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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Sixth Semester, B.E. - Automobile Engineering

Semester End Examination; May / June - 2019

Operation Research

Time: 3 hrs

Max. Marks: 100

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

ii) Assume suitably missing data, if any. iii) Use of Thermodynamic data and book is permitted.

UNIT - I

- 1 a. What is OR? What are its objectives? 6
- b. Solve the following LPP by graphical method, 14
- Maximize* $Z = 3x_1 + 4x_2$
- Subject to* $5x_1 + 4x_2 \leq 200$; $3x_1 + 5x_2 \leq 150$; $5x_1 + 4x_2 \geq 100$; $8x_1 + 4x_2 \geq 80$; Where $x_1, x_2 \geq 0$.
- 2 a. Define surplus variable, feasible solution, unbounded solution. 6
- b. Solve the following LPP by simplex method, 14
- Maximize* $Z = 3x_1 + 5x_2 + 4x_3$
- Subject to* $2x_1 + 3x_2 \leq 8$; $3x_1 + 2x_2 + 4x_3 \leq 15$; Where $x_1, x_2, x_3 \geq 0$.

UNIT - II

- 3 a. What is an unbalanced transportation problem? How do you solve such problems? 4
- b. A company has three plants at locations A, B and C which supply to warehouses located at D, E, F, G and H. Monthly plant capacities are 800, 500 and 900 units respectively. Monthly warehouse requirements are 400, 400, 500, 400 and 800 units respectively. Unit transportation costs are given below. Determine an optimum distribution for the company in order to minimize the total transportation cost. 16

		To				
		D	E	F	G	H
From	A	5	8	6	6	3
	B	4	7	7	6	6
	C	8	4	6	6	3

- 4 a. A company is faced with the problem of assigning six different machines to five different jobs. The costs estimated in hundreds of rupees are given in table. Solve the problem when the objective is to minimize the cost. 14

		Jobs				
		1	2	3	4	5
Machines	1	2.5	5	1	6	2
	2	2	5	1.5	7	3
	3	3	6.5	2	8	3
	4	3.5	7	2	9	4.5
	5	4	7	3	9	6
	6	6	9	5	10	6

b. Solve the following salesman problem:

		To			
		A	B	C	D
From	A	∞	8	14	6
	B	8	∞	12	6
	C	14	12	∞	14
	D	6	6	7	∞

6

UNIT - III

5 a. Determine the optimal sequence of jobs which minimizes the total elapsed time based on the following information,

Jobs	1	2	3	4	5
Machine A	3	8	7	5	2
Machine B	3	4	2	1	5
Machine C	5	8	10	7	6

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Also calculate the total elapsed time and idle time for each machine.

b. Use graphical method to minimize the time needed to process the following jobs on machines shown below. Calculate the total time needed to complete both the jobs.

Job 1	Sequence	A	B	C	D	E
	Time (in hours)	2	3	4	6	2
Job 2	Sequence	C	A	D	E	B
	Time (in hours)	4	5	3	2	6

10

6 a. Explain briefly the terms: Balking, Jockeying, Steady state, Traffic intensity.

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b. Customers arrive at the first class ticket counter of a theatre at the rate of 12 per hour. There is one clerk serving the customers at the rate of 30 per hour.

- i) What is the probability that there is no customer in the counter?
- ii) What is the probability that there are more than 2 customers in the counter?
- iii) What is the probability that there is no customer waiting to be served?
- iv) What is the probability that the customer is being served and nobody is waiting?

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7 a. Write the rules that there are to be followed while constructing a net work.

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b. The table below gives the list of jobs and their duration in days:

Jobs	Duration
1 - 2	5
1 - 3	4
1 - 4	2
2 - 4	1
4 - 5	4
3 - 5	6
4 - 6	2
6 - 7	5
2 - 7	2
5 - 7	2
3 - 4	0
2 - 6	2

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- i) Draw the project network
- ii) Find the critical path
- iii) Determine early start, early finish, late start, late finish time and total float for each activity.

8 a. Differentiate between PERT and CPM.

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b. The following table lists the jobs of a network with their time estimates,

Job	Duration in days		
	Optimistic	Most likely	Pessimistic
1 - 2	3	6	15
1 - 6	2	5	14
2 - 3	6	12	30
2 - 4	2	5	8
3 - 5	5	11	17
4 - 5	3	6	15
6 - 7	3	9	27
5 - 8	1	4	7
7 - 8	4	19	28

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- i) Draw the project network
- ii) Calculate the length and variance of the critical path
- iii) What is the probability that the jobs on critical path will be completed by 42 days?

UNIT - V

9 a. Solve the following game:

		Player B			
		1	2	3	4
Player A	1	1	7	3	4
	2	5	6	4	5
	3	7	2	0	3

6

b. Use the concept of Dominance to solve the following game :

		Player B			
		I	II	III	IV
Player A	1	3	2	4	0
	2	3	4	2	0
	3	4	2	4	0
	4	0	4	0	8

14

10 a. What is inventory? Explain the various costs involved in inventory.

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b. A company uses annually 48000 units of raw material costing Rs. 1.20 per unit. Placing each order costs Rs. 45 and carrying cost is 15% per year of the average inventory. Find;

- i) The economic ordering quality
- ii) The optimal cost

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iii) Suppose that the company follows EOQ purchasing policy that it operates for 300 days a year, that the procurement time is 12 days and the safety stock is 500 units, find the re-order point, maximum, minimum and average inventories.