B.E. Electronics & Communication/Telecommunication Engineering (Model Curriculum)
Semester-VIII

ET805M-1 - Introduction of Neural Network and Artificial Intelligence

P. Pages : 2 **GUG/W/23/14360**

Time : Three Hours * 7 8 9 9 * Max. Marks : 80

Notes : 1. All questions carry marks as indicated.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) How fuzzy sets are represented mathematically? Illustrate with suitable example. **8**

b) Define membership function. Discuss following MFS in detail. **8**
i) Triangular MF ii) Trapezoidal MF
iii) Gaussian MF iv) Sigmoidal MF

OR

2. a) List out the different industrial applications of fuzzy logic based system. Discuss any one applications in detail. **8**

b) Define the following nomenclatures used in fuzzy set theory: **8**
i) Normality ii) Fuzzy singleton
iii) Alphacut iv) Cardinality

3. a) Define fuzzy number fuzzy sets A and B with universe of discourse $X \in [-20, 20]$ as given below. **8**

$A = 0.3/1 + 0.6/2 + 1.0/3 + 0.7/4 + 0.2/5$

$B = 0.5/10 + 1.0/11 + 0.5/12$

Find addition and subtraction of fuzzy numbers A and B

b) State and verify the following properties of fuzzy sets through an example. **8**
i) Involution
ii) Absorption
iii) Law of contraction
iv) De-Morgan's law

OR

4. a) Find and plot the distance d(A,B) between fuzzy sets A and B given below with the universe of discourse **8**
X = {1, 2, 3, 4}
A = {(1,0.5), (2,1), (3,0.3)}
B = {(2,0.4), (3,0.4), (4,1)}

b) Find Sugeno's class of complement of fuzzy A is given below for the values of $\lambda = \{-0.8, 0, 1, 2\}$ **8**

$A = 0.7/1 + 0.5/2 + 0.1/3 + 0.6/4$

5. a) Define Linguistic variable with the help of example. Also discuss the following classification of Linguistic variable with an example. **8**

i) Primary terms ii) Linguistic hedges

b) In the manufacture of concrete there are two key variables; the water content, measured in percentage of total weight, and the temperature at curing in the batch plant, measured in degree Fahrenheit**.** Nominal water content percentages vary from 1 to 5%, and nominal temperature limits are from 40 to 80ºF. We characterize each parameter in Fuzzy linguistic terms as follows: **8**

Low temperature : $\left\{\frac{1}{40}+\frac{0.7}{50}+\frac{0.5}{60}+\frac{0.3}{70}+\frac{0}{80}\right\}$

High temperature : $\left\{\frac{0}{40}+\frac{0.2}{50}+\frac{0.4}{60}+\frac{0.7}{70}+\frac{1.0}{80}\right\}$

High water content : $\left\{\frac{0}{1}+\frac{0.2}{2}+\frac{0.4}{3}+\frac{0.9}{4}+\frac{1.0}{5}\right\}$

Low water content : $\left\{\frac{1}{1}+\frac{0.8}{2}+\frac{0.6}{3}+\frac{0.4}{4}+\frac{0.2}{5}\right\}$

Find the following membership functions:

i) Temperature not very low
ii) Temperature not very high
iii) Temperature not very low and not very high.
iv) Water content slightly high.

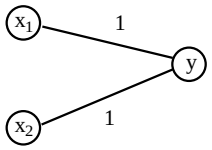
OR

6. a) Illustrate the functions of biological neuron. **8**
Discuss how artificial neuron models are inspired from biological neurons.

b) What is Artificial Neural network? Give it's strength and applications. **8**

7. a) Discuss in details the Artificial Neural Network terminologies. **8**

b) The network shown in following fig. **8**



Generate the output of logic AND functions by McCulloch- PHS neuron model.

OR

8. a) Draw and discuss the following models of neurons: **8**

i) Hard-limiting neuron. ii) Soft-limiting neuron.

b) Discuss few activation functions which are used in single layer and multilayer net to calculate the output. **8**

9. a) Define perceptron. Illustrate the basic concept of pattern classifier with block diagram. **8**

b) What is machine learning? List out it's types. Also explain any one into details. **8**

OR

10. a) Draw and discuss the architecture of feed forward neural network. **8**

b) Discuss the role of Artificial Intelligence in real life applications. Illustrate with suitable example. **8**

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