BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

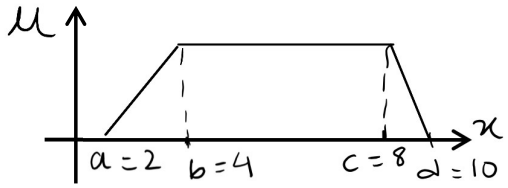
CLASS: BTech **SEMESTER : VII/ADD**
BRANCH: ECE **SESSION : MO/2024**

SUBJECT: EC415 R1 NEURAL NETWORK AND FUZZY SYSTEM

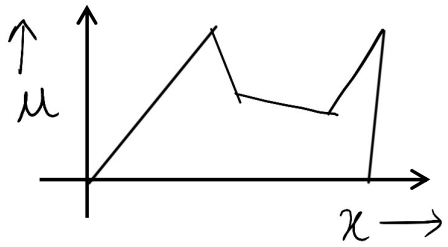
TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Explain what activation functions are and discuss their role in neural networks. Compare the common activation functions by providing their mathematical formula, plots, key characteristics, advantages, and disadvantages and their use cases.	[5]	1,2	2
Q.1(b)	Explain how the multilayer neural perceptron network can solve the nonlinearly separable problem. Solve the XOR problem to support your answer.	[5]	1,2	2,3
Q.2(a)	Explain different loss functions used in machine learning with their mathematical formulations. Compare various loss functions (at least 3), their behavior, and their suitability for specific application.	[5]	1,2 ,3	2
Q.2(b)	Draw a simple three-layer NN architecture and explain the forward and backward propagation of data. Explain the effect of different parameters (at least three) on the performance of Back propagation algorithm.	[5]		2
Q.3(a)	**i.** Write two key advantages of using RBF networks over standard feedforward neural networks. **ii.** Consider an RBF network with three RBF neurons in the hidden layer, each using a Gaussian function as the activation function. If the input vector is $\mathbf{x}=[2,3]$ and the centres of the RBF neurons are $\mathbf{c}_1=[1,1]$, $\mathbf{c}_2=[3,4]$, and $\mathbf{c}_3=[2,2]$ with spread parameter (variance) of $\sigma^2=1$. Calculate the outputs of the RBF neurons.	[5]	3	2,4
Q.3(b)	**i**. What is the difference between Machine learning and Deep learning? Give some examples of DL architecture. ii. In a CNN architecture, you have a convolutional layer with 16 filters, each of size 5×5, and it is applied to an input of dimensions $32\times32\times3$ using a stride of 1 and no padding. Calculate the output's dimension.	[5]	3	1,4
Q.4(a)	i. Is the concept of fuzzy is similar to probability theory ? Justify. ii.Find the value of μ corresponding to $x=3.5$ for the following trapezoidal membership function with a=2,b=4,c=8 and d=10.	[5]	4	2,4



Q.4(b)	Differentiate convex and non-convex MF. Proof the following membership function is non-convex in nature.	[5]	4	3,4



Q.5(a)	Discuss fuzzy inference system with block diagram. Explain any three defuzzification methods for defuzzifying a fuzzy set A of a universe of discourse Z.	[5]	4,5	2
Q.5(b)	Explain a fuzzy logic controller with the help of formulating an aircraft landing system.	[5]	4,5	3

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