Code: 20A54401

R20

B.Tech II Year II Semester (R20) Regular & Supplementary Examinations April/May 2024

MATHEMATICAL MODELING AND OPTIMIZATION TECHNIQUES

(Civil Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1		Answer the following: (10 X 02 = 20 Marks)	
	(a)	What objectives can modelling achieve?	2M
	(b)	Define studying models.	2M
	(c)	Write the difference between statistical analysis and sensitivity analysis.	2M
	(d)	Define Dimensionless form.	2M
	(e)	Explain Linear programming problem.	2M
	(f)	Define various type of variables which is used LPP.	2M
	(g)	Write the application of transportation problems.	2M
	(h)	Discuss unbalanced assignment problems.	2M
	(i)	Describe Two person zero sum game.	2M
	(j)	Explain dominance rule.	2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

2	Discuss classification of models and various stage of modelling.	10M
	OR	
3	Explain the process of solving problems using modelling.	10M
4	Discuss the Process of Modelling, its Advantages and Limitations.	10M
	OR	
5	Explain the importance of sensitivity analysis.	10M
6	Use Big - M method to solve the following LP problems Min Z = $2x_1 + x_2$ Subject to constraints $3x_1 + x_2 = 3;\ \ 4x_1 + 3x_2 \geq 6;\ \ x_1 + 2x_2 \leq 4$ and $x_1, x_2 \geq 0$.	10M
	OR	
7	Solve by dual simplex method Min Z = $3x_1 + 2x_2$ Subject to constraints $2x_1 + x_2 \geq 2;\ \ 3x_1 + 4x_2 \geq 12;$ and $x_1, x_2 \geq 0$.	10M

Contd. in Page 2

8 Determine an initial basic feasible solution and optimal solution to the following transportation problem using the North – West Corner Method. 10M

	Destination				
	D_1	D_2	D_3	D_4	Availability
S_1	6	4	1	5	14
S_2	8	9	2	7	16
S_3	4	3	6	2	5
Demand	6	10	15	4	

OR

9 Compute the Construction Company has requested bids for subcontracts o five different projects. Five companies have responds and their bids are respectively given below: 10M

Bid Amount

Bidders	I	II	III	IV	V
A	41	72	39	52	25
B	22	29	49	65	81
C	27	39	60	51	40
D	45	50	48	52	37
E	29	40	45	26	30

Determine the minimum cost assignment of sub-contracts to bidders, assuming that each bidder can receive only one contract.

10 Solve the game using graphical method. 10M

Player B

$$A \begin{bmatrix} 2 & 4 \\ 2 & 3 \\ 3 & 2 \\ -2 & 6 \end{bmatrix}$$

OR

11 Solve the game by using dominance rule 10M

Player B

$$A \begin{bmatrix} 4 & 2 & 4 \\ 2 & 4 & 0 \\ 4 & 0 & 8 \end{bmatrix}$$

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PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Write the Process of Modeling, its advantages and limitations. 2M
(b) What are the different Stages of modeling? 2M
(c) Explain the Building models. 2M
(d) What are the various methods for choosing mathematical equations? 2M
(e) What is linear programming problem (LPP)? 2M
(f) Define slack and surplus variables as involved in the LPP. 2M
(g) What is a Transportation problem? 2M
(h) Define assignment problem. 2M
(i) Define pure and mixed strategies. 2M
(j) Define saddle point and the value of game with examples. 2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

2 (a) Explain about mathematical modeling. 5M
(b) What objectives can modeling achieve? 5M

OR

3 Explain the following: 10M
(i) Classifications of models,
(ii) Stages of modeling.

4 Explain the following: 10M
(i) Dimensionless form,
(ii) Asymptotic behaviour.

OR

5 Explain the following: 10M
(i) Sensitivity analysis,
(ii) Modeling model output.

6 (a) Solve the following LPP by the graphical method: 5M

max $z = x_1 + 5x_2$,

Subject to $-x_1 + 3x_2 \le 10$;

$x_1 + x_2 \le 6$;

$x_1 - x_2 \le 2$.

$x_1 , x_2 \ge 0$.

(b) Solve the following LPP using big-M method: 5M

max $z = 3x_1 - 3x_2 + x_3$,

Subject to $x_1 + 2x_2 - x_3 \ge 5$;

$-3x_1 - x_2 + x_3 \le 4$.

$x_1 , x_2 , x_3 \ge 0$.

OR

Contd. In Page 2

7 (a) Explain in brief the primal and dual problems. 5M

(b) Use duality to solve the following LPP: 5M

$Min.Z = 3x_1 + x_2$, subject to $x_1 + x_2 \geq 1, 2x_1 + 3x_2 \geq 2, x_1, x_2 \geq 0.$

8 Find the starting solution in the following transportation problem by Vogel's Approximation Method. Also obtain the optimum solution: 10M

	D_1	D_2	D_3	D_4	Capacity
S_1	3	7	6	4	5
S_2	2	4	3	2	2
S_3	4	3	8	5	3
Demand	3	3	2	2	

OR

9 (a) Explain the Humgarian method to solve an assignment problem. 5M

(b) Consider the following assignment problem and find its optimal solution. 5M

Machines					
		I	**II**	**III**	**IV**
Persons	**A**	8	26	17	11
	B	13	28	4	26
	C	38	19	18	15
	D	19	26	14	10

10 (a) For the same with the following payoff matrix , determine the optimum strategies and value of the game: 5M

$$\begin{array}{c} \\ P_1 \end{array} \begin{array}{c} P_2 \\ \begin{bmatrix} 5 & 1 \\ 3 & 4 \end{bmatrix} \end{array}$$

(b) Solve the following game graphically: 5M

$$\begin{array}{c} \\ \text{Player A} \end{array} \begin{array}{c} \text{Player B} \\ B_1 \quad B_2 \quad B_3 \quad B_4 \\ \begin{matrix} A_1 \\ A_2 \end{matrix} \begin{bmatrix} 2 & 1 & 0 & -2 \\ 1 & 0 & 3 & 2 \end{bmatrix} \end{array}$$

OR

11 (a) Explain Max-Mini and Mini-Max principle used in Game theory. 5M

(b) What is a zero-sum two-person game? 5M

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