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P.E.S. College of Engineering, Mandya - 571 401
 (An Autonomous Institution affiliated to VTU, Belagavi)
Seventh Semester, B.E. -Industrial and Production Engineering
Semester End Examination; Dec. - 2019
Operations Research

Time: 3 hrs

Max. Marks: 100

Note: Answer **FIVE** full questions, selecting **ONE** full question from each unit.

UNIT - I

- 1a. Discuss the phases of Operation Research in detail. 5
- b. A person requires atleast 10, 12 and 12 units of chemical A, B and C respectively for his garden. The liquid product contains 5, 2 and 1 units of A, B and C respectively /jar. Dry product contains 1, 2 and 4 units of A, B and C per carton. If the liquid product is purchased at Rs.30/jar and dry product at Rs.20/carton how many of each should be purchased to minimize the cost and meet the requirement identify the total expenditure. 15
- 2a. Explain the basic requirements of linear programming problem. 5
- b. A manufacturing company makes the products X and Y and has a maximum production capacity of 9 tons/day. The firm has the permanent contract to supply at least 2 tons of X and atleast 3 ton of y per day to another company. Each tons of X requires 20 machine hrs production times while Y requires 50 machine hrs. Maximum available machine hrs is 360. The profit made is Rs.160 per ton of X and Rs.240 per ton of Y. It is required to evaluate the production schedule for maximum profit. 15

UNIT - II

- 3 a. What do you mean by degeneracy in simplex problem? How do you break it? 4
- b. Solve by simplex method.
- Min $Z = x_1 - 3x_2 + 2x_3$
- Sub to: $3x_1 - x_2 + 3x_3 \leq 7$
- $-2x_1 + 4x_2 \leq 12$ 16
- $-4x_1 + 3x_2 + 8x_3 \leq 18$
- Where $x_1, x_2, x_3 \geq 0$
- 4 a. Write the dual form of the following primal problem: 4
- Max $Z = 8x_1 + 16x_2$
- Sub to: $12x_1 + 9x_2 \leq 24$
- $6x_1 + 10x_2 \leq 18$ Where $x_1, x_2 \geq 0$

b. $\text{Max } Z = x_1 + 2x_2 + 3x_3 - x_4$

Sub to: $x_1 + 2x_2 + 3x_3 = 15$

$2x_1 + x_2 + 5x_3 = 20$

$x_1 + 2x_2 + x_3 + x_4 = 10$

Where $x_1, x_2, x_3, x_4 \geq 0$. Solve the above problem.

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UNIT - III

5 a. List the similarities between assignment problem and transportation problem.

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b. A company has five territories and five salesmen available for assignment. The territories are not equal rich in their sales potential. It is estimated that a typical salesmen operating in the each territory bring the following sales:

Territory	1:70000	Salesman	A:6
	2:60000		B:5
	3:50000		C:5
	4:40000		D:4
	5:30000		E:3

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The five salesmen are considered to differ in ability. It is estimated that their yearly sales the criterion is the maximum total sales. Formulate the matrix and find the optimal assignment.

6 a. Explain degeneracy in transportation problem. How do you break it?

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b. Paper manufacturing company has several plants, three of which manufactures two products a standard card and a deluxe card. A new deluxe card will be introduced which must be considered in terms of selling and cost. The selling prices are standard card Rs.14.95, deluxe card Rs.18.95 and a new deluxe card is Rs.21.95

Standard card	8.00	7.95	8.10	450
Deluxe card	8.50	8.60	8.45	1050
New deluxe card	9.25	9.20	9.30	600
Demand b_j	800	600	700	

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Solve the problem by transportation model. Initial solution by VAM and optional by MOD1 method.

UNIT-IV

7 a. Discuss the need for replacement with examples.

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b. A manufacturer offered two machines 'A' and 'B' 'A' is priced at Rs.5000 and running costs are estimated at Rs.800 for each of first five years, increasing by Rs. 200 in the 6th and subsequent years. Machine B which has the same capacity and has a cost of Rs. 2500, but it has the running cost of Rs.1200 per year for six years, increasing by 200 per year thereafter. The money is worth 10% per year. No salvage value. Recommend which machine should be purchased.

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- 8 a. Illustrate the uses of dummy activity in a network. 5
- b. Project predecessor and duration is given.

Job	A	B	C	D	E	F	G	H	I	J	K
Predecessor	-	A	B	C	B	E	D,F	E	H	G,I	J
Day	13	8	10	9	11	10	8	6	7	14	18

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- i) Draw the network
- ii) Find critical path
- iii) Compute ES, EF, LS, LF, TF, FF

UNIT-V

- 9 a. Discuss the customer behavior and server behavior in a Queuing system. 8
- b. Explain Kendall's notation. 4
- c. In a super market, the average arrival rate of customer is 10 every 30 minutes following Poisson process. The average time taken by a cashier to list and calculate the customer's purchase is 2.5 minutes following exponential distribution. Find the probability that the queue length exceeds 6? 8
- 10a. Two players, A and B match coins. If the coins match, then A wins two units of value if do not match them B wins two units of value. Formulate the matrix and find the value of game and strategies. 5
- b. Explain dominance rule. 5
- c. Solve the game using dominance rule;

		Player B		
		B1	B2	B3
Player A	A1	3	-2	4
	A2	-1	4	2
	A3	2	2	6

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