PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

22MA4D1 : OPERATIONS RESEARCH
Semester : IV

Course Code	22MA4D1	Course Delivery Method	Blended Mode
Credits	4	CIA Marks	30
No. of Lecture Hours / Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2021-22	Year of offering : 2023-24	Year of Revision: 2023-24	Percentage of Revision :5%

Course Objectives : The objective of this course is to develop problem solving skills of linear programming problems using Two-Phase method, Duality theory, Revised Simplex method, Game theory and Dynamic Programming.

COURSE OUTCOME	Upon successful completion of this course, students will be able to:
CO1	Solve a linear programming problem using Two-phase simplex method
CO2	Solve a linear programming problem using duality.
CO3	Solve a linear programming problem using Revised simplex method
CO4	Find the solutions of games and related problems.
CO5	formulate and solve dynamic programming problems related to the industry.

Mapping of Course Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**0**	**0**	**3**	**0**	**0**	**0**	**0**
CO2	**0**	**0**	**0**	**0**	**0**	**0**	**3**
CO3	**0**	**0**	**0**	**0**	**0**	**2**	**0**
CO4	**0**	**0**	**0**	**0**	**0**	**0**	**3**
CO5	**3**	**0**	**0**	**0**	**0**	**0**	**0**

UNIT –I

Further Discussion of the Simplex Method: The two phase Method for Artificial variables, phase-I, Phase-II, Numerical examples of the two phase method.
(Sections 5.1 to 5.4 of Chapter -5 of [1]]

UNIT –II

Duality theory and its Ramifications: Alternative formulations of linear programming problems, Dual linear programming problems, Fundamental properties of dual problems, Other formulations of dual problems, Unbounded solution in the primal, The dual simplex algorithm –an example. Post optimality problems, Changing the price vector, Changing the requirements vector, Adding variables or constraints
(Sections 8.1 to 8.7 & 8.10 of Chapter 8 of [1]).

UNIT –III

The Revised simplex method: Introduction, Revised simplex method: Standard form I, Computational procedure for standard form I, Revised simplex method: Standard form II, Computational procedure for standard form II, Initial identity matrix for phase–I, Comparison of the simplex method and Revised simplex method.
(Sections 7.1 to 7.6 &7.8 of Chapter 7 of[1]).

UNIT –IV

Theory of Games: Introduction, Basic definitions, Min- Max criterion, Saddle point, Solution of games with saddle points, Rectangular games without saddle points, 2x2 games without saddle points, Graphical method for 2xn and mx2 games.
(Selected topics of Chapter 24 of [2])

UNIT V

Dynamic Programming: Introduction, Characteristics of Dynamic Programming problem, Deterministic Dynamic Programming: Dynamic Programming approach to Shortest Route Problem, Dynamic Programming approach to Resource Allocation: Equipment, Replacement, Cargo loading, and capital budgeting. Dynamic Programming approach to linear programming, Stochastic Dynamic Programming.
(Sections 6.1 to 6.4 of chapter 6 of [3])

PRESCRIBED BOOKS:

[1] G.Hadley, *Linear programming,* Addison Wesley Publishing Company(1978).
[2] S.D.Sarma**,** *Operations Research – Theory, Methods and Applications,* Kedarnath Ramnath Publications(2017).
[3] Rathindra p. Sen, *Operations Research- Algorithms and Applications*, PHI(2009).

REFERENCE BOOK: Nita H.Shah, Ravi M. Gor, Hardik Soni, *Operations Research, PHI(2010).*

Course has Focus on : Foundation (Elective Paper)

Websites of Interest:

1. www. nptel.ac.in
2. www.epgp.inflibnet.ac.in
3. www.ocw.mit.edu

PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

M. Sc. Mathematics
Fourth Semester
22MA4D1 - OPERATIONS RESEARCH

Time: 3 hours **Max. Marks: 70**

SECTION - A

Answer all questions. All questions carry equal marks. **(5x4=20)**

1 (a)Explain the procedure of solving a L.P.P. if the variables are unrestricted in sign.
(CO1, L2)

(OR)

(b) Explain the procedure of finding the inverse of a matrix using simplex method.
(CO1, L2)

2 (a) Show that the dual of the dual is the primal in linear programming problems. (CO2, L3)

(OR)

(b) Find the dual of the following linear programming problem. (CO3, L3)

Max $z = x_1+2x_2$

$2x_1 - 3x_2 \leq 3$

$4x_1+ x_2 \leq -4,$ $x_1, x_2 \geq 0$

3 (a) Explain briefly the revised simplex method standard form – I. (CO3, L2)

(OR)

(b) Compare Simplex method and Revised Simplex method. (CO3, L2)

4 (a) Explain how to find the solution of a 2x2 rectangular game. (CO4, L2)

(OR)

(b) Explain the difference between pure strategy and mixed strategy. (CO4, L2)

5 (a) Discuss the relationship between linear programming and dynamic programming.
(CO5, L3)

(OR)

(b) Define dynamic programming problem. Explain its essential characteristics. (CO5, L3)

SECTION – B

All questions carry equal marks. **(5X10 = 50M)**

6. (a) Solve the following L.P.P using Two-phase method (CO1, L3)

$\max z = 5x_1 - 4x_2 + 3x_3$
$sub: 2x_1 + x_2 - 6x_3 = 20$
$6x_1 + 5x_2 + 10x_3 \le 76$
$8x_1 - 3x_2 + 6x_3 \le 50$
$x_1, x_2, x_3 \ge 0$

(OR)

b) Explain the procedure of Two-Phase simplex method. (CO1, L3)

7 (a)Use duality to solve the following L.P.P (CO2, L3)

$\max z = 2x_1 + x_2$
$sub: x_1 + 2x_2 \le 10$
$x_1 + x_2 \le 6$
$x_1 - x_2 \le 2$
$x_1 - 2x_2 \le 1$
$x_1, x_2 \ge 0$

(OR)

(b) Explain dual simplex algorithm. (CO2, L3)

8 (a) Use revised simplex method to solve the following L.P.P. (CO3, L4)

$\max z = 2x_1 + x_2$
$sub: 3x_1 + 4x_2 \le 6$
$6x_1 + x_2 \le 3$
$x_1, x_2 \ge 0$

(OR)

(b) Explain the computational procedure of revised simplex method standard form- II, (CO3, L4)

9. (a) Solve the following game graphically. (CO4, L4)

Players	B_1	B_2	B_3	B_4
A_1	2	1	0	-2
A_2	1	0	3	2

(OR)

(b) For the game with the following payoff matrix, determine the optimum strategies and the value of the game $A\begin{bmatrix} 5 & 1 \\ 3 & 4 \end{bmatrix}$ (CO4, L4)

10 (a) BST Road lines has 4 types of packages A,B,C, and D to be carried in their parcel van. The bulk density of each package is different. As per the company's rules, the packages fall under different categories of freight classification, and therefore, the revenue for each package are available:

Type of package	Wt. per unit(kg)	Expected unit revenue(Rs)
A	2000	200
B	4000	425
C	5000	550
D	3000	350

Determine the number of units of each package that would maximize the revenue, given that the capacity of van is limited to 10,000 kg. (CO5, L3)

(OR)

(b) Solve the following linear programming problem by applying dynamic programming procedure.

$$Max Z = 2x_1 + 5x_2$$
$$sub: 2x_1 + x_2 \le 43$$
$$2x_2 \le 46$$
$$x_1, x_2 \ge 0$$

(CO5, L3)

***