BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION SP2022)

CLASS: M.Tech./PRE-PHD **SEMESTER: I**
BRANCH: EEE **SESSION: MO 2022**

SUBJECT: EE519 COMPUTATIONAL TECHNIQUES IN ELECTRICAL ENGINEERING
TIME: 03 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. **The question paper contains 5 questions each of 10 marks and total 50 marks.**
2. **Attempt all questions.**
3. **The missing data, if any, may be assumed suitably.**
4. **Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

Q.1(a) Define design constraints, variable bounds and objective function. Also, make a flow chart for the optimal design formulation process. [5] CO-2

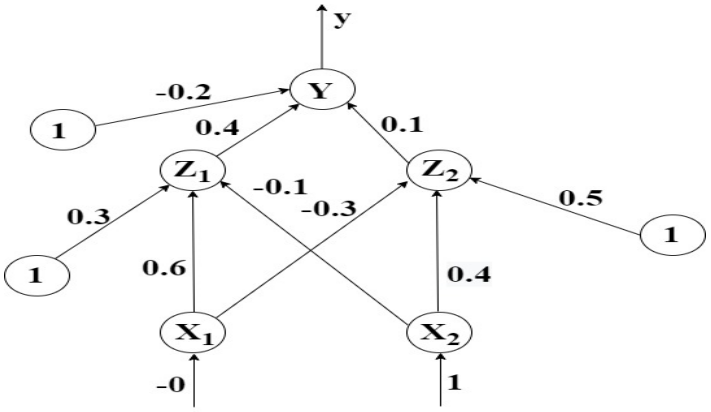
Q.1(b) Find the value of y when x = 0.1, y (0) = 1 and h = 0.1 for $\frac{dy}{dx} = 3x + y^2$, using Runge's Kutta fourth order. [5] CO-2

Q.2(a) Design the fuzzy logic-based application related to electrical engineering. [5] CO-5

Q.2(b) Design the neural network-based application related to electrical engineering. [5] CO-4

Q.3(a) Describe the biological neural network. Also, write the comparison between brain versus computer. [5] CO-3

Q.3(b) Find the new weights using back-propagation network for the network shown in figure below. It is presented with the input pattern [0,1] and the target output is 1. Use a learning rate α = 0.25 and binary sigmoidal activation function. [5] CO-3



Q.4(a) Consider two fuzzy sets $\tilde{A} = \left\{\frac{0.2}{1} + \frac{0.3}{2} + \frac{0.4}{3} + \frac{0.5}{4}\right\}$, $\tilde{B} = \left\{\frac{0.1}{1} + \frac{0.2}{2} + \frac{0.2}{3} + \frac{1}{4}\right\}$. Find the algebraic sum, algebraic product, bounded sum and bounded difference of the given fuzzy sets. [2] CO-3

Q.4(b) Consider a universe of aircraft speed near the speed of sound as X = {0.72, 0.725, 0.75, 0.775, 0.78} and a fuzzy set on this universe for the speed "near mach 0.75" = $\tilde{M}$ where $\tilde{M} = \left\{\frac{0}{0.72} + \frac{0.8}{0.725} + \frac{1}{0.75} + \frac{0.8}{0.775} + \frac{0}{0.78}\right\}$. Define a universe of altitudes as Y = {21, 22, 23, 24, 25, 26, 27} in k-feet and a fuzzy set on this universe for the altitude fuzzy set "approximately 24,000 feet" = $\tilde{N}$ where $\tilde{N} = \left\{\frac{0}{21k} + \frac{0.2}{22k} + \frac{0.7}{23k} + \frac{1}{24k} + \frac{0.7}{25k} + \frac{0.2}{26k} + \frac{0}{27k}\right\}$ [3] CO-3

(i) Construct a relation $\tilde{R} = \tilde{M} \times \tilde{N}$ (ii) For another aircraft speed say $\widetilde{M_1}$, in the region of mach 0.75 where $\widetilde{M_1} = \left\{\frac{0}{0.72} + \frac{0.8}{0.725} + \frac{1}{0.75} + \frac{0.6}{0.775} + \frac{0}{0.78}\right\}$ find the relation $\tilde{S} = \widetilde{M_1} \circ \tilde{R}$ using max-min relation.

PTO

Q.4(c) These three fuzzy sets $\widetilde{B_1}$, $\widetilde{B_2}$, $\widetilde{B_3}$ shown in figures below represents the uncertainty in each survey as to the membership of right-of -way width, in meters. Calculate the fuzzified values using the (i) center of largest area and (ii) centroid method. (Maximum height of figure 1, 2, and 3 are 0.3, 0.5 and 1 respectively) [5] CO-5

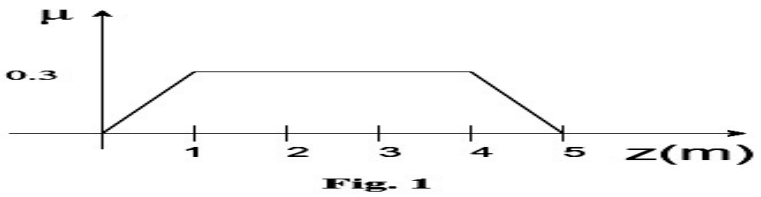


Fig. 1

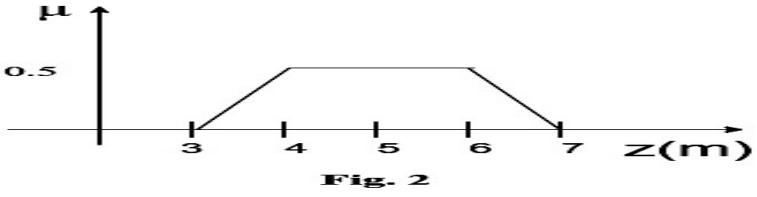


Fig. 2

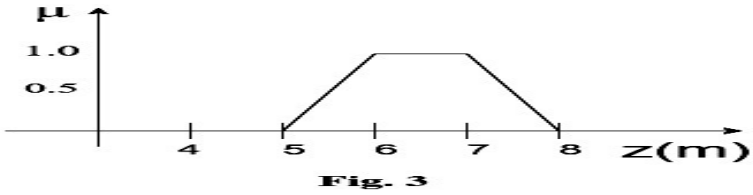


Fig. 3

Q.5(a) Describe the architecture of perceptron, learning rule and training algorithm. [5] CO-1

Q.5(b) Describe the Neuro fuzzy hybrid systems, neuro genetic hybrid systems and fuzzy genetic hybrid systems in detail. [5] CO-1

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