Code No: NR421401 **Set No.1**

IV B.Tech. I Semester Supplementary Examinations, July -2005
NEURAL NETWORKS & FUZZY LOGIC CONTROL
(Mechatronics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is the significance of momentum term in back propagation learning.
   (b) Why convergence is not guaranteed for the back propagation-learning algorithm.
2. (a) With help of suitable diagram, discuss the dynamics of the Hopfield network.
   (b) Taking a three-node net, why cannot the following states $V_1\ V_2\ V_3 = 000, 011, 110$ and 101 be made stable well.
3. (a) Explain Kohenen self organizing maps with example.
   (b) Explain with neat block diagram ART network architecture.
4. Explain the procedure of identification of dynamical system using neural networks.
5. Let X = 1, 2, 3, . . . , 10. Determine the cardinalities and relative cardinalities of the following fuzzy sets.
   (a) $\tilde{A} = \{(3, 10, (4, 0.2), (5, 0.3), (6, 0.4), (7, 0.6), (8, 0.8), (10, 1), (12, 0.8), (14, 0.6)\}$.
   (b) $\tilde{B} = \{(2, 0.4), (3, 0.6), (4, 0.8), (5, 1.0), (6, 0.8), (7, 0.6), (8, 0.4)\}$
   (c) $\tilde{C} = \{(2, 0.4), (4, 0.8), (5, 1.0), (7, 0.6)\}$
6. Write short notes on the following.
   (a) Fuzzification interface.
   (b) Knowledge base in fuzzy logic controller.
7. (a) Compare and contrast fuzzy logic control and classical control system.
   (b) Summarize in a point form the design steps of fuzzy logic control.
8. A dynamical system is represented by $y^1 + (1/\tau)y = Ax(t)$
   (a) Discretize the systems mathematical model into the form of a difference equation, i.e $y_{n+1} = f(x_n, y_n)$
   (b) For A = 10.0, T = 0.1, and a sampling interval t = 0.01, design a fuzzy rule-based system that gives values of y_{n+1} and x_n for a given value of y_n. Assume that x_n is varying over an interval between 0 and 1.

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Code No: NR421401 **Set No.2**

IV B.Tech. I Semester Supplementary Examinations, July -2005
NEURAL NETWORKS & FUZZY LOGIC CONTROL
(Mechatronics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. What is backpropagation?. Derive its learning algorithm with a schematic two-layer feedforward neural network.

2. (a) Explain the Hopfield network algorithm and its limitations.
   (b) Explain the Energy analysis of Discrete Hopfield Network.

3. Explain architecture of Konens self-organizing network. Explain the training algorithm of Kohonens layer.

4. Explain the procedure of identification of dynamical system using neural networks.

5. Let X = 1, 2, 3, . . . , 10. Determine the cardinalities and relative cardinalities of the following fuzzy sets.
   (a) $\tilde{A} = \{(3, 10, (4, 0.2), (5, 0.3), (6, 0.4), (7, 0.6), (8, 0.8), (10, 1), (12, 0.8), (14, 0.6)\}$
   .
   (b) $\tilde{B} = \{(2, 0.4), (3, 0.6), (4, 0.8), (5, 1.0), (6, 0.8), (7, 0.6), (8, 0.4)\}$
   (c) $\tilde{C} = \{(2, 0.4), (4, 0.8), (5, 1.0), (7, 0.6)\}$

6. Write short notes on the following.
   (a) Fuzzification interface.
   (b) Knowledge base in fuzzy logic controller.

7. Explain the step-by-step procedure in designing of a fuzzy logic controller.

8. A printer drum is driven by a brushless DC motor. The moment of inertia of the drum is $J = 0.00185 kg.m^2$. The motor resistance is $R = 1.12\Omega$. The torque constant for the motor is $K_T = 0.0363 Nm/A$. The back EMF constant is k = 0.0363 V/(rad/s). The equation of the system is
   $j\,\theta = \frac{K_T(V - \theta\ k)}{R}$
   where $= \frac{(V - \theta\ k)}{R}$ = I = motor current
   $\theta = rotational\ angle$
   $V = motorcontrol\ voltage$
   Using the initial conditions of $x_1 = 7.5^o$ and $x^2 = 150 rad/s$ and forming the difference equations, design the fuzzy controller.

