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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **End - Term Examinations – MAY 2025** |
| **Date:** 22-05-2025 **Time:** 09:30 am – 12:30 pm |

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| **School:** SOCSE | **Program:** B.tech-IST | |
| **Course Code:** CSE3016 | **Course Name:** NEURAL NETWORK AND FUZZY LOGIC | |
| **Semester**: VI | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **26** | **24** | **26** | **24** | **-** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

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| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** | | | | |
| **1.** | Draw multi-layer recurrent neural network. | **2 Marks** | **L1** | **CO1** |
| **2.** | Name any four rules or models of neural network. | **2 Marks** | **L1** | **CO1** |
| **3.** | State perceptron rule. | **2 Marks** | **L1** | **CO1** |
| **4.** | List the limitations of backpropagation. | **2 Marks** | **L1** | **CO2** |
| **5.** | Compare single layer and multi-layer perceptron. | **2 Marks** | **L2** | **CO2** |
| **6.** | Let A={0.4/x1+0.7/x2+0.8/x3+0.2/x4+0.1/x5} and B={0.6/x1+ 0.9/x2 +0.3/x3+0.1/x4+0.5/x5} be fuzzy sets. Compute A˅B and A˄B. | **2 Marks** | **L2** | **CO3** |
| **7.** | Let A and A’ be fuzzy sets and AvA’≠U. Why? | **2 Marks** | **L1** | **CO3** |
| **8.** | Let young={0.6/x1+0.3/x2+0.1/x3+0.2/x4+0.5/x5}. Estimate very young where modifier very=x2. | **2 Marks** | **L2** | **CO3** |
| **9.** | Define fuzzy quantifier and mention the types of fuzzy quantifier. | **2 Marks** | **L1** | **CO4** |
| **10.** | Describe about generalized hypothetical syllogism. | **2 Marks** | **L2** | **CO4** |

**Part B**

**Answer the Questions. Total Marks 80M**

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| 11. | a. | Consider a neural network having two layers namely input and output. The input layer contains two inputs nodes and bias. The output layer holds one output unit. It also contains two normal weights. Construct a neural network model to calculate y=x1x2’ logic using delta rule. | 10 Marks | L3 | CO1 |
|  | **b.** | Explain various types of activation functions in detail. | **10 Marks** | **L2** | **CO1** |
| Or | | | | | |
| 12. | **a.** | Suppose a neural network having two layers namely input and output. The input layer contains two inputs nodes and bias. The output layer holds one output unit. It also contains two normal weights. Construct a neural network model to calculate y=x1x2 logic using perceptron rule. | **10 Marks** | **L3** | **CO1** |
|  | **b.** | Illustrate about McCulloch Pitts and Hebb’s Model. | **10 Marks** | **L2** | **CO1** |

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| 13. | a. | Let us assume that a radial basis neural network which contains three layers namely input, hidden and output. The input layer contains two nodes. The hidden layer also contains four nodes. The output layer contains one node. The activation function used in hidden and output layers are gaussian and binary step activation function. Develop a model to compute a logic XNOR using above scenario. | 15 Marks | L3 | CO2 |
|  | **b.** | Validate that Wji = ηδjoi with respect to output layer using back-propagation algorithm. | **5 Marks** | **L2** | **CO2** |
| Or | | | | | |
| 14. | **a.** | Consider a Kohonen neural network having two layers namely input and output. The input layer contains four inputs nodes. The output layer holds two output unit. It also contains six normal weights namely W11=0.6, W21=0.5, W31=0.1, W41=0.4, W12=0.8, W22=0.3, W32=0.2 and W42=0.7. How clustering is arranged using Kohonen self-organizing model. When X1=[1, 1, 0, 1], X2=[1, 0, 0, 0], X3=[1, 1, 1, 1], X4=[0, 1, 1, 1], X5=[1, 0, 0, 1], η=0.5. | **15 Marks** | **L2** | **CO2** |
|  | **b.** | Suppose a neural network having two layers namely input and output. The input layer contains four inputs nodes. The output layer holds two output unit. It also contains eight normal weights. Construct a learning vector quantization neural network model using below table.   |  |  | | --- | --- | | **Vector** | **Class** | | **[0, 0, 1, 0]** | **1** | | **[1, 0, 0, 0]** | **2** | | **[0, 0, 1, 1]** | **1** | | **[1, 1, 0, 0]** | **2** | | **[0, 1, 0, 0]** | **1** | | **5 Marks** | **L3** | **CO2** |

