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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 - 2016
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. Define OR. Explain the characteristics of OR Models.   7

 b. With an example explain what is redundant constraint?   3

 c. A minimum nurses required at a 24 hour medical centre is as shown the following table.

Scheduled Hrs	No. of Nurses required
00 - 04 hr	2
04 - 08 hr	7
08 - 12 hr	15
12 - 16 hr	8
16 - 20 hr	20
20 - 24 hr	6

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According to schedule nurses can report at the beginning of any slot and work for 8 consecutive hours. Formulate the problem as an LPP.

2 a. What is degeneracy in LPP? How is it resolved?   6

 b. Solve the following LPP by dual simplex method,

Minimize $Z = 10x_1 + 6x_2 + 2x_3$

St. $-x_1 + x_2 + x_3 \geq 1$ 14

$3x_1 + x_2 - x_3 \geq 2$

$x_1, x_2, x_3 \geq 0$

3 a. Differentiate between transportation problem and assignment problem.   5

 b. The following information is available concerning the operation of manufacturing company.

Period	Units in order	Production capacity		Excess over cost/ unit OT	Storage cost/unit
		Regular time	Over Time		
Month 1	800	920	920	1.25	0.5
Month 2	1400	250	250	1.25	0.5

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Formulate the problem as a transportation problem and determine optimal solution.

4. An Airline operating seven days a week has the time table shown below. The crew must have a minimum lay over time of 3 hours between flights, obtain the pairing of flights. Also mention where the crew is based at

Flight No.	Delhi Departure	Calcutta Arrival
101	7.00 am	9.00 am
102	9.00 am	11.00 am
103	1.30 pm	3.30 pm
104	7.30 pm	9.30 pm
Flight No.	**Calcutta Departure**	**Delhi Arrival**
201	9.00 am	11.30 am
202	10.00 am	12.30 pm
203	3.30 pm	6.00 pm
204	8.00 pm	10.30 pm

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PART - B

5 a. State the principle assumptions of sequencing.   8

b. The time spent in processing two jobs on five machines A, B, C, D and E and the necessary technological ordering of the machines are as following :

Job I	A - 20	C - 10	D - 10	B - 30	E - 25
Job II	A - 10	C - 30	B - 15	E - 10	D - 15

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Determine the optimal sequence and elapsed time.

6. a. Explain the characteristics of a queue system.   6

b. A self service a store employs is cashier at its counter. 9 customers arrive on an average of 5 minutes while 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

   ii) Average queue length

   iii) Average time a customers spends in the system.

   iv) Average waiting time

   v)   Traffic intensity

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7 a. Define :

   i) Total slack

   ii) Free slack

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b. The following table gives list of jobs along with their time duration.

Duration (Days)

Job	t_0	t_m	t_p
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 network and identify the critical path.

ii) What is the probability that the jobs on critical path will be completed within due date of 41 days?

iii) What is the probability of completing the job on the next most critical path within due date of 41 days?

iv) What is your estimate of the probability that the entire project will be completed within due date? Explain why?

8 a. Explain the terms :

i) Two person zero sum game   ii) Payoff matrix

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b. If the following matrix has a saddle point, determine the value of game and ranges of P and Q.

$$
A\begin{array}{c} \\ \\ \\ \end{array}\begin{array}{|ccc|} \multicolumn{3}{c}{B} \\ \hline 1 & Q & 6 \\ P & 5 & 10 \\ 6 & 2 & 3 \\ \hline \end{array}
$$

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c. Solve the following game graphically,

			B	
		I	II	III
A	I	1	3	11
	II	8	5	2

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