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Code No: NR421401 **Set No.3**

IV B.Tech. I Semester Supplementary Examinations, July -2005
NEURAL NETWORKS & FUZZY LOGIC CONTROL
(Mechatronics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. With suitable diagram, derive the weight update equations in backpropagation algorithm for a multilayer feedforward neural network and explain the effect of learning rate, and momentum terms in weight update equations.
2. (a) Explain the Hopfield network algorithm and its limitations.
   (b) Explain the Energy analysis of Discrete Hopfield Network.
3. Explain architecture of Konens self-organizing network. Explain the training algorithm of Kohonens layer.
4. (a) What are major issues arise in plant inverse identification. Explain.
   (b) Explain the neural network configuration for plant inverse identification.
5. Let X = 1, 2, 3, . . . , 10. Determine the cardinalities and relative cardinalities of the following fuzzy sets.
   (a) $\tilde{A} = \{(3, 10, (4, 0.2), (5, 0.3), (6, 0.4), (7, 0.6), (8, 0.8), (10, 1), (12, 0.8), (14, 0.6)\}$.
   (b) $\tilde{B} = \{(2, 0.4), (3, 0.6), (4, 0.8), (5, 1.0), (6, 0.8), (7, 0.6), (8, 0.4)\}$
   (c) $\tilde{C} = \{(2, 0.4), (4, 0.8), (5, 1.0), (7, 0.6)\}$
6. Write short notes on the following
   (a) Knowledge base in fuzzy logic control system.
   (b) Decision making logic in fuzzy logic control system.
7. Explain the step-by-step procedure in designing of a fuzzy logic controller.
8. Design and develop a pressure process control by FLC model. Formulate necessary membership functions and required fuzzy rules for the application.

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Code No: NR421401 **Set No.4**

IV B.Tech. I Semester Supplementary Examinations, July -2005
NEURAL NETWORKS & FUZZY LOGIC CONTROL
(Mechatronics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is the significance of momentum term in back propagation learning.
   (b) Why convergence is not guaranteed for the back propagation-learning algorithm.
2. (a) With help of suitable diagram, discuss the dynamics of the Hopfield network.
   (b) Taking a three-node net, why cannot the following states $V_1\ V_2\ V_3 = 000, 011, 110$ and 101 be made stable well.
3. Explain architecture of Konens self-organizing network. Explain the training algorithm of Kohonens layer.
4. Explain the procedure of identification of dynamical system using neural networks.
5. (a) Prove $E(A) = E(A^c) = E(A \cap A^c) = E(A \cup A^c)$
   (b) Determine the intersections and unions of the following fuzzy sets:
      i. $\tilde{A} = \{(3, 10, (4, 0.2), (5, 0.3), (6, 0.4), (7, 0.6), (8, 0.8), (10, 1), (12, 0.8), (14, 0.6)\}$.
      ii. $\tilde{B} = \{(2, 0.4), (3, 0.6), (4, 0.8), (5, 1.0), (6, 0.8), (7, 0.6), (8, 0.4)\}$
      iii. $\tilde{C} = \{(2, 0.4), (4, 0.8), (5, 1.0), (7, 0.6)\}$
6. What are the main components of fuzzy logic controller? Explain each of them in detail.
7. Explain the step-by-step procedure in designing of a fuzzy logic controller.
8. Design a fuzzy controller for a temperature control system of a room. Assume your own control actions due to which the temperature of the room may vary. Design in fuzzy rule-based system to keep the room at a comfortable temperature.

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