Semester V (B.Tech)

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Jaypee University of Engineering & Technology, Guna

T-2 (Odd Semester 2022)

18B11CI932-ARTIFICIAL NEURAL NETWORK

Maximum Duration: 1 Hour 30 Minutes

Maximum Marks: 25

Notes:

1. This question paper has **five** questions.
2. Write relevant answers only.
3. Do not write anything on question paper (Except your Er. No.).

		Marks	CO Number(s) as per course description
Q1.	Consider the three prototype patterns shown in figure below	**[05]**	**CO3**

$\mathbf{p_1}$ $\mathbf{p_2}$ $\mathbf{p_3}$

a) Check the orthogonality of these patterns.
b) Use the Hebb rule to determine the weight matrix for a linear auto-associator to recognize these patterns.
c) Draw the network diagram.

Q2. Given the vector space of functions of the form $\alpha + \beta e^{2t}$. One basis set for this vector space is $V = \{1 + e^{2t}, 1 - e^{2t}\}$. Consider the differentiation transformation D. Determine the followings: **[05]** **CO2**

a) matrix of the transformation relative to the basis set.
b) eigenvalues and eigenvectors of the transformation.
c) matrix of the transformation relative to the eigenvectors as basis vectors.

Q3. Consider the quadratic function given below. Find out the followings **[05]** **CO4**

$$F(\mathbf{x}) = \frac{1}{2}\mathbf{x}^T \begin{bmatrix} 1 & -3 \\ -3 & 1 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 4 & -4 \end{bmatrix} \mathbf{x} + 2 .$$

a) Gradient and Hessian matrix for F(x)
b) Sketch the contour plot for F(x).
c) Find the directional derivative of F(x) at the point $x^* = [0\ 0]^T$ in the direction $p = [1\ 1]^T$

Q4. Discuss the limitations of Perceptron networks in computing the logical functions. [05] CO2

Q5. Consider the three input/output prototype patterns: [05] CO3

$$\left\{p_1 = \begin{bmatrix}1\\0\end{bmatrix}, t_1 = [1]\right\}, \left\{p_2 = \begin{bmatrix}1\\1\end{bmatrix}, t_2 = [-1]\right\}, \left\{p_1 = \begin{bmatrix}0\\1\end{bmatrix}, t_1 = [1]\right\}$$

(a) Show that the problem cannot be solved unless the network uses a bias

(b) Use a pseudoinverse rule to design a network with the given prototype patterns.