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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - CARRY OVER THEORY EXAMINATION - APRIL 2023

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

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1. Attempt all parts:-

- 1-a. If an artificial variable is present in the basic variable column of optimal simplex table, then the problem has _____ solution. (CO1) 1
- (a) Alternative
(b) No solution
(c) Bounded
(d) **Infeasible**
- 1-b. In Linear programming problem (CO1) 1
- (a) Objective function is linear
(b) Constraints are linear.
(c) Both objective function and constraints are linear.
(d) None of these
- 1-c. Which of the following is not an Integer programming problem? (CO2) 1
- (a) Pure Integer Programming problem
(b) Mixed Integer Programming problem

- (c) 0-1 Integer Programming problem
- (d) Continuous Integer Programming problem
- 1-d. In a branch and bound problem, if $x = 5.5$, and $y = 3$, which of the following would be a possible branching option. (CO2) 1
- (a) $x \geq 4$
- (b) $x \geq 6$
- (c) $y \geq 6$
- (d) None of these
- 1-e. Lagrange's multiplier method is used to solve (CO3) 1
- (a) Inequality constrained problems
- (b) Equality constrained problems
- (c) Both a) and b)
- (d) None of these
- 1-f. The function $f(x) = x_1 x_2$ is (CO3) 1
- (a) Convex
- (b) Concave
- (c) Both convex and concave
- (d) None of these
- 1-g. Newton- Gregory Forward interpolation formula can be used _____ (CO4) 1
- (a) Only for unequally spaced interval
- (b) Only for equally spaced interval
- (c) Both A and B
- (d) None of these
- 1-h. The Iterative formula for Newton Raphson method is given by: (CO4) 1
- (a) $x_1 = x_0 - f(x_0)/f'(x_0)$
- (b) $x_0 = x_1 - f(x_0)/f'(x_0)$
- (c) $x_0 = x_1 + f(x_0)/f'(x_0)$
- (d) $x_1 = x_0 + f(x_0)/f'(x_0)$
- 1-i. In between two rational number there is/are: (CO5) 1
- (a) Exactly one rational number
- (b) Infinitely many rational number
- (c) Many irrational numbers
- (d) None of these

- 1-j. A card is drawn from a pack of 52 cards. What is the probability of getting a king of a black suit? (CO5) 1
- (a) $1/26$
- (b) $3/26$
- (c) $1/52$
- (d) None of these

2. Attempt all parts:-

- 2.a. What is degeneracy in LPP? (CO1) 2
- 2.b. Define zero-one integer programming problem. (CO2) 2
- 2.c. Write the conditions for a function to be neither maxima nor minima. (CO3) 2
- 2.d. Write the formula for Simpson's one third rule. (CO4) 2
- 2.e. Is 2331024 divisible by 12? (CO5) 2

SECTION B

30

3. Answer any five of the following:-

- 3-a. Find the dual of following LPP : (CO1) 6
- Min. $Z = 2y + 5z$
- s.t.
- $x + y \geq 2$
- $2x + y + 6z \leq 6$
- $x - y + 3z = 4$
- $x, y, z \geq 0.$
- 3-b. Solve the following LPP by Simplex Method (CO1) 6
- Max $z = 3x_1 + 2x_2$
- Subject to
- $x_1 + x_2 \leq 4$
- $x_1 - x_2 \leq 2$
- and $x_1, x_2 \geq 0$
- 3-c. Explain the procedure of Gomory's cutting plain method for an integer programming problem. (CO2) 6
- 3-d. Define Integer programming problem and also the applications of Integer programming problem. (CO2) 6
- 3.e. Determine the maximum value of the function 6
- $f(x_1, x_2, x_3) = x_1 + 2x_3 + x_2x_3 - x_1^2 - x_2^2 - x_3^2.$ (CO3)
- 3.f. Find the real root of following equation $x^3 - 5x + 3 = 0$ by using Regula Falsi 6

method till 3rd iterations. (CO4)

- 3.g. How many words can be formed from the letters of the word "DIRECTOR" so that the vowels are always together? 6

SECTION C

50

4. Answer any one of the following:-

- 4-a. A firm manufactures two products A and B on which the profits earned per unit are Rs 3 and Rs 4 respectively. Each product is processed on two machines M_1 and M_2 . Product A requires one minute of processing time on M_1 and two minutes on M_2 while B requires one minute on M_1 and one minute on M_2 . Machine M_1 is available for not more than 7 hours, while machine M_2 is available for 10 hours during any working day. Formulate the number of units of products A and B to be manufactured to get maximum profit. Solve graphically to get the optimal solution. (CO1) 10

- 4-b. Solve the following LPP : (CO1) 10

$$\begin{aligned}\text{Max } Z &= -2x - y \\ \text{s.t. } 3x + y &= 3 \\ 4x + 3y &\geq 6 \\ x + 2y &\leq 4 \\ x, y &\geq 0\end{aligned}$$

5. Answer any one of the following:-

- 5-a. Find the optimum integer solution to the following LPP by using cutting plane method. (CO2) 10

$$\text{Max. } Z = X + Y$$

s.t.

$$3X + 2Y \leq 5$$

$$y \leq 2$$

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

- 5-b. Solve the following integer programming problem using Branch and Bound method (CO2) 10

$$\text{Max. } Z = 2X + Y$$

s.t.

$$X - Y \leq 10$$

$$2X - Y \leq 40$$

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

6. Answer any one of the following:-

- 6-a. Find the optimum solution of the following constrained multivariable problem: 10

(CO3)

$$\text{Min. } Z = x^2 + (y+1)^2 + (z-1)^2$$

$$\text{S.t. } x + 5y - 3z = 6$$

- 6-b. Find the extreme point of the function $u = x^2 + 4y^2 + 4z^2 + 4xy + 4xz + 16yz$. 10
(CO3)

7. Answer any one of the following:-

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

- 7-b. Use Gauss-Seidel iterative method to solve the following system of 10
simultaneous equations: (CO4)

$$9x + 4y + z = -17$$

$$x - 2y - 6z = 14$$

$$x + 6y = 4$$

Perform four iterations.

8. Answer any one of the following:-

- 8-a. Find the largest number of four digits divisible by 12, 15 and 18. (CO5) 10

- 8-b. Companies A, B, C produce 30%, 45%, 25% of the cars respectively. It is known 10
that 2%, 3% and 2% of these cars produced from A, B, C are defective. (CO5)

i. What is the probability that a car purchased is defective.

ii. If a car purchased is found to be defective what is the probability that
this car produced by the company A.