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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 (2021 - 2022)

Subject: Optimization and Numerical Techniques

Time: 3 Hours | Max. Marks: 100

General Instructions:

1. The question paper comprises three sections, A, B, and C. You are expected to answer them as directed.
2. Section A - Question No- 1 is 1 mark each & Question No- 2 carries 2 mark each.
3. Section B - Question No-3 is based on external choice carrying 6 marks each.
4. Section C - Questions No. 4-8 are within unit choice questions carrying 10 marks each.
5. 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. A Linear Programming Problem have ______________ optimal solution (CO1) 1

(a) 1
(b) 2
(c) More than 1
(d) More than 2

1-b. ______________ 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-c. Branch and bound method divides the feasible solution space into smaller parts by (CO2) 1

(a) Branching
(b) Bounding
(c) Enumerating
(d) All of the above

1-d. In a pure integer programming problem(CO2) 1

(a) All the decision variable require integer solutions
(b) Few of the decisions variables require integer solution
(c) Different objective functions are mixed together
(d) None of the above

1-e. The function $f(x) = 2x^3 - 3x^2$ is (CO3) 1

(a) Convex for $x \leq 0.5$
(b) Convex for $x \geq 0.5$
(c) Convex for $x < 0.5$
(d) None of these

1-f. Every non-linear programming problem can be solved using (CO3) 1

(a) Lagrange's multiplier Method
(b) Kuhn tracker method
(c) Both Lagrange's multiplier Method & kuhn tracker Method
(d) None of these

1-g.	If $f(x) = x^2 - 153$ then the iterative formula for Newton Raphson Method is given by: (CO4)		1

(a) $x_{n+1} = 0.5\left[x_n + \frac{153}{x_n}\right]$

(b) $x_{n+1} = 0.5\left[x_n - \frac{153}{x_n}\right]$

(c) $x_{n+1} = 0.5\left[\frac{153}{x_n}\right]$

(d) None of these

1-h. The process of finding the values inside the interval (x_0 , x_1) is called (CO4) 1

(a) Interpolation
(b) Extrapolation
(c) Iterative
(d) Polynomial Equation

1-i. Find the unit digit of $(4137)^{754}$ (CO5) 1

(a) 9
(b) 7
(c) 3
(d) 1

1-j. The remainder is 29, when a number is divided 56. If the same number is divided by 8, then what is the remainder? (CO5) 1

(a) 3
(b) 4
(c) 7
(d) 5

2. Attempt all parts:-

2.a. Write the primal problem in dual form (CO1) 2
Maximize $Z = 2x_1 + 4x_2$
Subject to constraints, $2x_1+3x_2 \leq 2$
$x_1+ x_2 \leq 6$
where $x_1, x_2 \geq 0$

2.b. What is zero-one IPP? (CO2) 2

2.c. Show that intersection of two convex sets is also convex set.(CO3) 2

2.d. Write the formula for Simpson's one-third rule. (CO4) 2

2.e. What is the probability that a leap year selected at random will contain 53 Sundays?(CO5) 2

SECTION B 30

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

3-a. Solve the lpp by Graphical method-.(CO1). 6
Max $z = 6x + 4y$
s.t $2x + 3y \leq 20$,
$2x + y \leq 16$,
$x,y \geq 0$

3-b. Solve by Big M Method- (CO1) 6

Maximize $Z = x + 3y$

.

s.t. $2x + 6y \le 8,$

$3x + 4y \ge 5$

$x, y \ge 0$

3-c. Define i) All integer programming problem 6

ii) Mixed LPP

3-d. Discuss the need of integer programming in mathematical programming.(CO2) 6

3.e. Use the Lagrange's multiplier method to solve the following problems:(CO3) 6

$$\text{Minimize } Z = 3x_1^2 + x_2^2 + 2x_1x_2 + 6x_1 + 2x_2$$

$$\text{Subject to } 2x_1 - x_2 = 4,$$

$$x_1, x_2 \ge 0$$

3.f. Find the real root of the equation 3x-cosx-1=0 correct to 4 decimal places by Regula falsi method.(CO4) 6

3.g. Write a short note on bijective function and prove that the function given by $f(x) = 2x^3 + 3$ is not bijective function. (CO5) 6

SECTION C 50

4. Answer any one of the following:-

4-a. Find the solution of lpp $\text{Max } z = 8000x_1 + 7000x_2$ (CO1) 10

Subject to $3x_1 + x_2 \le 66,$

$x_1 + x_2 \le 45,$

$x_1 \le 20,$

$x_2 \le 40,$

$x_1, x_2 \ge 0$

4-b. A manufacturer produces two types of models A and B. Each model of the type A requires 4 hrs of grinding and 2 hrs of polishing; where as each model of the type B requires 2 hrs of grinding and 5 hrs of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works 40 hrs in a week and each polisher works 60 hours in a week. Profit on A model is 3 rs. and on B model is rs. 4. Whatever is produced in a week is sold in the market. Find the maximize the profit.(CO1) 10

5. Answer any one of the following:-

5-a. Use branch and bound method technique to solve the following problem: (CO2) 10

Max. Z = X + Y

s.t.

$3X - 2Y \le 5$

$Y \le 2$

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

5-b. Solve the following integer programming problem using cutting plane procedure (CO2) 10

Max. Z = X + 2Y

s.t.

$X + Y \le 7$

$2Y \le 7$

$2X \le 11$

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

6. Answer any one of the following:-

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

$$\text{Minimize} \quad Z = x_1^2 + (x_2+1)^2 + (x_3-1)^2$$

$$\text{Subject to} \quad x_1 + 5x_2 - 3x_3 = 6 \quad , \quad x_1, x_2, x_3 \geq 0$$

6-b. Use the Kuhn-Tucker conditions to solve the following problems:(CO3) 10

$$\text{Maximize} \quad f(x,y) = 8x^2 + 2y^2$$

$$\text{Subject to} \quad x^2 + y^2 \leq 9,$$

$$x, y \geq 0.$$

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

7-a. Apply Crouts method to solve the equations: (CO4) 10
x+ *y* - *z* = 2; 2*x* + 3*y* + 5*z* = -3; 3*x* + 2*y* + -3*z* = 6.

7-b. Develop the divided difference table from the data given below and obtain the interpolation polynomial *f*(*x*) (CO4) 10

x	1	3	5	7	11
f(*x*)	5	11	17	23	29

also find the value of *f*(19.5).

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

8-a. Solve the following- 10

A. An integer is chosen at random from two hundred digits. What is the probability that integers are divisible by 6 or 8? (CO5)
B. Three news papers and are published in a certain city. It is estimated from a survey that of the adult population: 10% read 20% read 14% read ,4% read both and 8% read both and , 5% read both and 2% read all three. Find the probability what percentage read at-least one of the papers? (CO5)

8-b. Solve the following- 10
A. The sum of squares of three numbers is 138 and the sum of their products taken two at a time is 131. Find their sum. (CO5)
B. Find the largest number of 4-digits divisible by 12, 15 and 18. (CO5)
C. How many words can be formed by using all letters of the word "HISAR“? (CO5)