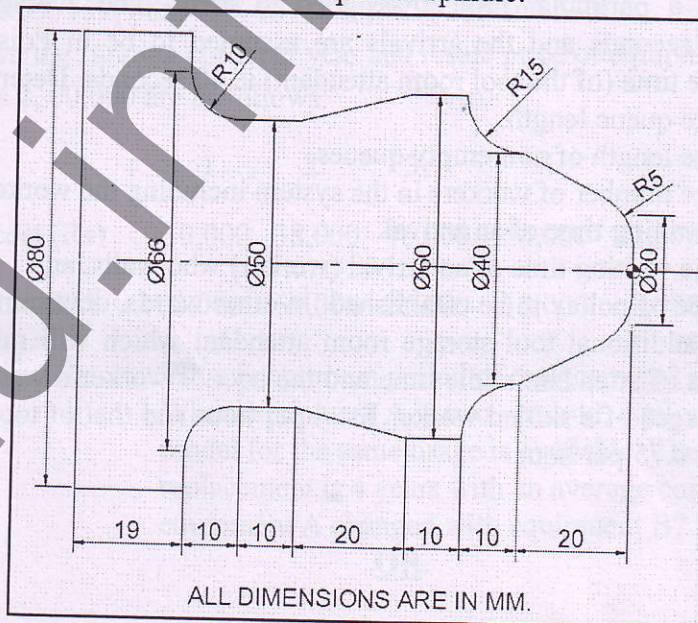
| Job | J _A | J _B | J _C | J _D | J _E | J _F | J _G |
|------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Machine M ₁ | 4 | 9 | 12 | 5 | 6 | 11 | 3 |
| Machine M ₂ | 2 | 1 | 4 | 8 | 6 | 3 | 6 |
| Machine M ₃ | 5 | 6 | 9 | 4 | 2 | 1 | 7 |
| Machine M ₄ | 13 | 16 | 11 | 9 | 11 | 14 | 10 |

Find the total elapsed time and idle time of all 4 Machines. And also draw the Gantt chart for all 4 machines.

- (B) A city corporation has decided to carry out road repairs on four main arteries of the city. (4)
The govt. has agreed to make a special grant of Rs. 50 lakh towards the cost with a conditions warrant, a supplementary token grant will also be considered favorably. The corporation has floated tenders and five contractors have spent in their bids. In order to expedite work, one road will be awarded to only one contractor.

| Contractor | Cost of repairs on road (Rs. Lakhs) | | | |
|------------|-------------------------------------|----|----|----|
| | R1 | R2 | R3 | R4 |
| C1 | 9 | 14 | 19 | 15 |
| C2 | 7 | 17 | 20 | 19 |
| C3 | 9 | 18 | 21 | 18 |
| C4 | 10 | 12 | 18 | 19 |
| C5 | 10 | 15 | 21 | 16 |

- Find the best way of assigning the repairs to the contractors and the costs.
 - If it is necessary to seek supplementary grant, what should be the amount sought?
 - Which of the five contractors will be unsuccessful in his bid?
- (C) Prepare the detail process sheet for given components. And Raw Material size: 100 mm (4)
Long. X 80Φ Assume feed rate and r.p.m of spindle.



Section - II

- Q.4 (A) What are steps in sales forecasting? Explain factors affecting sales forecasting. (6)
 (B) Forecast the demand for the following series by exponential smoothing method: (6)

| | | | | | | | | | | |
|---------------|----|----|----|----|----|----|----|----|----|----|
| Period | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Actual demand | 60 | 72 | 74 | 66 | 63 | 78 | 68 | 79 | 62 | 72 |

OR

- Q.4 (A) Explain comparison between JIT and MRP. (3)
 (B) How MRP differs from inventory control system? What are the inputs to MRP? (3)
 (C) The car sales figures of AUDI company are as follows for the year 2011: (6)

| | | | | | | | | | | | | |
|-------------|------|------|------|------|-----|------|------|------|-------|------|------|------|
| Month | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
| Sales units | 300 | 380 | 460 | 400 | 540 | 580 | 620 | 640 | 705 | 790 | 845 | 900 |

- (i) compute 3 months moving average
 (ii) forecast demand for the month of Jan. 2012
 (iii) If the actual demand for the month of Jan.2012 is 950 units, what should be the forecast for the month of Feb.2012?

- Q.5 (A) A firm that produces wood shutters and bookcases has received two orders for shutters. (6)
 One for 100 shutters and one for 150 shutters. The 100 unit order is due for delivery at the start of week 4. The 150 unit order is due for delivery at the start of week 8. Each shutter consists of 4 slatted wood sections and two frames. The wood sections are made by the firm and fabrication takes one week. The frames are ordered, and lead time is two weeks. Assembly of the shutters requires one week. There is a scheduled receipt of 70 wood sections in week 1 (at the beginning of). Determine the size and timing of planned orders (MRP) necessary to meet the delivery requirements where there is lot for lot ordering.
 (B) What are the differences between retrieval type and generative type of CAPP? Which is better? Explain generative type CAPP system. (5)

OR

- Q.5 (A) Apple inc. has developed a forecast for the group of items that has the following demand pattern: (6)

| | |
|---------|--------|
| Quarter | Demand |
| 1 | 230 |
| 2 | 240 |
| 3 | 210 |
| 4 | 340 |
| 5 | 380 |
| 6 | 200 |
| 7 | 250 |
| 8 | 360 |

- (a) The firm estimates that it costs Rs. 130 per unit to increase production rate Rs. 200 per unit to decrease the production rate, Rs. 50 per unit to carry the items in inventory and Rs. 100 per unit if subcontracted. Compare the costs of the pure strategies.
 (b) Given the cost figures in (a), evaluate the following mixed strategies company maintains a constant production rate of 250 units per quarter and permits 20% overtime

when demand exceeds the production rate. The incremental cost of overtime is Rs. 25 per hour. The company plans to meet the excess demand by hiring and firing of workers.

- (B) What is aggregate planning? Explain strategies to meet non-uniform demand. What are aggregate planning guidelines? (5)

Q.6 Attempt All. (12)

- (A) Explain functions of MIS.
(B) Classify Management Information and explain in detail.
(C) Explain MRP system with its block diagram.

END OF PAPER