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Odd Semester Supplementary Examination-2022

Paper Name: Mathematics for ML &AIPaper Code: BTCSE(AI)-311
Time: 3 Hours **Maximum Marks:** 75

Section –A

(All questions are compulsory) (7 X 5 = 35)

S. No	Questions	Marks	Course Outcomes	Blooms Taxonomy Level
Q.1	Prove that $A = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ is digonalizable.	5	CO2	L4
Q.2	Define Subspace and hence Prove that $W = \{(x_1,\ x_2,\ 0) \in R^3 \mid x_1,\ x_2 \in R\}$ is a subspace of R^3.	5	CO1	L3
Q.3	Define linear transformation and prove that $T: R^3 \to R^2$ defined by $T(x, y, z) = (x + y + z,\ x - y + z)$ for all (x, y, z) in R^3 is a linear transformation.	5	CO2	L4
Q.4	Find the gradient of the scalar valued function $f(x,\ y,\ z) = x^3y^2z + 4xyz$ at $(1,\ 2,\ 1)$.	5	CO4	L3
Q.5	If $x = r\cos\theta$ and $y = rsin0$ then find the Jacobian $\frac{\partial(x,\ y)}{\partial(r,\ \theta)}$.	5	CO1	L3
Q.6	Compute the Hessian of the scalar valued function $f(x,\ y,\ z) = x^3y^2 + yz + z^2y$ at $(1,\ 2,\ 1)$.	5	CO4	L4
Q.7	Construct the Lagrange function for the LPP: Minimum$Z(x_1, x_2, x_3) = x_1x_2 + x_2x_3 + x_3x_1$, Subject to: $x_1 + x_2 + x_3 = 3$. Hence, find the minimum value of $Z(x_1, x_2, x_3)$.	5	CO3	L5

Section – B

(Attempt any Four Questions out of Six) **(4 X 10 = 40)**

S. No	Questions	Marks	Course Outcomes	Blooms Taxonomy Level
Q.1	Using the Gram-Schmidt Orthonormalization Process find an orthonormal basis for the subspace W of R^3 spanned by $\alpha_1 = (1,\ 1,\ 1\ ),\ \alpha_2 = (0, 1,\ 1)\ ,\ \alpha_3 = (1,\ 1,\ 0)$	10	CO3	L4
Q.2	Find the singular value decomposition $A = \begin{pmatrix} 2 & 2 \\ -1 & 1 \end{pmatrix}$.	10	CO2	L3
Q.3	Discuss the following terms: (i) Primal Support Vector Machine (ii) Hard Margin Support Vector Machine (iii) Soft Margin Support Vector Machine (iv) Dual Support Vector Machine (v) Convex Duality via Lagrange Multipliers.	10	CO5	L2
Q.4	Let T be Linear operator on R^3 defined by $T(x, y, z) =$ (x+y+z , x-y+z , x+y-z) for all (x,y,z) in R^3. Then find (i) Matrix of linear operator (ii) Find the Characteristic values (iii) Characteristic polynomial of T (iv) Is T invertible ?	10	CO2	L4
Q.5	Find the eigen space of the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$.	10	CO3	L3
Q.6	Define gradient decent and optimize to the quadratic function in two dimensions using gradient decent algorithm $f\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \frac{1}{2}\begin{pmatrix} x_1 \\ x_2 \end{pmatrix}^T \begin{pmatrix} 2 & 1 \\ 1 & 20 \end{pmatrix}\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} - \begin{pmatrix} 5 \\ 3 \end{pmatrix}^T \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$, where the initial location $x_0 = (-3,\ -1)^T$.	10	CO4	L4

BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3- Applying, 4- Analyzing, 5- Evaluating, 6- Creating)

*************End of Paper*************