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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 - 2017/Jan - 2018

Operations Research

Time: 3 hrs *Max. Marks: 100*

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

UNIT - I

1 a. Discuss the features of Operations Research. 6

b. A Canning company is constructed to receive 60,000 kg of ripe tomatoes at Rs. 7/kg, from which it produces canned tomato juice and tomato paste. The canned products are packed in cases of 24 each. A single can of juice requires 1 kg of fresh tomatoes where as a can of paste requires 1/3 kg only. Company's share of market is limited to 2000 cases of juice and 6000 cases of paste. The whole sale price per case of paste and juice stands at Rs. 90 and Rs. 180 respectively. Device a production schedule for the company. Use graphical method. 14

2 a. Illustrate multiple solution and redundancy with suitable example with reference to LPP. 8

b. A firm makes products *X* and *Y* and has a maximum production capacity of 9 tons/day. A firm has a permanent contract to supply at least 2 tons of *X* and at least 3 tons of *Y* to another company. Each tons of *X* requires 20 machine hrs production times and each ton of *Y* requires 50 machine hrs. The daily maximum available machine hr. is 360. The profit made is Rs. 80/ton of *X* and Rs. 120/ton of *Y*. It is required to determine the production schedule for maximum profit. 12

UNIT - II

3 a. Discuss degeneracy while solving simpler problem. How do you break it? 5

b. Solve by simple method:

$\text{Max } Z = 2x_1 + x_2$

Sub to $4x_1 + 3x_2 \le 12$

$4x_1 + x_2 \le 8$

$4x_1 - x_2 \le 8 \qquad x_1, x_2 \ge 0$ 15

4 a. Write the dual form of primal problem.

$\text{Min } Z = x_1 + x_2 + x_3$

$x_1 - 3x_2 + 4x_3 = 5$

$x_1 - 2x_2 \le 3$

$2x_2 - x_3 \ge 4 \qquad x_1, x_2, x_3 \ge 0$ 5

Contd…2

b. Solve by "Big M" method. 15

Max $Z = x_1 + 2x_2 + 3x_3 - x_4$

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

$2x_1 + x_2 + 5x_3 = 20$

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

$x_1, x_2, x_3, x_4 \geq 0$

UNIT - III

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

b. A company has three plants supplying same product to five depots. The cost of manufacture and transportation cost various from plant to plant. The data on capacity requirement and unit cost of transportation are given: 15

		Depots					
		1	2	3	4	5	Supply
Plant	A	5	3	3	6	4	100
	B	4	5	6	3	7	125
	C	2	3	5	2	3	175
Demand		60	80	85	105	70	

Cost of manufacture are:

Plant	Variable cost/unit (Rs)	Fixed cost (Rs)
A	13	70
B	15	40
C	14	50

Determine the quantity of dispatch from each plant to different depots satisfying the requirement at optimal total cost.

6 a. Illustrate the situations where travelling salesmen type of model can be used. 5

b. A company has one surplus truck in each of cities A, B, C, D and E and one deficit truck in each of cities 1, 2, 3, 4, 5 and 6. The distance between the cities in kilometers is given below. Choose the assignment of truck from cities in surplus to cities in deficit, so that the total distance covered by the vehicle is minimum. 15

	1	2	3	4	5	6
A	11	17	8	16	20	15
B	9	7	12	6	15	13
C	13	16	15	12	16	8
D	21	24	17	28	24	15
E	14	10	12	11	15	6

Contd…3

UNIT - IV

7 a. List and explain with example, the reasons for replacement. 5

b. Following failure rates have been observed for certain type of light bulbs:

Month	1	2	3	4	5
% Failure	10	25	50	80	100

There are 1000 bulbs in use. It cost Rs. 2 to replace an individual bulb, which was burnt out. If all the bulbs were replaced simultaneously it would cost 50 paise per bulb. It is proposed to replace all the bulbs at fixed interval whether they have burnt out or not and continue replacing burnt out bulb as and when they fail. Predict the interval at which all the bulbs should be replaced. 15

8 a. List the PERT assumptions. 4

b. Identify the critical path for the following project. Compute ES, EF, LS, LF, TF and FF.

Job	A	B	C	D	E	F	G	H	I	J	K
Predecessor	-	-	A	A	I, J, K	B, D	B, D	F	A	G, H	F
Days	2	2	3	4	6	3	8	1	2	6	2

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UNIT - V

9 a. Discuss the basic components of the Queuing system. 10

b. The belt snapping for conveyors in an open cast mine occur at the rate of 2 per shift. There is only one hot plate available for vulcanising and can vulcanise on an average 5 belts snap per shift.

i) Identify the probability that when a belt snaps, the hot plate is readily available 10

ii) Determine the average number of belts in the system

iii) Predict the waiting time of an arrival

iv) Recommend the average waiting time plus vulcanising time.

10 a. Discuss two-person zero sum game. List the assumptions. 8

b. Payoff matrix for the player A is given. Solve graphically. Determine the strategies and find the value of game.

		Player A			
		A1	A2	A3	A4
Player B	B1	2	2	3	-2
	B2	4	3	2	6

12

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