Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_

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**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **17EI2032** | **Duration :** | **3hrs** |
| **Sub. Name :** | **THEORY AND DESIGN OF NEURO FUZZY CONTROLLERS** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Signal transmission in a neuron is an electrochemical activity. Justify this statement with necessary explanations and diagrams. | CO1 | 10 |
| b. | Perform two training steps of the network using perceptron learning rule for λ = 1 and η = 0.25. The training pairs are x1=[2 0 -1], d1= -1. And x2 = [1 1 -1],d2 = 1 Assume bipolar binary activation function. | CO2 | 10 |
| (OR) | | | | |
| 2. | a. | Illustrate the concept of linear inseparability using the XOR problem. | CO2 | 5 |
| b. | With neat block diagrams, explain the weight adjustment mechanism in a backpropagation network and derive the generalized delta learning rule for it. | CO2 | 15 |
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| 3. | a. | Illustrate plant inverse identification technique using neural network and demonstrate its application in feedforward control. | CO3 | 10 |
| b. | Show how a neural network learns an approximation of the system characteristics and uses it to generate the appropriate control signal in a CMAC Controller | CO5 | 10 |
| (OR) | | | | |
| 4. | a. | What is the goal of inverted pendulum task? Explain how a neural network can be trained to balance an inverted pendulum. | CO5 | 15 |
| b. | Mention the advantages of neuro controller over conventional controller. | CO3 | 5 |
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| 5. | a. | How does a fuzzy set differ from a classical set? | CO4 | 4 |
| b. | For the given fuzzy sets, verify De Morgans laws. | CO2 | 6 |
| c. | In the field of computer networking there is an imprecise relationship between the level of use of a network communication bandwidth and the latency experienced in peer-to-peer communications. Let X be a fuzzy set of use levels (in terms of the percentage of full bandwidth used) and Y be a fuzzy set of latencies (in milliseconds) with the following membership functions:     1. Find the Cartesian product represented by the relation R= X x Y Now, suppose we have a second fuzzy set of bandwidth usage given by     Find S = Z o R   1. using max–min composition; 2. using max–product composition | CO5 | 10 |
| (OR) | | | | |
| 6. | a. | The objective in a distillation process is to separate components of amixture in the input stream. The relationship between the input variable, temperature, and the output variable, distillate fractions, is not precise but the human operator of this process has developed an intuitive understanding of this relationship.The universe for each of these variables is  X=universe of temperatures*(*◦F*)*={160*,*165*,*170*,*175*,*180*,*185*,*190*,*195}  Y = universe of distillate fractions (percentages) = {77*,* 80*,* 83*,* 86*,* 89*,* 92*,* 95*,* 98}  Now we define fuzzy setsAandBon X and Y, respectively:     1. Determine the proposition, IF ‘‘temperature is hot’’ THEN ‘‘separation of mixture is good,’’ or symbolically,A→B. From this, 2. Now define another fuzzy linguistic variable as     and find the ‘‘new’’ rule IF A’THEN B’, find B’using max–min composition. | CO5 | 15 |
| b. | Differentiate fuzzy tolerance and equivalence relations | CO5 | 5 |
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| 7. |  | For the aggregation of fuzzy sets represented by the following membership function, determine the crisp value using the following defuzzification methods.   1. Centroid Method 2. Weighted Average Method 3. Mean Max Membership Method 4. Center of Sums Method | CO4 | 20 |
| (OR) | | | | |
| 8. | a. | With a block diagram, explain the concept of adaptive fuzzy systems. | CO4 | 10 |
| b. | Write a note on the aggregation of fuzzy sets and the methods of aggregation. | CO4 | 10 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | What is a fuzzy logic controller? With relevant diagrams and explanations, describe the steps to design a fuzzy logic controller for a temperature process. | CO5 | 15 |
| b | Mention the advantages of fuzzy logic controllers over conventional controllers. | CO5 | 5 |