U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

February 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 23ME4ESORE **Max Marks: 100**
Course: Operations Research

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

			UNIT - I	CO	PO	Marks
1	a)		Explain the scope of Operations Research	CO1	PO1 PO2 PO3	**10**
	b)		A man goes to market to purchase buttons. He needs at least 20 large buttons and small 30 buttons. The shopkeeper sells button in two forms (i) boxes and (ii) cards. A box contains 2 large buttons and 5 small buttons and a card 10 large buttons and 5 small buttons. Find the most economical way in which he should purchase the buttons, if a box costs 10 paisa and a card costs 25 paisa only. Formulate the problem and solve using graphical method.	CO1	PO1 PO2 PO3	**10**
			OR			
2	a)		Explain feasible, basic feasible and optimal solution.	CO1	PO1 PO2 PO3	**06**
	b)		Solve the following LPP by the simplex method. Max $Z = 3x_1+2x_2$ Subject to constraints $2x_1+x_2 \leq 1$ $3x_1+4x_2 \geq 4$ $x_1, x_2 \geq 0$	CO1	PO1 PO2 PO3	**14**
			UNIT - II			
3	a)		Solve the dual simplex method to solve the following linear programming problem Max $Z = -2x_1- 3x_2$ Subject to constraints $x_1+x_2 \geq 2$ $2x_1+x_2 \leq 10$ $x_1+x_2 \leq 8$ $x_1,x_2 \geq 0$	CO2	PO1 PO2 PO3	**14**

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		b)	What are the advantages of Revised simplex method over standard simplex method?	*CO2*	*PO1* *PO2* *PO3*	**06**
			OR			
	4	a)	Obtain the dual of the following primal LP problem. Maximize $Z = x_1 - 2x_2 + 3x_3$ subject to the constraints (i) $-2x_1 + x_2 + 3x_3 = 2$, (ii) $2x_1 + 3x_2 + 4x_3 = 1$ and $x_1, x_2, x_3 \geq 0$	*CO2*	*PO1* *PO2* *PO3*	**06**
		b)	Use the revised simplex method to solve the following LP problem: Maximize $Z = 2x_1 + x_2$ subject to the constraints (i) $3x_1 + 4x_2 \leq 6$, (ii) $6x_1 + x_2 \leq 3$ and $x_1, x_2 \geq 0$	*CO2*	*PO1* *PO2* *PO3*	**14**
			UNIT - III			
	5		A cement company has 3 factories which manufactures cement and sends to 4 distribution centers. The supply position, demand and the associated transportation cost per quintal are shown below: Distribution centre / Supply W X Y Z C_i Factory A: 10 8 5 4 — 7 B: 7 9 15 8 — 8 C: 6 10 14 8 — 10 Demand: 6 6 8 5 i) Find out the optimal transportation schedule. ii) If the company wants, at least 5 quintals of cement to be sent from C to Y, will the transportation schedule be any different. If so, what will be the new optimal schedule and cost? iii) Suppose the company desires to send at most 0.5 quintals from C to Y, what will be the optimal schedule and cost?	*CO1*	*PO1* *PO2* *PO3*	**20**
			OR			
	6	a)	A company has 4 territories open and 4 salespersons available for assignment. The territories are not equally rich in their sales potential. It is estimates that a typical salesperson operating in each territory would bring in the following annual sales: Territory: I	II	III	IV Annual sales (Rs): 60000	50000	40000	30000 Four salesperson are also considered to differ in their ability: it is	*CO1*	*PO1* *PO2* *PO3*	**16**

			estimated that working under the same conditions, their yearly sales would be proportional as follows: Salesperson | A | B | C | D Proportion | 7 | 5 | 5 | 4 If the criterion is to maximize expected sales, then the initiative answer is to assign the best salesperson to the richest territory, the next best salesperson to the second richest territory and so on. Verify this answer by the assignment technique.			
	b)		Explain the difference between TP and AP	*CO1*	*PO1* *PO2* *PO3*	**04**
			UNIT - IV			
7	a)		Explain the following terms with reference to game theory i) Saddle point ii) Mixed strategy iii) 2-person zero sum game	*CO3*	*PO1* *PO2* *PO3*	**06**
	b)		A chemical manufacturer has to process 7 products through two stages of manufacturing viz., Crushing and Refining. The time taken for each of these items at the different stages is given below in appropriate units. Products | | 1 | 2 | 3 | 4 | 5 | 6 | 7 Time | Crushing | 5 | 7 | 3 | 4 | 6 | 7 | 12 | Refining | 2 | 6 | 7 | 5 | 9 | 5 | 8 i) Find an order in which these products are to be produced through these stages so as to minimize the total processing time. Also determine the make span and idle time for each process. ii) Suppose a third stage viz., Finishing, with the following processing time is to be added, find the order in which these products are to be produced through these three stages so as to minimize the total processing time. Products | 1 | 2 | 3 | 4 | 5 | 6 | 7 Finishing | 10 | 12 | 11 | 13 | 12 | 10 | 11	*CO4*	*PO1* *PO2* *PO3*	**14**
			OR			
8	a)		Players A and B play a game in which each has three coins, a 5p, 10p and a 20p. Each selects a coin without the knowledge of the other's choice. If the sum of the coins is an odd amount, then A wins B's coin. But, if the sum is even, then B wins A's coin. Find the best strategy for each player and the values of the game.	*CO4*	*PO1* *PO2* *PO3*	**10**
	b)		Use the graphical method to minimize the time needed to process the following jobs on the machines shown, i.e. for each machine find the job that should be done first. Also, calculate the total elapsed time to complete both jobs.	*CO4*	*PO1* *PO2* *PO3*	**10**

			Machine Job 1 { Sequence: A B C D E Time (hrs) 3 4 2 6 2 Machine Job 2 { Sequence: B C A D E Time (hrs) 5 4 3 2 6			
			UNIT - V			
	9	a)	At the interest rate of 10%, determine the best replacement policy for a machine purchased today at the cost of Rs 8000/-. The following information is available with regard to the machine. **Year** 1 2 3 4 5 6 7 Value are assumed to have occurred at the end of **Running cost** 1300 1500 1700 1900 2100 2500 4000 **Resale value** 4100 2700 2100 1600 1100 700 600	*CO5*	*PO1* *PO2* *PO3*	**14**
		b)	Explain replacement policy for the items that fail suddenly**.**	*CO5*	*PO1* *PO2* *PO3*	**06**
			OR			
	10	a)	Machine A costs Rs 45,000 and its operating costs are estimated to be Rs 1,000 for the first year increasing by Rs 10,000 per year in the second and subsequent years. Machine B costs Rs 50,000 and operating costs are Rs 2,000 for the first year, increasing by Rs 4,000 in the second and subsequent years. If at present we have a machine of type A, should we replace it with B? If so when? Assume that both machines have no resale value and their future costs are not discounted.	*CO5*	*PO1* *PO2* *PO3*	**10**
		b)	A company is considering the purchase of a new machine at Rs 15,000. The economic life of the machine is expected to be 8 years. The salvage value of the machine at the end of the life will be Rs 3,000. The annual running cost is estimated to be Rs 7,000. (a) Assuming an interest rate of 5 per cent, determine the present worth of future costs of the proposed machine. (b) Compare the new machine with the presently-owned machine that has an annual operating cost of Rs 5,000 and cost of repair Rs 1,500 in the second year, with an annual increase of Rs 500 in the subsequent years of its life.	*CO5*	*PO1* *PO2* *PO3*	**10**

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