Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

SECOND SEMESTER M.TECH. (CONTROL SYSTEMS)

END SEMESTER EXAMINATIONS, APR/MAY 2017

SUBJECT: SOFT COMPUTING TECHNIQUES [ICE 5222]

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. What is meant by soft computing? Mention the different techniques available and briefly explain how each one is different from the other. 2

1B. Mention significance of a membership function. Draw a trapezoidal membership function and explain the meaning of the following terms: support, boundary, and height. 3

1C. Given two fuzzy sets *A* and *B*, compute their Complement, Union, Intersection, Difference, and verify the De Morgan's laws. 5

$$\underset{\sim}{A} = \left\{\frac{1}{2} + \frac{0.5}{3} + \frac{0.6}{4} + \frac{0.2}{5} + \frac{0.6}{6}\right\},$$
$$\underset{\sim}{B} = \left\{\frac{0.5}{2} + \frac{0.8}{3} + \frac{0.4}{4} + \frac{0.7}{5} + \frac{0.3}{6}\right\}.$$

2A. Consider speed control of DC motor. Two variables speed (in RPM) and load torque (N-m) are resulting in the following two fuzzy sets. 5

$$S = \frac{0.2}{x1} + \frac{0.6}{x2} + \frac{0.8}{x3} + \frac{0.6}{x4} + \frac{0.4}{x5}$$

$T = \frac{0.3}{y1} + \frac{0.5}{y2} + \frac{0.6}{y3} + \frac{1.0}{y4} + \frac{0.8}{y5} + \frac{0.3}{y6} + \frac{0.2}{y7}$. Find fuzzy relation *R* that relates speed and torque. The fuzzy armature current (*I*) relates universe y to z.

$$I = \begin{matrix} z \\ \begin{bmatrix} 0.4 \\ 0.5 \\ 0.6 \\ 0.3 \\ 0.7 \\ 0.6 \\ 1.0 \end{bmatrix} \end{matrix}$$

Find Q by max–min composition and max–product composition of *I* and *R*.

2B. Define defuzzification? For the given membership function shown in Fig.Q2B, determine the defuzzified output using centroid method. 5

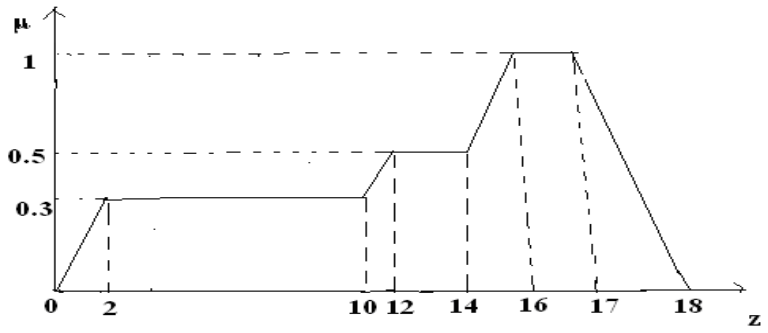

Fig. Q2B

3A. What are the different neural network architectures? Explain. 2

3B Generate OR function using McCulloch Pitts neuron model. 3

3C. Develop a perceptron for the OR function with bipolar inputs and targets. 5

Inputs		Target	
X1	X2	B	t
1	1	1	
-1	1	1	
1	-1	1	
-1	-1	1	

4A. List the similarities and differences between Kohonen SOM and Learning Vector Quantization. 2

4B. Consider a Kohonen net with 5 cluster units C1 to C5 and 2 input units. The weight vectors for the cluster units are (0.2, 0.3), (0.6,0.5), (0.4,0.7), (0.9,0.6) and (0.2,0.8). Find the winning cluster unit for the input vector (0.3, 0.4). Use learning rate of 0.3 and find the new weights for the winning unit. 3

4C. Obtain the output of a feedforward network with backpropagation algorithm, during the feed forward stage only, when the input pattern [0.3 0.5 0] is presented to it and the target output is 0.7. Consider the learning rate of 0.3. Use binary sigmoid activation function. The network has 3 input units X1, X2 and X3, 3 hidden units Z1, Z2 and Z3 and one output unit Y. Bias is connected to units Z3 and Y. The weight matrices are as shown below: 5

W=[1 1 2], W0=[-1]; $V=\begin{bmatrix}1 & 2 & 1\\ 1 & 2 & 2\\ 3 & 0 & 1\end{bmatrix}$, V0=[-1 0 1]

5A. What are neuro fuzzy systems? List their advantages over simple neural network or fuzzy logic based systems? 2

5B. Explain the architectural features of ART1 network. What are its advantages? 3

5C. Explain the meaning of Genetic algorithms. Why are they useful? Explain the genetic algorithms program flow using flowchart. 5