



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; July / Aug. - 2022

Operations Research

Time: 3 hrs

Max. Marks: 100

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

UNIT - I

1 a. Define Operations Research and discuss the phases on OR. 8

b. Solve the LPP by graphical method;

$$\text{Max } z = 6x_1 + 7x_2$$

$$\text{Subjected to } 4x_1 + 6x_2 \leq 36$$

$$2x_1 + 3x_2 \geq 12$$

$$2x_1 - 2x_2 \leq 6$$

$$\text{Where } x_1, x_2 \geq 0$$

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2 a. What is linear programming? Define slack, surplus and artificial variables. 5

b. Solve the given problem by simplex method;

$$\text{Max } z = 107x_1 + x_2 + 2x_3$$

$$\text{Subjected to } 14x_1 + x_2 - 6x_3 + 3x_4 = 7$$

$$16x_1 + \frac{1}{2}x_2 - 6x_3 \leq 5$$

$$16x_1 - 8x_2 - x_3 \leq 0$$

$$\text{where } x_1, x_2, x_3, x_4 \geq 0$$

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UNIT - II

3 a. How would you differentiate Transmission problem and Assignment problems? 5

b. A company has 3 factories F_1, F_2, F_3 from which it transports to 4 warehouses W_1, W_2, W_3 and W_4 . The unit cost of production at the 3 factories are Rs. 4, 3 and 5 respectively. Given the following information, unit cost of Transportation, capacities of 3 factories and requirements of 4 warehouses, find the optimal allocation.

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	W_1	W_2	W_3	W_4	Capacity
F_1	5	7	3	8	300
F_2	4	6	9	5	500
F_3	2	6	4	5	200
Demand	200	300	400	100	

- 4 a. The owner of a machine shop has four machines available to assign the jobs for the day. Five jobs are offered with the expected profit in Rupees. Each machine on each job is as follows. Find the assignment of the machines to the jobs that will result in a maximum profit, which job to be declined.

	A	B	C	D	E
1	62	78	50	101	82
2	71	84	61	73	59
3	87	92	111	71	81
4	48	64	87	77	80

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- b. A travelling salesman has to visit 5 cities. He wishes to start from a particular city. Visit each once and return to his starting point find the least cost route.

	A	B	C	D	E
A	∞	4	10	14	2
B	12	∞	6	10	4
C	16	14	∞	8	14
D	24	8	12	∞	10
E	2	6	4	16	∞

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UNIT - III

- 5 a. Determine the optimal sequence for 5 jobs the minimum elapsed time. Also find the idle for 3 machines.

Jobs		1	2	3	4	5
Processing line in hours on M/c	A	3	8	7	5	4
	B	4	5	1	2	3
	C	7	9	5	6	10

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- b. Use graphical method to minimize the total time required to process the jobs given in table below on different machines. Calculate the total elapsed time to complete the jobs. For each machine specify the job that should be done first.

Job 1	Sequence	A	B	C	D	E
	Time (hr)	1	2	3	5	1
Job 2	Sequence	C	A	D	E	B
	Time (hr)	3	4	2	1	5

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- 6 a. How the queues are classified? Explain the customer’s behavior. 8
- b. At a one man barber shop customers arrive according to PD with a mean arrival rate of 5/hr. The hair cutting time is ED with a hair cut taking 10 min on an average assuming that the customers are always willing to wait. find
 - (i) Average number of customers in the shop 12
 - (ii) Average waiting time of a customer
 - (iii) The percent of time an arrival can walk right without having to wait.
 - (iv) The probability of a customer waiting for more than 5 min.

UNIT - IV

- 7 a. Define free float and Independent float. 4
- b. A project has the following schedule.

Activity	1-2	1-3	1-4	2-5	3-6	3-7	4-6	5-8	6-9	7-8	8-9
Time in months	2	2	1	4	8	5	3	1	5	4	3

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Construct the network and critical path. Also determine ES, EF, LS and JF.

- 8 a. Discuss the common errors in drawing networks. 4
- b. The project schedule has the characteristics as shown in the table:

Activity	a	m	b
1-2	5	6	7
2-3	7	8	9
2-4	4	5	6
3-5	4	6	8
4-5	7	9	11
4-6	4	6	8
5-7	7	8	9
6-7	10	11	12
7-8	6	7	8
7-9	3	4	5
8-10	7	8	9
9-10	8	9	10

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- (i) Draw the PERT Network
- (ii) Calculate expected duration & variance for each activity.
- (iii) Identify the CP and expected project length
- (iv) What is the probability that the project will be completed in 44 day of the issue time?

UNIT - V

9 a. Explain the following terms with respect to game theory;

(i) Pure strategy

(ii) Saddle point

(iii) Value of game

(iv) Two person zero sum game

(v) Payoff

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b. Use dominance rule to find the optimal strategies for both the players

	B ₁	B ₂	B ₃	B ₄	B ₅	B ₆	
A ₁	4	3	1	3	2	2	10
A ₂	4	3	7	-5	1	2	
A ₃	4	3	4	-1	2	2	

10 a. What is inventory? Explain the various costs involved in inventory.

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b. A particular team has a demand of 9000 units per year. The cost of one procurement is Rs. 100 and the holding cost per unit is Rs. 2040 per year. The replacement is instantaneous and no shortages are allowed. Determine;

(i) The economic lot size

(ii) The number of order per year

(iii) The time between orders

(iv) The total cost per year if the cost of one unit is Rs. 1

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The cost of shortage is also given by Rs. 5 per unit per year

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