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

(An Autonomous Institution affiliated to VTU, Belgaum)

**Eighth Semester, B.E. - Mechanical Engineering**

**Semester End Examination; June/July - 2015**

**Operations Research**

Time: 3 hrs

Max. Marks: 100

Note: Answer any FIVE full questions, selecting at least TWO full questions from each part.

### PART - A

- 1 a. Explain the various phases of OR. 6
- b. Using graphical method compute maximum and minimum value of the following objective function.
- $$Z = 200x_1 + 400x_2$$
- Subject to  $x_1 + x_2 - 200 \geq 0$  14
- $$x_1 + 3x_2 - 400 \geq 0$$
- $$x_1 + 2x_2 - 350 \leq 0$$
- $$x_1 \geq 0, \quad x_2 \geq 0$$
2. Use the two – phase simplex method to
- Maximize  $Z = 5x_1 - 4x_2 + 3x_3$
- Subject to  $2x_1 + x_2 - 6x_3 = 20$  20
- $$6x_1 + 5x_2 + 10x_3 \leq 76$$
- $$8x_1 - 3x_2 + 6x_3 \leq 50$$
- $$x_1, x_2, x_3 \geq 0$$
3. Solve the following transportation problem where cell entries are unit costs and optimize it.
- |                | D <sub>1</sub> | D <sub>2</sub> | D <sub>3</sub> | D <sub>4</sub> | D <sub>5</sub> | Available |
|----------------|----------------|----------------|----------------|----------------|----------------|-----------|
| O <sub>1</sub> | 68             | 35             | 4              | 74             | 15             | 18        |
| O <sub>2</sub> | 57             | 88             | 91             | 3              | 8              | 17        |
| O <sub>3</sub> | 91             | 60             | 75             | 45             | 60             | 19        |
| O <sub>4</sub> | 52             | 53             | 24             | 7              | 82             | 13        |
| O <sub>5</sub> | 51             | 18             | 82             | 13             | 7              | 15        |
| Required       | 16             | 18             | 20             | 14             | 14             |           |
4. XYZ airline operating 7 days a week has given the following time table. Crew must have a minimum layover of 5 hours between flights. Obtain the pairing of flights that minimizes layover time away from home. For any given pairing the crew will be based at the city that results in smaller layover. 20

Contd...2

	Chennai – Mumbai		Mumbai – Chennai
Flight No.	Departure – Arrival	Flight No	Departure – Arrival
A <sub>1</sub>	6 AM – 8 AM	B <sub>1</sub>	8 AM – 10 AM
A <sub>2</sub>	8 AM – 10 AM	B <sub>2</sub>	9 AM – 11 AM
A <sub>3</sub>	2 PM – 4 PM	B <sub>3</sub>	2 PM – 4 PM
A <sub>4</sub>	8 PM – 10 PM	B <sub>4</sub>	7 PM – 9 PM

**PART - B**

- 5 a. State the Johnson’s rule for sequencing of n jobs through 3 machines. 4
- b. Two major parts P<sub>1</sub> and P<sub>2</sub> for a product require processing through six machine centres. The technological sequence of the parts on six machines and manufacturing times on each machine are,

	Machine Sequence	:	C	A	E	F	D	B	
Part P <sub>1</sub>	Time (hrs)	:	2	3	4	5	6	1	16
	Machine Sequence	:	B	A	E	F	C	D	
Part P <sub>2</sub>	Time (hrs)	:	3	2	5	3	2	3	

- 6 a. Find the total elapsed time and the job that should be done first. Explain the terms: 8
- i) Queue length    ii) Balking    iii) Reneged    iv) Jockeying.
- b. Workers come to tool room to receive special tools for accomplishing a particular project assigned to them. The average time between two arrivals is 60 seconds and the arrivals are assumed to be in Poisson distribution. The average service time is 40 seconds determine, 12
- i) Average queue length.                      ii) Average length of non empty queues.
- iii) Average number of workers in system including the workers being attended.
- iv) Mean waiting time of an arrival.

- 7 a. Explain the terms : PERT, CPM. 4
- b. A project with the following activities and their duration is given:

Activity :	1 - 2	1 - 3	1 - 4	2 - 5	2 - 6	3 - 7	4 - 8	5 - 9	
Duration :	2	2	0	2	5	4	5	6	
Activity :	6 - 9	7 - 8	8 - 9						16
Duration :	3	4	6						

Draw the network diagram of the project indicating earliest start, earliest finish, latest finish and total float of each activity. Also identify critical path.

- 8 a. Explain the following terms : 8
- Game, strategy, saddle point and dominance.
- b. Solve the following 2 x 3 game by graphical method

		Player B			
		1	2	3	
Player A	1	6	4	3	12
	2	2	4	8	