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

(An Autonomous Institution affiliated to VTU, Belgaum)

Seventh Semester, B.E. - Automobile Engineering

Semester End Examination; Dec. - 2015

Operations Research

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer any **FIVE** full questions, selecting at least **TWO** full questions from each part.*
ii) Assume suitable missing data.
iii) Use of normal distribution table is permitted.

PART - A

1 a. What is OR? What are the characteristics of OR? 6

b. Solve the following LPP by graphical method: 14

Minimize $Z = 600x_1 + 400x_2$

Subject to : $3000x_1 + 1000x_2 \geq 24000$

$1000x_1 + 1000x_2 \geq 16000$

$2000x_1 + 6000x_2 \geq 48000$

Where $x_1, x_2 \geq 0$

2 a. Define slack variable, feasible solution, optimum solution. 6

b. Solve the following LPP by Simplex method: 14

Maximize $Z = 2x_1 + 5x_2 + 7x_3$

Subject to : $3x_1 + 2x_2 + 4x_3 \leq 100$

$x_1 + 4x_2 + 2x_3 \leq 100$

$x_1 + x_2 + 3x_3 \leq 100$

Where $x_1, x_2, x_3 \geq 0$

3 a. What is degeneracy in transportation problem? How is it resolved? 4

b. A company has four factories from which is ships its products to four warehouses which are the distribution centres. Transportation cost/unit between various factories and warehouses are as follows: 16

		Warehouses				
		W1	W2	W3	W4	Availability
Factories	F1	44	56	52	54	140
	F2	41	51	49	56	260
	F3	46	61	56	58	360
	F4	48	60	51	57	220
	Requirement	200	320	250	210	

i) Obtain the initial basic feasible solution by Vogel's approximation method.

ii) Find the optimum transportation schedule and cost.

iii) Is the solution unique? If not, find the alternate solution.

Contd….2

4 a. An air freight company picks up and delivers freight where customers require. Company has two types of aircrafts X and Y with equal loading capacities but different operating costs. These are as shown below.

Type of Aircraft	Cost per km in Rs.	
	Empty	Loaded
X	1.00	2.00
Y	1.50	3.00

The present four locations of the aircrafts which the company is having are as shown below:

J → X, K → Y, L → Y, M → X

Four customers of the company located at A, B, C, D wants to transport nearly the same size of load to their final destination. The final destinations are at distances of 600, 300, 1000 and 500 km from loading points A, B, C and D respectively. Distance in km between location of aircraft and loading points are as follows: 13

	A	B	C	D
J	300	200	400	100
K	300	100	300	300
L	400	100	100	500
M	200	200	400	200

Determine the optimum allocation.

b. A machine operator processes four jobs on his machine. The setup cost per change depends on the job currently on the machine and setup to be made according to the following table.

		To			
		A	B	C	D
From	A	∞	4	7	3
	B	4	∞	6	3
	C	7	6	∞	7
	D	3	3	7	∞

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If each job is to be processed once and only once each week, how should the jobs must be sequenced on the machine?

PART - B

5 a. Eight jobs each of which must go through the machines A, B and C in the order CAB. Determine a sequence for the jobs and total elapsed time.

Jobs	1	2	3	4	5	6	7	8
Machine A	4	6	7	4	5	3	6	2
Machine B	8	10	7	8	11	8	9	13
Machine C	4	6	3	3	4	9	15	11

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

Contd….3

b. Use graphical method to minimize the time needed to process the following jobs on the machine shown below. Calculate the total time needed to complete both the jobs. 7

Job 1	Sequence	A	B	C	D
	Time (in hours)	4	6	7	3
Job 2	Sequence	D	B	A	C
	Time (in hours)	4	7	5	8

6 a. Find the range of values p and q that will render the entry (2, 2) a saddle point in the following game: 7

$$A \begin{pmatrix} & B & \\ 1 & q & 6 \\ p & 5 & 10 \\ 6 & 2 & 3 \end{pmatrix}$$

b. Use the concept of dominance to sole the following game: 13

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

7 a. Explain briefly the terms: Balking, Jockeying, Steady state, Traffic intensity. 8

b. A self service store employs one cashier at its counter. Nine customers arrive on an average of every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival and exponential distribution for service, find 12

i) The average number of customers in the system.

ii) The average number of customers in the queue or average queue length.

iii) The average time a customer spends in the system.

iv) The average time a customer waits before being served.

8 a. Differentiate between PERT and CPM. 4

b. An assembly operation involves the completion of 11 jobs. The job labels, the time required for completing each one and the necessary immediate predecessors of each job are shown in the table. 16

Job	A	B	C	D	E	F	G	H	I	J	K
Time (days)	13	8	10	9	11	10	8	6	7	14	18
Immediate Predecessors	-	A	B	C	B	E	D, F	E	H	G, I	J

i) Draw the network and determine the critical path.

ii) Also prepare a table of Free float and Total Float.

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