

B.E. Mechanical Engineering (Model Curriculum) Semester - VI  
**OEC3021 - Operations Research Techniques**

P. Pages : 3

Time : Three Hours



**GUG/S/23/14072**

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
  2. Assume suitable data wherever necessary.
  3. Answer 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.
  4. Use of non programmable calculator is permitted.
  5. Use of normal std. distribution table is permitted.

1. a) Define OR. What are its characteristics? What are the advantages. 8
- b) Explain various phases of OR in detail. 8

**OR**

2. Solve the L.P. problem by simplex method. 16  
Max  $Z = 120x + 100y$   
Sub to  $2x + 2.5y \leq 1000$   
 $3x + 1.5y \leq 1200$   
 $1.5x + 4y \leq 1200$   
 $x, y \geq 0$

3. A product is produced by four factories A, B, C and D. The unit production costs in them are Rs. 2, Rs. 3, Rs. 1 and Rs. 5 respectively. Their production capacities are, factory A – 50 units, B – 70 units, C – 30 units and D – 50 units. These factories supply the product to four stores, demand of which are 25, 35, 105 and 20 units respectively. Unit transport cost in rupees from each factory to each store is given in the table below. Determine the extent of deliveries from each of the factories to each of the stores so that the total production and transportation cost is minimum. 16

	1	2	3	4
A	2	4	6	11
B	10	8	7	5
C	13	3	9	12
D	4	6	8	3

**OR**

4. Production cost of product P1, P2 & P3 per unit manufactured on machined M1, M2, M3 & M4 are tabulated in the table. Sales price per unit P1 = 70Rs / Unit, P2 = 85Rs / Unit & P3 = 60Rs / Unit. 16

Machine Product	M1	M2	M3	M4
P1	40	50	30	25
P2	30	20	30	30
P3	30	35	25	35

Decide product machine combination for maximization of total profit.

5. A project consists of six activities as shown below.

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Activity	Predecessor Activity	Normal		Crash	
		Time (Days)	Cost (Rs)	Time (Days)	Cost (Rs)
A	--	8	100	6	200
B	--	4	150	2	350
C	B	2	50	2	50
D	A	10	100	5	400
E	A	5	100	1	200
F	E	3	80	1	100

If the indirect cost is 75Rs / Day

- 1) Find the optimum project duration,
- 2) Draw the activity network of the project
- 3) Find the critical path and duration
- 4) Determine the minimum cost schedule. Also calculate the optimum cost for project duration.

**OR**

6. A project has following characteristics.

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Activity	Depends on	to	tm	tp
A	--	1	2	3
B	A	1	2	3
C	A	1	3	5
D	B	3	4	5
E	C	2	3	4
F	C	3	5	7
G	D, E	4	5	6
H	F	6	7	8
I	G, H	2	4	6
J	G, H	4	6	8
K	I	1	2	3
L	J	3	5	7

Construct the network and find.

- a) Critical path
- b) The probability to complete the project within 32 weeks
- c) Time in which the project can be completed with a probability of 90%.

7. a) What is the necessity of maintaining inventory? What are the causes of poor inventory control? 8

b) A stockiest has to supply 400 units of a product every Monday to his customers. He gets the product at Rs. 50 per unit from the manufacture. The cost of ordering and transportation from the manufacture is Rs. 75 per order. The cost of carrying inventory is 7.5% per year of the cost of product. 8

Find:

- i) The economic lot size,
- ii) The total optimal cost (including the capital cost)

**OR**

8. a) What is Inventory? Explain various inventory carrying cost. **8**
- b) A particular item has a demand of 9,000 units/year. The cost of one procurement is Rs. 100 and the holding cost per unit is Rs. 2.40 per year. The replacement is instantaneous and no shortages are allowed. Determine: **8**
- The economic lot size,
  - The number of orders per year,
  - The time between orders,
  - The total cost per year if the cost of one unit is Rs. 1.

9. a) Explain in detail various steps involved in Decision Theory. **6**
- b) A manufacturing company processes 6 different jobs on two machines A and B. Numbers of units of each job and its processing times on A and B are given in given table. Find the optimal sequence, the total minimum elapsed time and idle time for each machine. **10**

Job no.	No. of units of each job	Processing time	
		Machine A (minutes)	Machine B (minutes)
1	3	5	8
2	4	16	7
3	2	6	11
4	5	3	5
5	2	9	7.5
6	3	6	14

**OR**

10. a) Explain in detail situation under which sequencing problems are classified. **6**
- 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.

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