



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

(An Autonomous Institution affiliated to VTU, Belagavi)

Sixth Semester, B.E. - Automobile Engineering

Semester End Examination; May / June - 2018

Operations Research

Time: 3 hrs

Max. Marks: 100

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

ii) Use of normal distribution table is permitted.

UNIT - I

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

b. Solve the following LPP by graphical method :

Maximize $Z = 6x_1 + 4x_2$

Subject to $8x_1 + 3x_2 \leq 360$

$5x_1 + 6x_2 \leq 450$

$4x_1 + 3x_2 \leq 240$, where $x_1, x_2 \geq 0$

14

2 a. Define slack, surplus and artificial variables. 6

b. Solve the following LPP by Big-M method.

Maximize $Z = x_1 + 2x_2 + 3x_3$

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

$2x_1 + x_2 + 5x_3 = 20$

$x_1 + 2x_2 + x_3 \leq 8$, $x_1, x_2, x_3 \geq 0$

14

Is alternative solution exists or not?

UNIT - II

3 a. What is an unbalanced transportation problem? How do you solve such problems? 4

b. A company has four plants at locations A, B, C and D which supply to four warehouses located at E, F, G and H. Transportation cost per unit between various plants and warehouses are as follows

		Warehouse				Supply
		E	F	G	H	
Plants	A	48	60	56	58	140
	B	45	55	53	60	260
	C	50	65	60	62	360
	D	52	64	55	61	220
Demand		200	320	250	210	

16

i) Find the optimum transportation schedule and cost

ii) Is the solution unique? If not, find the alternate solution

4 a. A company is faced with the problem of assigning six different machines to five different jobs. The costs estimated in hundreds of rupees are given in table. Solve the problem when the objective is to minimize the total cost.

		Jobs				
		1	2	3	4	5
Machines	1	2.5	5	1	6	2
	2	2	5	1.5	7	3
	3	3	6.5	2	8	3
	4	3.5	7	2	9	4.5
	5	4	7	3	9	6
	6	6	9	5	10	6

14

b. Solve the following travelling salesman problem :

		To			
		A	B	C	D
From	A	∞	8	14	6
	B	8	∞	12	6
	C	14	12	∞	14
	D	6	6	7	∞

6

UNIT - III

5 a. Determine the optimal sequence of jobs which minimizes the total elapsed time based on the following information :

Job	1	2	3	4	5
Machine A	3	8	7	5	2
Machine B	3	4	2	1	5
Machine C	5	8	10	7	6

10

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

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

Job 1	Sequence	A	B	C	D	E
	Time (in hours)	6	8	4	12	4
Job 2	Sequence	B	C	D	A	E
	Time (in sequence)	10	8	4	6	12

10

6 a. Explain the terms: Steady state and Transient state. Explain briefly how the queues are classified.

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

UNIT - IV

- 7 a. Write Fulkerson’s Rule for numbering the events. 4
- b. A project of a series of tasks labeled A, B, . . . , I with the following relationships:

(W < X, Y means X and Y cannot start until W is completed). With this notation, construct the network diagram having the following constraints. A < D, E; B, D < F; C < G; B < H; F, G < I

Find the critical path and minimum time of completion of the project when the time (in days) of completion of each task is as follows: 16

Task	A	B	C	D	E	F	G	H	I
Time	23	8	20	16	24	18	19	4	10

Also determine Early Start, Early Finish, Late Start, Late Finish and Total Float.

- 8 a. Differentiate between PERT and CPM. 4
- b. The following table lists the jobs of a network with their time estimates.

Job	Duration in days		
	Optimistic	Most likely	Pessimistic
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

- i) Draw the project network
- ii) Calculate the length and variance of the critical path
- iii) What is the probability that the jobs on critical path will be completed by 42 days?

UNIT - V

- 9 a. Solve the following game :

		Player B				
		1	2	3	4	5
Player A	1	9	3	1	8	0
	2	6	5	4	6	7
	3	2	4	4	3	8
	4	5	6	2	2	1

8

b. Solve the following game by using principle of dominance :

Player A		Player B				
		1	2	3	4	5
	1	1	3	2	7	4
	2	3	4	1	5	6
	3	6	5	7	6	5
	4	2	0	6	3	1

12

10 a. Define the following terms as applied to inventory models :

i) Holding cost

ii) Reorder level

iii) Delivery lag

iv) Deterministic demand

8

b. Consider an item with an annual demand of 20000 units. The estimated ordering cost is Rs. 100 and the estimated inventory carrying cost is 20%. The unit price of this item is Rs. 20. Determine the following :

i) The economic ordering quantity

ii) Number of orders per year

iii) The optimum scheduling period

iv) The annual total inventory carrying cost

12

* * * *