2017

M.Sc. 4th Semester Examination

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

PAPER—MTM-403

Full Marks : 50

Time : 2 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

(Magneto Hydro-dynamics & Soft Computing)

Unit—I

(Magneto Hydro-dynamics)

[Marks : 25]

Answer Q. No. *1* and any *two* from the rest.

1. Answer any *two* questions : 2×2

(a) State Alfven theorem.

(b) Write Maxwell's electromagnetic field equations when medium is in motion.

(c) Define Hartmann number and write its significance.

2. (a) Using MHD approximations simplify the generalised Ampere's law.

(b) Derive magnetic induction equation. Write its dimensionless form. 3+(4+1)

3. Give the mathematical formulation of MHD coutte flow problem. Find the velocity component of this flow. 3+5

4. Interpret physically the expression for Lorentz force by per unit volume (simplified form). Hence indicate the existence of transverse Alve'n wave. 5+3

[Internal Assesment : 05 Marks]

Unit—II

(Soft Computing)

[Marks : 25]

Answer Q. No. 5 and any *two* from the rest.

5. Answer any *two* questions : 2×2

(i) What are the differences between biological neural network and artificial neural network ?

(ii) What are the basic parameters involved in Genetic Algorithms.

(iii) Explain fuzzy inference rules.

(iv) Draw the flowchart of Genetic Algorithm.

6. Define bias and threshobe in artificial neural network. Implement OR function with binary inputs and bipolar targets using perceptron training algorithm upto 3 iterations. 2+6

7. (i) Select the parent chromosomes for cross-over using Roulette-Wheel selection procedure for the following informations :

Objective function : Max $f(x) = 50x - x^2$, $1 \leq x \leq 30$
Current population : 01011, 10011, 01110, 01010, 01101
Random numbers : 0.41, 0.97, 0.12, 0.36, 0.64

4

(ii) Suppose a fuzzy rule for a system controller is "IF the concentration within the tank is 'high', THEN the tank should drain at a 'fast' rate". The fuzzy sets for a "high" concentration and a "fast" drainage rate can be

$$\tilde{H} = \text{"High"} = \left\{\frac{0}{100} + \frac{0.2}{150} + \frac{0.4}{200} + \frac{0.7}{250} + \frac{1}{300}\right\}$$

represents universe X in grams/liter and

$$\tilde{F} = \text{"Fast"} = \left\{\frac{0}{0} + \frac{0.3}{2} + \frac{0.6}{4} + \frac{1.0}{6} + \frac{0.8}{8}\right\}$$

represents universe Y in liters/minute

(a) From these fuzzy sets construct a relation for the rule.

(b) Suppose a new rule uses a different concentration, say "moderately high" and is expressed by the fuzzy membership function as

$$\tilde{H}' = \text{"moderately high"}$$

$$= \left\{\frac{0}{100} + \frac{0.3}{150} + \frac{0.3}{200} + \frac{1.0}{250} + \frac{0.1}{300}\right\}$$

using Max-Min compositions find the resulting drainage rate. 4

8. The fuzzy rules for a simple temperature regulator that uses in a fan should look like this :

1. IF T is "very cold", THEN "stop" fan.
2. IF T is "cold", THEN "turn down" fan.
3. IF T is "normal", THEN "maintain" level.
4. IF T is "hot", THEN "speed up" fan.

The states of input and output fuzzy veriables and corresponding fuzzy numbers are as

Variable(s)	State(s)	Fuzzy number(s)
Temperature (T)	Very Cold	(0, 0, 10, 15)
	Cold	(10, 15, 20, 25)
	Normal	(20, 25, 30, 35)
	Hot	(30, 35, 45, 45)
Regulator level	Stop	(0, 0, 0.35)
	Turn down	(0.2, 0.4, 0.6)
	Maintain	(0.5, 0.7, 0.85)
	Speed up	(0.7, 1.0, 1.0)

Determine the regulator level when temperature (T_0) is given 13°C using Mamdani's Fuzzy inference system. 8

[Internal Assesment : 05 Marks]