U.S.N.										

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

Autonomous Institute Affiliated to VTU

October 2024 Supplementary 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.

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.

		UNIT - I	CO	PO	Marks
1 a)	What are the essential characteristics of Operations Research? Mention the different phases of OR, Point out some limitations of Operations Research	CO2	PO1 PO2 PO4	08
b)	A person requires 10,12 and 12 units of chemicals A, B & C respectively for his garden. A liquid product contains 5,2 and 1 units of A, B and C respectively per jar. A dry product contains 1,2 and 4 units of A, B and C per carton. If the liquid product is sold for Rs.3/- per jar and the dry product is sold for Rs.2/- per carton, how many of each should be purchased to minimize the cost and meet the requirement. Formulate and solve graphically.	CO2	PO1 PO2 PO4	12
	OR			
2 a)	Solve the following LP problem by simplex method. Max $Z=15x_1 + 6x_2 +9x_3+2x_4$ Subject to $2x_1+x_2+5x_3+6x_4 \leq 20$ $3x_1+x_2+3x_3+25x_4 \leq 24$ $7x_1+x_4 \leq 70$ $x_1, x_2, x_3, x_4 \geq 0$	CO2	PO1 PO2 PO4	12
b)	Solve the following using Big M method Max $Z=3x_1+2x_2$ subject to $2x_1+x_2 \leq 2$ $3x_1+4x_2 \geq 12$ $x_1,x_2 \geq 0$	CO2	PO1 PO2 PO4	08
	UNIT - II			
3 a)	Use Dual simplex method to solve the following LPP Max $Z= - 3x_1 - 2x_2$ subject to $x_1+x_2 \geq 1$, $x_1+x_2 \leq 7$ $x_1+2x_2 \geq 10$, $x_2 \leq 3$ $x_1,x_2 \geq 0$	CO2	PO1 PO2 PO4	14
b)	Write the Dual of the primal problem. Max $Z=4x_1 + x_2 +4x_3+5x_4$ Subject to $4x_1+6x_2 - 5x_3+4x_4 \geq - 20$ $3x_1 - 2x_2+4x_3+x_4 \leq 10$	CO2	PO1 PO2 PO4	06

SUPPLEMENTARY EXAMS 2024

			$8x_1 - 3x_2 - 3x_3 + 2x_4 \leq 20$ and $x_1, x_2, x_3, x_4 \geq 0$			
			UNIT - III			
	4	a)	There are three reservoirs with daily supplies of 15,20 & 25 million liters of fresh water respectively. On each day, we must supply four cities A, B, C and D whose demands are 8,10,12 and 15 respectively. The cost of pumping per million liters of water is given below: **Reservoir** / **Cities** |	**A**	**B**	**C**	**D** | | I | 2 | 3 | 4 | 5 | | II | 3 | 2 | 5 | 2 | | III | 4 | 1 | 2 | 3 | Determine the cheapest pumping schedule if excess water can be disposed of at no cost. Use VAM to determine the IBFS.	*CO3*	*PO1* *PO2* *PO4*	**16**
		b)	Write the differences between transportation problem and assignment problem	*CO3*	*PO1* *PO2* *PO4*	**04**
			OR			
	5	a)	Find the optimal assignment of jobs on Machines to maximize the profit earned. |	**G1**	**G2**	**G3**	**G4** | | **B1** | 11 | 1 | 5 | 8 | | **B2** | 9 | 9 | 8 | 1 | | **B3** | 10 | 3 | 5 | 10 | | **B4** | 1 | 13 | 12 | 11 |	*CO3*	*PO1* *PO2* *PO4*	**10**
		b)	A salesman has to visit five cities, A, B, C, D and E. The distance (in hundred miles) between the five cities is as follows, which route should be selected so that the total distance travelled is minimum? |	**A**	**B**	**C**	**D**	**E** | | **A** | -- | 7 | 6 | 8 | 4 | | **B** | 7 | -- | 8 | 5 | 6 | | **C** | 6 | 8 | -- | 9 | 7 | | **D** | 8 | 5 | 9 | -- | 8 | | **E** | 4 | 6 | 7 | 8 | -- |	*CO3*	*PO1* *PO2* *PO4*	**10**
			UNIT - IV			
	6	a)	Briefly explain the following terms connected to Game theory (i) Pure strategy (ii) Mixed strategy (ii) Saddle point (iv) Pay off	*CO3*	*PO1* *PO2*	**04**

SUPPLEMENTARY EXAMS 2024

					PO4	
	b)	Use the principle of dominance to solve the following game Player B Player A		*CO3*	*PO1* *PO2* *PO4*	**06**
	c)	Use graphical method to minimize the time needed to process the following jobs on the machines shown below. Also calculate the total time needed to complete both the jobs.		*CO4*	*PO1* *PO2* *PO4*	**10**
		UNIT - V				
7	a)	The cost of machine is Rs.6100/- and its scrap value is Rs.100/-. The maintenance costs are found from experience to be: When should the machine be replaced?		*CO5*	*PO1* *PO2* *PO4*	**08**
	b)	The probability Pn of failure just before age *n* is shown below. If individual replacement costs Rs.12.50/- and group replacement costs Rs3/- per item. Find the optimal replacement policy:		*CO5*	*PO1* *PO2* *PO4*	**12**

	1	**2**	**3**	**4**
1	2	-2	4	1
2	6	1	12	3
3	-3	2	0	6
4	2	-3	7	7

Job1	Sequence	A	B	C	D	E
	Time (hrs)	3	4	2	6	2
Job2	Sequence	B	C	A	D	E
	Time (hrs)	5	4	3	2	6

Year	1	2	3	4	5	6	7	8
Maintenance cost (Rs.)	100	250	400	600	900	1250	1600	2000

n	1	2	3	4	5
Pn	0.1	0.2	0.25	0.3	0.15

****

SUPPLEMENTARY EXAMS 2024