

B.E DEGREE (Full time) ARREAR EXAMINATIONS, NOV/DEC2011
MECHANICAL ENGINEERING BRANCH
SEVENTH SEMESTER
REGULATION 2004
ME 512 OPERATIONS RESEARCH

TIME: 3 HRS

MAX.MARKS: 100

ANSWER ALL QUESTIONS
PART-A(10 X 2 = 20 MARKS)

1. Define "Basic feasible solution".
2. State the necessary and sufficient condition for a transportation problem to have a feasible solution.
3. Distinguish between PERT and CPM.
4. What do you understand by Activity On Node diagram?
5. Define the terms 'EOQ' and 'Safety stocks'.
6. What is reorder level? Write an expression to determine the same.
7. What is Kendall notation?
8. Mention the various types of simulation.
9. What do you understand by two person zero sum game?
10. Distinguish between individual and group replacements.

PART-B(16 x 5 = 80 MARKS)

11. Solve the following Linear programming problem using the results of its dual problem.

$$\text{Minimize } Z = 24X_1 + 30X_2$$

$$2X_1 + 9X_2 \geq 10$$

$$4X_1 + 9X_2 \geq 15$$

$$6X_1 + 6X_2 \geq 20$$

$$X_1 \text{ and } X_2 \geq 0.$$

- 12.(a) A project has the following activities with their durations

| | | | | | | | | | |
|--------------------|---|---|---|---|------|------|---|---|---------|
| Activity | : | A | B | C | D | E | F | G | H |
| Time | : | 1 | 2 | 2 | 2 | 4 | 1 | 4 | 8 |
| Preceding activity | : | - | - | - | A, B | B, C | C | D | E, F, G |

- (i) Draw the project network
- (ii) Calculate the total floats and indicate the critical path.
- (iii) What is the minimum project completion time?

(OR)

12.(b) The time estimates (in weeks) for the activities of PERT network are given below:

| Activity: | 1-2 | 2-3 | 2-4 | 3-5 | 4-5 | 5-6 |
|-----------|-----|-----|-----|-----|-----|-----|
| To : | 1 | 1 | 1 | 1 | 2 | 2 |
| Tm : | 2 | 4 | 2 | 2 | 3 | 3 |
| Tp : | 3 | 7 | 9 | 9 | 4 | 4 |

(i) Determine the project duration.

(ii) What is the probability that the project will be completed in 14 days? (10)

(iii) Five jobs must pass through a lathe and a surface grinder in that order. The processing time in hours are shown below. Determine a minimum make span sequence of job.

| | | | | | |
|------------------|---|---|---|---|----|
| Job : | 1 | 2 | 3 | 4 | 5 |
| Lathe : | 4 | 1 | 5 | 2 | 5 |
| Surface grinder: | 3 | 2 | 4 | 3 | 6. |

(6)

13. (a) The annual demand for a component is 7200 units. The carrying cost is Rs 500/unit/year, the ordering cost is Rs. 1500 per order and the shortage cost is Rs 2000/ unit/ year. Find the optimum values of economic order quantity, maximum inventory, maximum shortage quantity, cycle time, inventory period and shortage period. Compare the values of above with a situation where shortages are not allowed.

(OR)

(b) The annual demand of a product is 36000 units. The average lead time is 3 weeks. The standard deviation of the demand during the average lead time is 150 units/week. The cost of ordering is Rs 500 per order. The cost of purchase of the product per unit is Rs 15. The cost of carrying per unit per year is 20% of the purchase price. The maximum delay in lead time is 1 week and the probability of the delay is 0.3. Assume a service level of 0.95.

(i) What is re-order level if Q system is followed?

(ii) What is the maximum inventory level, if P system is followed?

14. (a) Goods trucks arrives randomly at a stock yard with a mean of 8 trucks/hour. A crew of four operators can unload a truck in 6 minutes. Trucks waiting in queue to be unloaded are paid a waiting charge at the rate of Rs 60 per hour. Operators are paid a wage rate Rs 20 per hour. It is possible to augment the crew strength to 2 or 3 (of four operators per crew) when the unloading time will be 4 minutes or 3 minutes respectively per truck. Find the optimal crew size.

(OR)

14. (b) Customer arrives at a clinic at the rate of 8/hour and the doctor can serve at the rate of 9/hour. (i) What is the probability that there is no queue? (ii) What is the probability that there are 10 customers in the system? (iii) What is the probability that a customer does not join the queue and walks into doctor's room? (iv) What is expected number in the system? (v) What is expected waiting time in the queue?

15.(a) Reduce the following game by dominance and find the game value

| | | Player B | | | |
|----------|-----|----------|----|-----|----|
| | | I | II | III | IV |
| Player A | I | 3 | 2 | 4 | 0 |
| | II | 3 | 4 | 2 | 4 |
| | III | 4 | 2 | 4 | 0 |
| | IV | 0 | 4 | 0 | 8 |

(OR)

15. (b) A group process plant in an oil refinery is fitted with valves. Over a period of time, it has been observed that the failure pattern of 400 of these valves is

| | | | | | | | | | |
|---------------------|---|---|----|----|-----|-----|----|----|----|
| Month | : | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Number of failures: | | 8 | 20 | 48 | 104 | 120 | 56 | 32 | 12 |

If there are 500 valves and they cost Rs 50 each to replace individually and Rs 25 each to replace on a planned group maintenance system, what is the least expensive programme?