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

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B.E. - Mechanical Engineering

Semester End Examination; May / June - 2019

Operations Research

Time: 3 hrs

Max. Marks: 100

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

UNIT - I

- 1 a. Describe the various phases of OR. 10
- b. A city hospital has the following minimal daily requirement of nurses :

Period	Clock time (24 hours day)	Minimal No. of nurses required
1	6 AM to 10 AM	2
2	10 AM to 2 PM	7
3	2 PM to 6 PM	15
4	6 PM to 10 PM	8
5	10 PM to 2 AM	20
6	2 AM to 6 AM	6

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Nurses report to the hospital at the beginning of each period and work for 8 consecutive hours. The hospital wants to determine the minimal number of nurses to be employed so that there is sufficient number of nurses available for each period. Formulate this as a linear programming problem.

- 2 a. What are the characteristics of OR? 8
- b. Apply the graphical method to solve the following LPP :

Max $Z = 2x_1 + x_2$

Show that $x_1 + 2x_2 \leq 10$

$x_1 + x_2 \leq 6$

$x_1 - x_2 \leq 2$

$x_1 - 2x_2 \leq 1$ and $x_1, x_2 \geq 0$

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UNIT - II

- 3. Use the two-phase simplex method to,

Maximize $Z = 5x_1 - 4x_2 + 3x_3$

Subject to $2x_1 + x_2 - 6x_3 = 20$

$6x_1 + 5x_2 + 10x_3 \leq 76$

$8x_1 - 3x_2 + 6x_3 \leq 50$

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

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4. Maximize $Z = x_1 + 2x_2 + 3x_3 - x_4$

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

$2x_1 + x_2 + 5x_3 = 20$

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

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

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UNIT - III

5. Find the optimum solution to the following transportation problem in which the cells contains the transportation cost in rupees :

	W ₁	W ₂	W ₃	W ₄	W ₅	Available
F ₁	7	6	4	5	9	40
F ₂	8	5	6	7	8	30
F ₃	6	8	9	6	5	20
F ₄	5	7	7	8	6	10
Required	30	30	15	20	5	

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6. Solve the following transportation problem to get optimal solution :

		Destinations						Supply
		1	2	3	4	5	6	
Origins	1	9	12	9	6	9	10	5
	2	7	3	7	7	5	5	6
	3	6	5	9	11	3	11	2
	4	6	8	11	2	2	10	9
Demand		4	4	6	2	4	2	

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UNIT - IV

7 a. Substantiate the statement “Assignment Problems are inherently degenerates”.

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b. Solve the following assignment problem :

	A	B	C	D	E
M ₁	4	6	10	5	6
M ₂	7	4	--	5	4
M ₃	--	6	9	6	2
M ₄	9	3	7	2	3

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8. Time table of an airline that operates 7 days a week given below. Minimum layover time for crew members is 5 hours. Obtain the pairing of flights that result in minimum layover. Crew can based at any one of the cities that results smaller layover.

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Delhi	--	Jaipur	Jaipur	--	Delhi
Flight No.	Depart	Arrive	Flight No.	Depart	Arrive
1	7 AM	8 AM	101	8 AM	9.15 AM
2	8 AM	9 AM	102	8.30 AM	9.45 AM
3	1.30 PM	2.30 PM	103	12 Noon	1.15 PM
4	6.30 PM	7.30 PM	104	5.30 PM	6.45 PM

UNIT - V

- 9 a. Explain the elements of a queueing system. 10
- b. A self service store employs one cashier at its counter. Nine customers arrive on an average every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming poisson distribution for arrival rate and exponential distribution for service time, find;
- i) Average number of customers in the system 10
 - ii) Average number of customers in the queue or average queue length
 - iii) Average time a customer spends in the system
 - iv) Average time a customer waits before being served
- 10 a. What are the characteristics of games? 8
- b. Solve the following 2 x 4 game by graphical method,

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

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