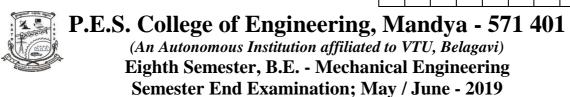
U.S.N



**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.
- 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?
- b. Apply the graphical method to solve the following LPP :

 $Max \ Z = 2x_1 + x_2$ 

Show that  $x_1 + 2x_2 \le 10$ 

$$x_1 + x_2 \le 6$$
  
 $x_1 - x_2 \le 2$   
 $x_1 - 2x_2 \le 1$  and  $x_1, x_2 \ge 0$ 

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

Maximize  $Z = 5x_1 - 4x_2 + 3 x_3$ Subject to  $2x_1 + x_2 - 6 x_3 = 20$  $6x_1 + 5x_2 + 10 x_3 \le 76$  $8x_1 - 3x_2 + 6 x_3 \le 50$  $x_1, x_2, x_3, x_4 \ge 0$ 

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4. Maximize  $Z = x_1 + 2x_2 + 3x_3 - x_4$ Subject to  $x_1 + 2x_2 + 3x_3 = 15$  $2x_1 + x_2 + 5x_3 = 20$  $x_1 + 2x_2 + x_3 + x_4 = 10$  $x_1, x_2, x_3, x_4 \ge 0$ 

## UNIT - III

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

	$\mathbf{W}_1$	$W_2$	<b>W</b> <sub>3</sub>	$W_4$	<b>W</b> <sub>5</sub>	Available
$F_1$	7	6	4	5	9	40
F <sub>2</sub>	8	5	6	7	8	30
F <sub>3</sub>	6	8	9	6	5	20
$F_4$	5	7	7	8	6	10
Required	30	30	15	20	5	

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

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

## UNIT - IV

- 7 a. Substantiate the statement "Assignment Problems are inherently degenerates".
  - b. Solve the following assignment problem :

	А	В	С	D	Е
$M_1$	4	6	10	5	6
M <sub>2</sub>	7	4		5	4
M <sub>3</sub>		6	9	6	2
$M_4$	9	3	7	2	3

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



9 a. Explain the elements of a queueing system.

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 poission distibution
for arrival rate and exponential distribution for service time, find;

i) Average number of customers in the system

ii) Average number of customers in the queue or average queue length

iii) Average time a customers spends in the system

iv) Average time a customers waits before being served

10 a. What are the characteristics of games?

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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