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| 15. | a. | Let a=25, b=50, c =100, d=125. Then deduce the equivalent fuzzy value of the following using trapezoidal membership function. x=20, 45, 90, 110, 75, 130. | 6 Marks | L3 | CO3 |
|  | **b.** | Suppose R and S are two fuzzy relations defined on the universe X x Y.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | |  | 0.4 | 0.5 | 0.2 |  | 0.6 | 0.1 | 0.7 | | R= | 0.1 | 0.6 | 0.8 | S= | 0.8 | 0.3 | 0.5 | |  | 0.3 | 0.9 | 0.5 |  | 0.4 | 0.6 | 0.2 |   Estimate (R˅S)C = RC˄SC. | **6 Marks** | **L2** | **CO3** |
|  | **c.** | Suppose A and B are two fuzzy sets where A={(X1,0.3), (X2,0.6), (X3,0.7)} B={(X1,0.5), (X2,0.4), (X3,0.2)} C={(X1,0.7), (X2,0.5), (X3,0.8)}. Prove that A˄(B˅C) = (A˄B)˅(A˄C). | **8 Marks** | **L3** | **CO3** |
| Or | | | | | |
| 16. | **a.** | Let us consider c=20 and σ=5. Determine the fuzzy value for the following using gaussian membership function.  x=25, 30, 15, 10, 5, 35. | **8 Marks** | **L3** | **CO3** |
|  | **b.** | Suppose A and B are two fuzzy sets where A={(X1,0.3), (X2,0.6), (X3,0.7)} B={(X1,0.7), (X2,0.5), (X3,0.8)} defined on X. Determine bounded sum, bounded difference. | **8 Marks** | **L2** | **CO3** |
|  | **c.** | Let U={1,2,3,4,5,6} and A be fuzzy sets where A={(1,0.3), (2,0.6), (3,0.7), (4,0.5), (5,0.4), (6,0.8)} defined on U. A mapping V=f(U)=U2-2 is defined on U. Compute V, B using extensive principles of fuzzy set. | **4 Marks** | **L3** | **CO3** |

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| 17. | a. | Compare multi-valued logic with classical logic. | 4 Marks | L2 | CO4 |
|  | **b.** | Verify (A˅B˅C)’ = A’˄B’˄C’ using three-valued logic | **6 Marks** | **L3** | **CO4** |
|  | **c.** | Let A={0.4/x1+0.7/x2+0.8/x3+0.2/x4+0.1/x5} and B={0.6/y1+ 0.9/y2 +0.3/y3+0.1/y4+0.5/y5} be fuzzy sets defined on X and Y. A’={0.3/x1+0.6/x2+0.2/x3+0.15/x4+0.4/x5} be also fuzzy set defined on X. Deduce generalized modus ponens. | **10 Marks** | **L2** | **CO4** |
| Or | | | | | |
| 18. | **a.** | Discuss Linguistic Hedges with suitable example. | **4 Marks** | **L2** | **CO4** |
|  | **b.** | Prove hypothetical syllogism tollens using three-valued logic. | **6 Marks** | **L3** | **CO4** |
|  | **c.** | Let A={0/10+0.8/20+0.8/30+0.8/40+0/50} and B={0/30+ 0.4/40 +0.4/50+0.4/60+0/70} be fuzzy sets then find the defuzzification value using center of sum and center of gravity method. | **10 Marks** | **L3** | **CO4** |