Printed Page:-05 **Subject Code:- AAS0404**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION (2024 - 2025)

Subject: Optimization and Numerical Techniques

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 20

1. Attempt all parts:-

1-a. If any value in X_B column of final simplex table is negative, then the solution is _____.(CO1, K2) 1

(a) Feasible

(b) Infeasible

(c) Unbounded

(d) No solution

1-b. The maximum value of $Z = 4x + 2y$ subject to the constraints $2x + 3y \leq 18$, $x + y \geq 10$, $x, y \geq 0$ is (CO1, K3) 1

(a) 36

(b) 40

(c) 30

(d) None of these

1-c. The part of the feasible solution space eliminated by plotting a cut contains (CO2, K2) 1

(a) Only non-integer solution

(b) Only integer solution

(c) Both A) and B)

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(d) None of these

1-d. In a branch and bound problem , if x= 5, and y= 4.5, which of the following would be a possible branching option (CO2,K2) 1

(a) $y \geq 4$

(b) $x \leq 5$

(c) $y \geq 5$

(d) $y \leq 5$

1-e. The Minimum value of $f(x_1,x_2) = 2x_1^2 + x_2^2 - 4x_1 + 4 - 4x_2$ is (CO3,K3) 1

(a) 0

(b) -2

(c) 1

(d) None of these

1-f. If $(rt - s^2) > 0$, $r < 0$, $t < 0$ then the function is (CO3,K2) 1

(a) Concave

(b) Convex

(c) Neither convex nor concave

(d) Strictly concave

1-g. The relation between Δ & E is (CO4, K2) 1

(a) $\Delta = E - 1$

(b) $\Delta = E + 1$

(c) $\Delta = E$

(d) None of these

1-h. For finding complex roots of algebraic or transcendental equations, we can use: (CO4,K1) 1

(a) Bisection method.

(b) Regula-Falsi method.

(c) Newton-Raphson method.

(d) None of these methods.

1-i. If $A = \{1,4,6\}, B = \{3,6\}$ and $C = \{3,4,6\}$, then $A \cap (B \cap C)$ is: (CO5,K2) 1

(a) $\{3,4,5,6\}$

(b) $\{4,6\}$

(c) $\{1,4,6\}$

(d) $\{6\}$

1-j. Find ${}^4P_2$: (CO5,K2) 1

(a) 12

(b) 28

(c) 40

(d) 36

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2. Attempt all parts:-

2.a. Consider a chocolate manufacturing company that produces only two types of chocolate A and B. Both the chocolates require Milk and Choco only. To manufacture each unit of A and B, the following quantities are required: 2

i. Each unit of A requires 1 unit of Milk and 3 units of Choco
ii. Each unit of B requires 1 unit of Milk and 2 units of Choco.

The company kitchen has a total of 5 units of Milk and 12 units of Choco. On each sale, the company makes a profit of Rs 6 per unit A sold and Rs 5 per unit B sold. Formulate the above as an LPP to maximize the profit. (CO1,K2)

2.b. Calculate the fractional part of -2/3 by Gomory's method.(CO2,K2) 2

2.c. Check whether the function: $f(x, y) = x^2 + xy + y^2$ is convex or not.(CO3,K3) 2

2.d. Write the Newton's forward interpolation formula. (CO4,K2) 2

2.e. If function $f:R \to R$ is defined by $f(x) = x^3 + 1.$ Check whether the function is one-one and onto or not. (CO5,K2) 2

SECTION-B 30

3. Answer any five of the following:-

3-a. Write the dual of the given LPP: (CO1, K3) 6

Max. $Z = x_1 + x_2 + x_3$

Subject to

$x_1 - 3x_2 + 4x_3 = 5$

$x_1 - 2x_2 \leq 3$

$2x_2 - x_3 \geq 4$

$x_1, x_2, x_3 \geq 0$

3-b. Solve the following LPP by using graphical method: (CO1,K3) 6

Min $Z = 50x_1 + 70x_2$

Subject to

$2x_1 + x_2 \geq 8$

$x_1 + 2x_2 \geq 10$

$x_1, x_2 \geq 0$

3-c. Solve the following LPP by Branch and Bound method:(CO2,K3) 6

Max. $Z = 5x+2y$

S.t.

