Printed Page:- 06 **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 (2023 - 2024)

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.*

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SECTION A **20**

1. Attempt all parts:-

1-a. _____ method is an alternative method of solving a Linear Programming Problem involving artificial variables.(CO1) 1

(a) Simplex Method

(b) Big-M Method

(c) Dual Simplex Method

(d) Graphical Method

1-b. If there is no non-negative replacement ratio in solving a Linear Programming Problem then the solution is _____. (CO1) 1

(a) Feasible

(b) Bounded

(c) Infinite

(d) Unbounded

1-c. The first step in a branch and bound approach to solving integer programming problems is to (CO2) 1

(a) Non linear problem.

(b) Change the objective function coefficients to whole integer numbers.

(c) Solve the original problem using LP by allowing continuous non integer solutions.

(d) Compare the lower bound to any upper bound of your choice.

1-d. Modifications made for the mixed integer cutting plane method are (CO2) 1

(a) Value of the objective function is bounded

(b) Row corresponding to an integer variable serve as a source row

(c) Any row serve as a source row

(d) Row corresponding to an non- integer variable serve as a source row

1-e. A twice differentiable function $f:R^2 \rightarrow R$ is convex. Then the Hessian matrix is (CO3) 1

(a) Negative-definite for all real numbers

(b) Negative semi-definite for all real numbers

(c) Positive-definite for all real numbers

(d) None of these.

1-f. Saddle point is a..... (CO3) 1

(a) Point where the function has maximum value

(b) Point where the function has minimum value

(c) Point where the function has zero value

(d) Point where function neither have maximum value nor minimum value

1-g. Rate of convergence of Bisection method is (CO4) 1

(a) Very slow

(b) Linear

(c) Quadratic

(d) 1.618

1-h. The nth divided difference of a polynomial of degree n is (CO4) 1

(a) Zero

(b) A constant

(c) A variable

(d) None of these

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1-i. Find the least value must be assigned to * so that the number 197*5462 is divisible by 9. (CO5) 1

(a) 2

(b) 1

(c) 3

(d) 4

1-j. If $f:R \rightarrow R$ then which one of the following is many one (CO5) 1

(a) $f(x) = x^2 + 1, x \varepsilon R$

(b) $f(x) = -x, x \varepsilon R$

(c) $f(x) = x, x \varepsilon R$

(d) None of these

2. Attempt all parts:-

2.a. Write a short note on artificial variable. (CO1) 2

2.b. Differentiate between the pure integer programming problem and the mixed programming problem. (CO2) 2

2.c. Write a short note on convex set. (CO3) 2

2.d. Find the polynomial interpolating the data: (CO4) 2

x :	0	1	2	3
$f(x)$:	1	2	1	10

2.e. Find the least number which is divided by 4, 6, 8, 12 and 16 leaves a remainder of 2 in each case. (CO5) 2

SECTION B **30**

3. Answer any <u>five</u> of the following:-

3-a. Solve the following LPP graphically: (CO1) 6

Maximize $Z = 3x + 5y$

s.t. $x - 2y \leq 6$

$x \leq 10$

$y \geq 1$

$x, y \geq 0$.

3-b. Reshma wishes to mix two types of food P and Q in such a way that the vitamin contents of the mixture contain at least 8 units of vitamin A and 11 units of vitamin B. Food P costs Rs 60/kg and Food Q costs Rs 80/kg. Food P contains 3 units/kg of Vitamin A and 5 units / kg of Vitamin B while food Q contains 4 units/kg of Vitamin A and 2 units/kg of vitamin B. Formulate the LPP and solve graphically. (CO1) 6

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3-c.	Write short note on zero-one programming and Knapsack problem. (CO2)	6
3-d.	Discuss the need of integer programming in mathematical programming.(CO2)	6
3.e.	Find the maximum and minimum values of the function $f(x, y) = x^2 + 2y^2 - 4x - 8y + 10$. (CO3)	6
3.f.	Find a real root of the equation $x \log_{10} x = 1.2$ by Regula-Falsi method correct to two decimal places. (CO4)	6
3.g.	In how many ways can the letter of word ASSASSINATION be arranged such that (CO5) i) All the four S came together ii) All the Vowels occur together	6

SECTION C **50**

4. Answer any <u>one</u> of the following:-

4-a. Solve by Big M method 10

Maximize $z = 6x_1 + 4x_2$

Subject to

$x_1 + x_2 \leq 5$

$x_2 \geq 8$

$x_1, x_2 \geq 0$ (CO1)

4-b. Solve the following LP problem by Two phase method: (CO1) 10

Maximize Z = 10x + 13y

s.t.

2x + y ≤ 8

x + 4y ≥ 7

Both x and y all ≥0

5. Answer any <u>one</u> of the following:-

5-a. Find the optimum integer solution to the following LPP. (CO2) 10

Max. Z = X + Y

s.t.

3X+ 2Y ≤ 5

y ≤ 2

X, Y ≥ 0 and are integers.

5-b. Solve the following integer programming problem by using branch and bound method: (CO2) 10

Max. Z = 2X + 3Y

s.t.

X+ Y ≤ 35

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$4X + 9Y \leq 36$

$X, Y \geq 0$ and are integers.

6. Answer any <u>one</u> of the following:-

6-a. Use the Lagrange's multipliers to solve the following non-linear programming problem. Does the solution maximize or minimize the objective function? (CO3) 10

$$\text{Optimize} \quad Z = 2x_1^2 + x_2^2 + 3x_3^2 + 10x_1 + 8x_2 + 6x_3 - 100$$

$$\text{Subject to} \quad x_1 + x_2 + x_3 = 20,$$

$$x_1, x_2, x_3 \geq 0$$

6-b. Solve the following non-linear programming problem: (CO3) 10

$$\text{Optimize} \quad Z = -x_1^2 - x_2^2 + 4x_1 + 6x_2$$

$$\text{Subject to} \quad x_1 + x_2 \leq 2,$$

$$2x_1 + 3x_2 \leq 12,$$

$$x_1, x_2 \geq 0$$

7. Answer any <u>one</u> of the following:-

7-a. Apply Runge Kutta method to find an approximate value of y when $x = 0.2$, given that 10

$dy/dx = x + y$, $y = 1$ when $x = 0$. (CO4)

7-b. Evaluate $\int_0^1 \sqrt{\sin x + \cos x}\, dx$ using Simpson's one third rule and Simpson's third eight rule by dividing the interval into six equal parts. (CO4) 10

8. Answer any <u>one</u> of the following:-

8-a. For the following statement give which conclusion follows logically and why explain (CO5) 10

Statements:

All the locks are keys.

All the keys are bats.

Some watches are bats.

Conclusions:

A. Some bats are locks.

B. Some watches are keys.

C. All the keys are locks.

8-b. 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 10

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studying Mathematics find the probability that the student is a (CO5)

i. Girls
ii. Boy.

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