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NEW SCHEME
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**Seventh Semester B.E. Degree Examination, Dec.06/Jan. 07**  
**Electrical and Electronics Engineering**  
**Fuzzy Logic Control**

Time: 3 hrs.]

[Max. Marks:100

**Note: 1. Answer any FIVE questions.****2. Assume suitable data for missing data.**

- 1 a. With respect to fuzzy set, explain the following.  
 i) Normal and subnormal ii) height and Nucleus iii) Support and  $\alpha$  - cut. (06 Marks)  
 b. Give the definitions of different fuzzy set operations viz, union, inter section, complement of a fuzzy set. Illustrate them with the following fuzzy sets.

$$A = \left\{ \frac{0.1}{0} + \frac{0.4}{1} + \frac{1}{2} + \frac{0.3}{3} + \frac{0.2}{4} \right\}$$

$$B = \left\{ \frac{0.2}{0} + \frac{0.5}{1} + \frac{1}{2} + \frac{0.4}{3} + \frac{0.3}{4} \right\}$$

Also prove the DeMorgan's theorem for the above sets. (08 Marks)

- c. Discuss the axioms of S-norm and t-norm. (06 Marks)
- 2 a. Explain briefly the composition of fuzzy relation. (06 Marks)  
 b. Find the fuzzy Cartesian product using "Min-Max" composition, for the given fuzzy sets.

$$I = \left\{ \frac{0.4}{0.8} + \frac{0.7}{0.9} + \frac{1}{1} + \frac{0.8}{1.1} + \frac{0.6}{1.2} \right\}$$

$$V = \left\{ \frac{0.2}{30} + \frac{0.8}{45} + \frac{1}{60} + \frac{0.9}{75} + \frac{0.7}{90} \right\}$$

$$C = \left\{ \frac{0.4}{0.5} + \frac{1}{0.6} + \frac{0.5}{0.7} \right\}$$

Find i)  $I = I \times C$  ii)  $P = V \times I$  iii)  $E = P.T.$  (08 Marks)

- c. With suitable illustration, explain the operations, projection (proj) and cylindrical (cc) extension. (06 Marks)
- 3 a. Discuss with examples, the fuzzy logic propositions. (06 Marks)  
 b. What is approximate reasoning? Describe the general inference rules used in approximate reasoning. (08 Marks)  
 c. Explain how fuzzy conditional ( IF-THEN) production rules are interpreted? Illustrate with suitable examples. (06 Marks)
- 4 a. With the help of block diagram, explain the general structure of a FKBC (fuzzy knowledge based controller). (10 Marks)  
 b. Explain i) PI ii) PD iii) PID fuzzy controllers. (10 Marks)

Contd... 2

- 5 a. Explain in "the choice of membership function" as a design parameter involved in the construction of database. (06 Marks)
- b. What are the different defuzzification methods? Explain any two methods of defuzzification. (06 Marks)
- c. Determine the fuzzifier output by centre of sums, first of maximum, last of maximum, mean of maximum, and centre of average (or weighted average method). (08 Marks)

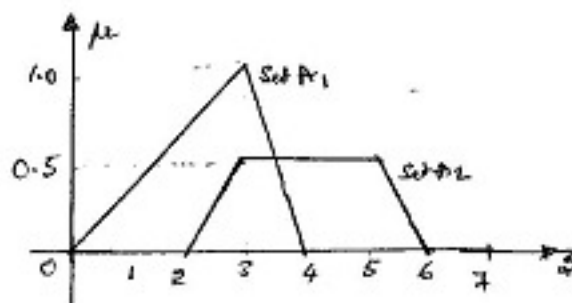


Fig. 5 (c)

- 6 a. Show that FKBC is a non-linear transfer element of a system controller. (10 Marks)
- b. Explain the most important any two adaptation techniques of fuzzy system. (10 Marks)
- 7 a. Explain the self organizing fuzzy logic controller. (10 Marks)
- b. Discuss the advantages of FKBC in process control. Explain how FKBC is superior to conventional controllers? Explain. (10 Marks)
- 8 Write short notes on any four :
- Sliding mode FKBC
  - Fuzzyfication methods.
  - Scaling factor and its heuristic method of selecting scaling factor.
  - Ways of assigning membership values.
  - Fuzzy associative memory (FAM).

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