$3x+4y \leq 3$

$x+3y \geq 5$

$x, y \geq 0$ and are integers.

3-d. Write short note on Knapsack and cargo loading problem. (CO2,K1) 6

3.e. Show that the set $S=\{(x_1, x_2, x_3): 2x_1 - x_2 + x_3 \leq 4\}$ is a convex set. (CO3,K2) 6

3.f. Calculate the real root of following equation $x^3 - 5x + 3 = 0$ by using Regula Falsi method till 3rd iterations. (CO4, K3) 6

3.g. For the following statement, which conclusion follows logically and why (CO5, K2) 6

A. Some actors are singers.
B. All the singers are dancers.
Conclusions:
1. Some actors are dancers.
2. No singer is actor.

SECTION-C 50

4. Answer any one of the following:-

4-a. Solve the following LP problem using Big M method:(CO1,K3) 10

Maximize z = -x - y
subject to the constraints:
$3x + 2y \geq 30$
$2x - 3y \geq 30$
$x + y \leq 5$
$x, y \geq 0$

4-b. Solve the following LPP by using Two Phase method: (CO1,K3) 10

Min $Z = x_1 - 2x_2 - 3x_3$
subject to $-2x_1 + x_2 + 3x_3 = 2$
$2x_1 + 3x_2 + 4x_3 = 1$
$x_1, x_2, x_3 \geq 0$

5. Answer any one of the following:-

5-a. Find the optimum integer solution of the IPP by using Gomory's method: (CO2,K3) 10

Min $Z = x_1 - 3x_2 + 2x_3$
Subject to
$3x_1 - x_2 + 3x_3 \leq 7$
$-2x_1 + 4x_2 \leq 12$
$-4x_1 + 3x_2 + 8x_3 \leq 10$
$x_1, x_2 \geq 0$ and are integer.

5-b. Solve the following LPP by using Branch and Bound method (For only one subproblem): (CO2,K3) 10

Max $z = 2x_1 + 3x_2$
s.t. $x_1 + x_2 \leq 35$
$4x_1 + 9x_2 \leq 36$
$x_1, x_2 \geq 0$ and are integers.

6. Answer any one of the following:-

6-a. Solve the following NLPP by the method of Lagrange multiplier: (CO3,K3) 10

Optimize $z = 2x^2 + 2y^2 + 3z^2 + 10x + 8y + 6z - 100$
Subject to

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$x + y + z = 20$

$x,y,z \geq 0$

6-b. Use Kuhn Tucker method to slove the following NLLP: (CO3,K3) 10

Maximize $Z=12x_1 + 21x_2 + 2x_1x_2 - 2x_1^2 - 2x_2^2$

s. t. $x_2 \leq 8$

$x_1 + x_2 \leq 10$

$x_1, x_2 \geq 0.$

7. Answer any one of the following:-

7-a. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Simpson's one third rule and Simpson's 3/8th rule. (CO4,K3) 10

7-b. By Using Lagrange interpolation find f(8) from the following data: (CO4,K3) 10

X	4	5	7	10	11	13
f	48	100	294	900	1210	2028

8. Answer any one of the following:-

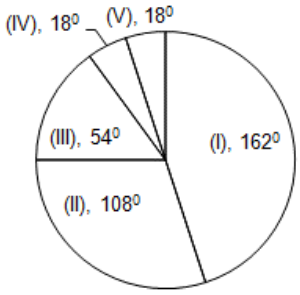
8-a. In a certain college 25% of boys and 10% of girls are studying mathematics. The girls constitute 60% of the students. If a student is selected and is found to be studying Mathematics find the probability that the student is a (CO5,K3) 10

i. Girls

ii. Boy.

8-b. The various sections of the population are indicated below in the pie-chart. Study the pie-chart and answer the following questions: (CO5,K3) 10

The total population of a city is 5000



I. Employees of the Public Sector

II. Employees of the Private Sector

III. Employees of the Corporate Sector

IV. Self-Employed

V. Unemployed.

A. Calculate the percentage of the employed persons is self-employed.

B. Calculate the number of persons employed in the Corporate Sector.

C. Calculate the number of Unemployed persons.

D. Calculate the number of persons employed in both the Public Sector and Corporate Sector.

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