

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014**

**Subject code: 2710312****Date: 09-01-2015****Subject Name: Intelligent Systems and Control****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Find the new weights, using back-propagation network for the network shown in figure 1. The network is presented with the input pattern [-1, 1] and the target output is +1. Use a learning rate of 0.25 and bipolar sigmoidal activation function. **07**
- (b) For the input and output fuzzy set windows for FLC given in figure 2 and figure 3, together with the fuzzy rule base shown in figure 4, determine the crisp control signal  $u(t)$  when  $e = -3$  and  $ce = 0.3$ . **07**
- Q.2** (a) The fuzzy sets A, B and C are all defined on the universe  $X=[0,5]$  with the following membership functions: **07**
- $$\mu_A(x) = \frac{1}{1 + 2(x - 2)^2}, \mu_B(x) = 3^{-x}, \mu_C(x) = \frac{2x}{x + 4}$$
1. Sketch the membership functions
  2. Define the intervals along the x-axis corresponding to the  $\lambda$  – cut sets for each of the fuzzy sets A, B and C for  $\lambda=0.2, 0.4, 0.6, 0.9, 1.0$ .
- (b) Give comparisons between classical relations and fuzzy relations. **07**  
 Consider two fuzzy sets  $A_1 = (0.2/x_1, 0.9/x_2)$  and  $A_2 = (0.3/y_1, 0.5/y_2, 1/y_3)$ . Determine the fuzzy relation between these sets.
- OR**
- (b) Discuss about Takagi – Sugeno models to develop fuzzy closed loop models in detail with suitable example. **07**
- Q.3** (a) Discuss about process reaction curve method for the identification of FOPTD models in detail. **07**
- (b) Discuss about on line identification of SOPTD models in detail. **07**
- OR**
- Q.3** (a) Discuss about the assessment of PI/PID controller in detail **07**
- (b) Discuss about auto tuning of PID controller using relay feedback experiments in detail. **07**
- Q.4** (a) Give explanation on fuzzy PID controller design in detail. **07**
- (b) Discuss about supervised and unsupervised learning of neural networks in detail. **07**
- OR**
- Q.4** (a) Give explanation on the use of Genetic algorithm in finding the optimal gains of conventional PID controller in detail. **07**
- (b) Give explanation on Radial Basis Function Network ( RBFN ) **07**
- Q.5** (a) Implement XOR function logic using suitable neural network. **07**
- (b) Discuss about the training of Kohonen Network in detail. **07**
- OR**
- Q.5** (a) Derive and discuss about delta training rule for multilayer feed forward neural network **07**

- (b) Discuss about the identification algorithm for Oscillatory step response in detail.

