B.E. Mechanical Engineering (Model Curriculum) Sem-VI

OEC3021 : Operations Research Techniques

P. Pages : 3 **GUG/W/22/14072**

Time : Three Hours * 3 3 0 1 * Max. Marks : 80

Notes : 1. All questions carry marks as indicated.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8, Q. 9 or Q. 10,
6. Use of Random number chart, normal standard distribution table is permitted.

1. a) Define O. R. what are its characteristics? Give advantages and limitation of OR. **8**

b) Explain the various phases in OR in detail. **8**

OR

2. Solve the following LP problem by simplex method. **16**

Maximize $Z = x1 + 2x2 + 3x3 - x4$

Subject to $x1 + 2x2 + 3x3 = 15$

$2x1 + x2 + 5x3 = 20,$

$x1 + 2x2 + x3 + x4 = 10,$

$x1, x2, x3, x4 \geq 0$

3. A race horse owner has 4 horses named A, B, C and D. He plans to enter them in four races. If he wishes to enter one horse in each race and cannot enter any horse in more than one race how should he enter them so as to make his expected total purse wining as great as possible and data is given in following table. **16**

Probability of win'g → Horses ↓	Race – 1	Race – 2	Race – 3	Race – 4
A	0.04	0.3	0.2	0.8
B	0.2	0.2	0.15	0.3
C	0.15	0.1	0.0	0.2
D	0.1	0.0	0.0	0.2
Purse in Rs	5000	7500	25000	40000

OR

4. A company has four manufacturing plants and five distributions. Every plant manufactures the same product, which is sold at different prices to the distributors. Cost of manufacturing and cost of raw materials are different in different plant. The capacity is also different for different plant: **16**

Item	Plants			
	1	2	3	4
Manufacturing cost per unit (Rs.)	12	10	8	8
Raw material cost per unit (Rs.)	8	7	7	5
Capacity per period (Units)	100	200	120	80

The sale prices and transportation cost per unit and requirement of the distributors is as follows:

Distributors	Transportation Cost (Rs.)				Sales Price (Rs.)	Requirement (Units)
	1	2	3	4		
A	4	7	4	3	30	80
B	8	9	7	8	32	120
C	2	7	6	10	28	150
D	10	7	5	8	34	70
E	2	5	8	9	30	80

Find initial solution by VAM and Optimum Solution by MODI method.

5. The time estimates (in weeks) for the activities of a PERT network are given below. **16**

Activity	to	tm	tp
1 - 2	1	1	7
1 - 3	1	4	7
1 - 4	2	2	8
2 - 5	1	1	1
3 - 5	2	5	14
4 - 6	2	5	8
5 - 6	3	6	15

Draw the project network and find

i) PERT critical path
ii) Expected project length
iii) Probability that project will be completed at least 4 weeks earlier than expected time.

OR

6. Indirect cost is Rs. 80 per day and activity with its dependency are given find optimum project duration. **16**

Activity	Depends on	Normal		Crash	
		Cost	Time	Cost	Time
A	---	100	8	200	6
B	---	150	4	350	2
C	B	50	2	90	1
D	A	100	10	400	5
E	A	100	5	200	1
F	E	80	3	100	1

7. a) A company purchases 10000 items per year for use in its production shop. The unit cost is Rs. 10 per year, holding cost is Rs. 0.80 per month and cost of making purchases is Rs. 200/-. Determine the following if no shortages are allowed. **8**

i) The optimum order quantity
ii) The optimum total year cost
iii) The number of orders per year
iv) The time between orders

b) Why it is necessary to maintain the inventory? **4**

c) Explain ABC analysis in detail. **4**

OR

8. a) An aircraft company uses rivets at an approximately constant rate of 5000 kg per year. The rivets costs Rs. 20 per kg and company estimates that is costs Rs. 200/- to place an order and carrying cost of inventory is 10% per year. **10**

i) What is ordering quantity? How frequently should order of rivets be placed?

ii) If actual costs are Rs. 500/- to place an order and 15% carrying cost, the optimal policy would change. How much company losing per year because of imperfect cost information.

b) Define. **6**

i) Economic ordering quantity

ii) Replenishment period

iii) Lead time

9. a) Explain the following terms in the context of sequencing problems: **6**

i) Total elapsed time

ii) Idle time

iii) Processing order

b) There are seven jobs, each of which has to go through the machines A and B in the order AB. Processing times in hours are given as **10**

Job	:	1	2	3	4	5	6	7
Machine A	:	3	12	15	6	10	11	9
Machine B	:	8	10	10	6	12	1	3

Determine a sequence of these jobs that will minimize the total elapsed time T. Also find idle time for machines A and B.

OR

10. a) Explain the importance of sequencing problem. What are the various methods of solving sequencing problems? Briefly explain them. **6**

b) Explain the steps in decision theory approach in detail. **5**

c) Under which types of environments the decisions are made? Explain each in brief. **5**

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