

Reg. No.:

Name :



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TERM END EXAMINATIONS (TEE) – January 2023

Programme	: B.Tech.[BAI]	Semester	: Interim 2022-23
Course Title/ Course Code	: Convex Optimization / CSA3002	Slot	: C21+C22+C23
Time	: 1½ hours	Max. Marks	: 50

Answer ALL the Questions

Q. No.	Question Description	Marks
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PART - A (30 Marks)

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| 1 | (a) Discover optimal solution for the following Linear Programming Problem using the graphical method.
Minimize $Z = -x_1 + 2x_2$
subject to the constraints
(i) $-2x_1 + 3x_2 \leq 10$, (ii) $x_1 + x_2 \leq 6$, (iii) $x_1 - 2x_2 \leq 2$
and $x_1, x_2 \geq 0$ | 10 |
|---|---|----|

OR

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| (b) | Test for convexity of polyhedron and ellipsoid.
Let $f : R^m \rightarrow R^n$ be the linear-fractional function
$f(x) = (Ax + b)/(c^T x + d)$, $dom f = \{x \mid c^T x + d > 0\}$.
The inverse image of a convex set C under f is :
$f^{-1}(C) = \{x \in dom f \mid f(x) \in C\}$.
For the convex sets such as
Polyhedron $C = \{y \mid Gy \leq h\}$
and
Ellipsoid $\{y \mid y^T P^{-1} y \leq 1\}$, $P \in S_{++}^n$,
give a simple description of $f^{-1}(C)$. | 10 |
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| 2 | (a) Analyze the steps of steepest descent algorithm for unconstrained minimization problem. Showcase the working of this algorithm taking an example function. | 10 |
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OR

- | | | |
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| (b) | Inspect the pseudocode of Teaching Learning Based Optimization (TLBO) algorithm mentioning all the parameters involved in it and examine its efficiency of TLBO algorithm to maximize the following function.
$f(x) = 2x_1 - 3x_1x_2 + x_2$, where $-4 \leq x_1, x_2 \leq 4$
Choose population size randomly and show the solution after two iterations. | 10 |
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- 3 (a) Analyze the steps of interior point method with an example function and diagrammatical representation. Utilize Barrier method to transform an inequality-constrained problem to unconstrained problem and KKT conditions in favor of this method. 10

OR

- (b) Compare and contrast between Ridge regression and LASSO regression with an example. Discover the prediction capability of ridge regression with mathematical representation. 10

PART - B (20 Marks)

- 4 Simplify the following convex optimization problem choosing Simplex Method. 10
Maximize $Z = x_1 + 2x_2$
subject to
 $x_1 + 4x_2 \leq 8$
 $x_1 + x_2 \leq 12$
and $x_1, x_2 \geq 0$
- 5 Identify the applications of convex optimization in machine learning and deep learning. Illustrate the features of CVXPY tool and write the python code for optimization problem using least squares method. 10

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