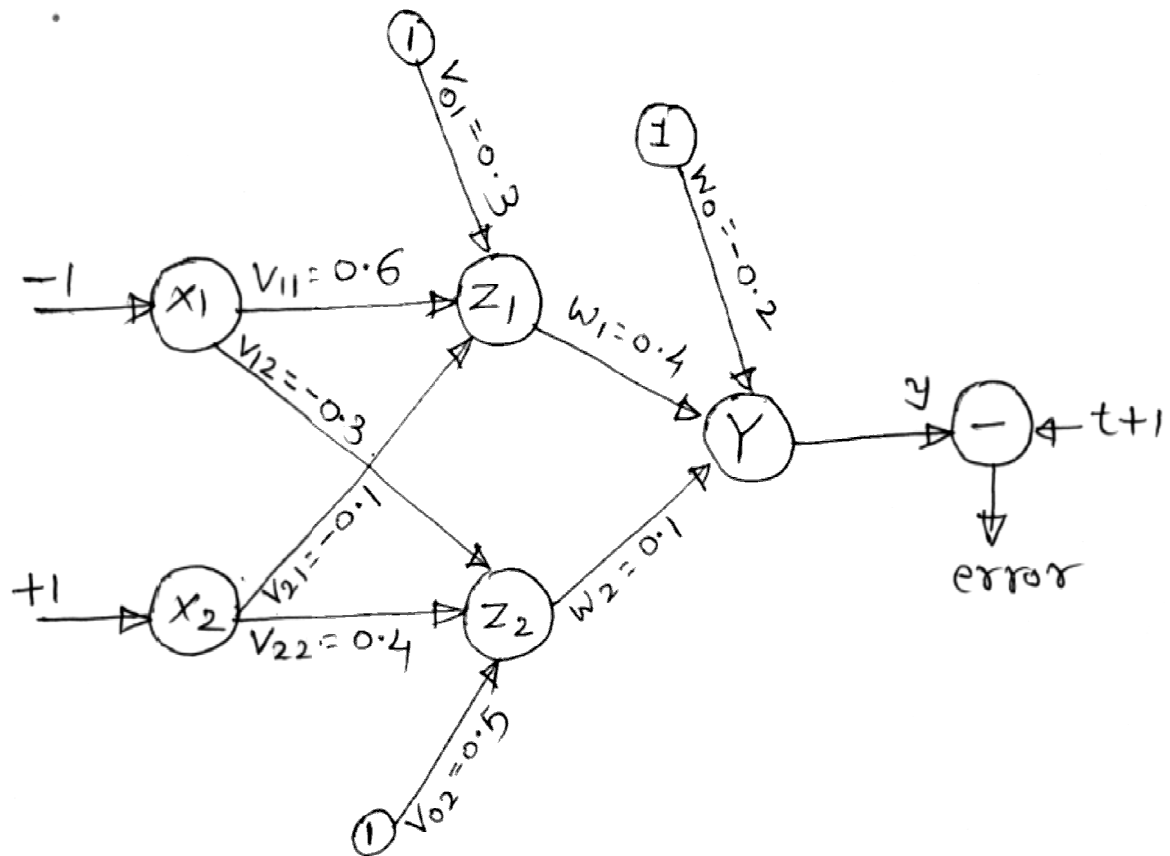


Figure: 1

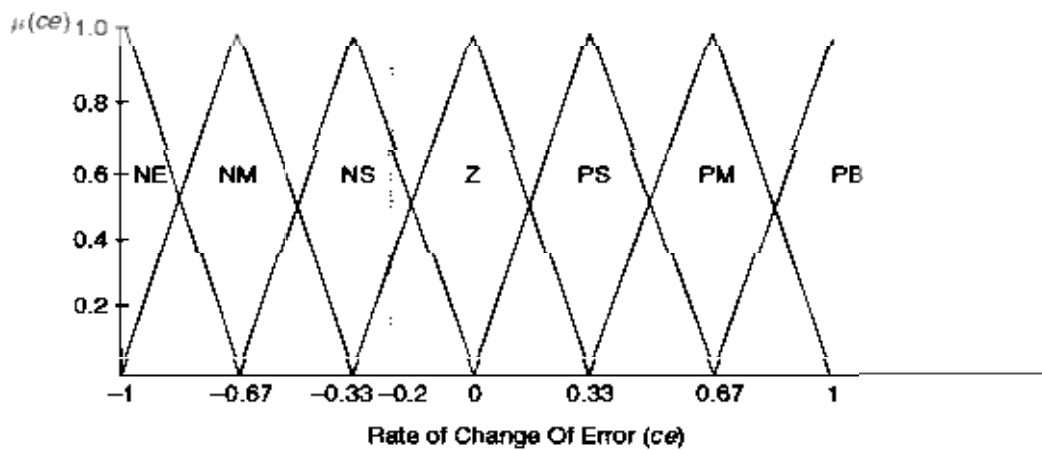
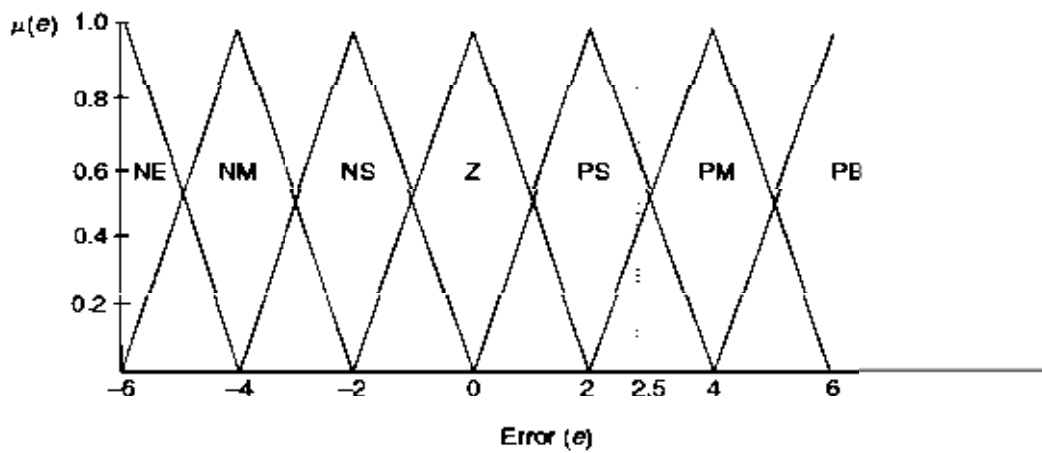


Figure:2

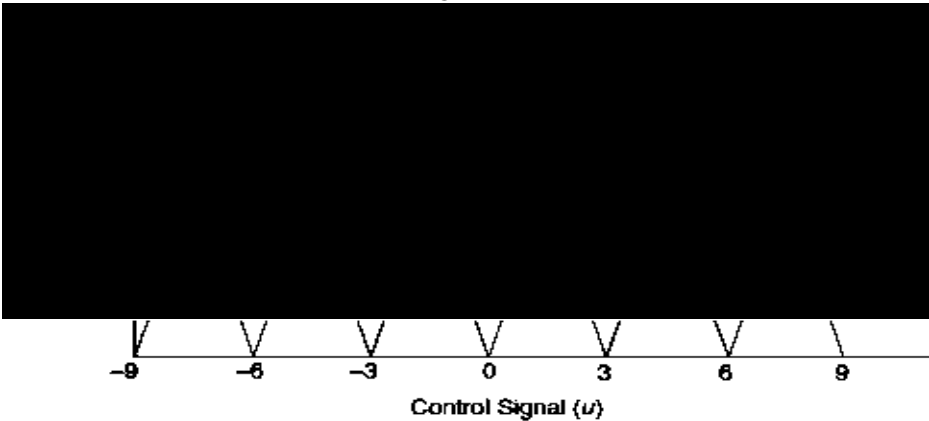


Figure:3

$e$ $ce$	NB	NM	NS	Z	PS	PM	PB
NB	NB	NB	NB	NM	Z	PM	PB
NM	NB	NB	NB	NM	PS	PM	PB
NS	NB	NB	NM	NS	PS	PM	PB
Z	NB	NM	NS	Z	PS	PM	PB
PS	NB	NM	NS	PS	PM	PB	PB
PM	NB	NM	NS	PM	PB	PB	PB
PB	NB	NM	Z	PM	PB	PB	PB

Figure:4

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