2019

MSc

4th Semester Examination

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

PAPER – MTM-403

Full Marks : 50

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

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

Illustrate the answers wherever necessary.

UNIT – I

Full Marks: 25

(Magneto Hydro-dynamics)

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

1. Answer any ***TWO*** questions : 2 X 2

   a) Describe, how to work Magneto-Hydrodynamics as a power generator.

   b) Write, the statement of Alfven's theorem.

   c) Explain the terms 'drift velocity' and 'line of force' in MHD.

2. (a) Write down the basic equations of magneto-hydrodynamics and hence deduce the magnetic induction equation in MHD flows. 2+3

   (b) Find the rate of change of magnetic energy in magneto-hydrodynamic. 3

3. (a) Define magnetic Reynolds number and explain its significance.

   (b) For a conducting fluid in a magnetic field, show that the magnetic body force per unit volume, i.e. $\mu (\nabla \times H) \times H$ is equivalent to a tension μH^2 per unit area along the lines of force, together with a hydrostatic pressure $\frac{1}{2}\mu H^2$, where symbols have their usual meaning . 2+6

4. (a) Prove that in a steady non-uniformly rotating star, the angular velocity must be constant over the surface traced out by the rotation of the magnetic lines of force about the magnetic field axis . 4

   (b) Give the mathematical formulation of MHD flow past a porous plate and derive its velocity expression . 4

[Internal Assessment : 05 marks]

UNIT – II

Full Marks: 25

(Soft Computing)

Answer Q. no ***5*** and any ***TWO*** from the rest.

5. Answer any ***TWO*** questions : 2x2

(a) What is the importance of Defuzzification methods in fuzzy control system ?

(b) Give the schematic diagram of the working cycle of Binary Genetic Algorithm.

(c) Draw the McCulloch – Pitts neuron model for the Boolean function

$$f(x_1, x_2, x_3) = x_1 x_2 \bar{x}_3 + \bar{x}_1 x_2 \bar{x}_3$$

(d) What do you mean by the terms soft and hybrid computing ?

6. (a) Let X ={1, 2, 3, 4 } and Y = $\{a, b, c, d\}$ be two universes of discourses. Also, let

$\tilde{A}$ = {(1,0.4), (2, 0.7), (3,0.9), (4,0.3)},

$\tilde{B}$ = {$(b, 0.6), (c, 0.8), (d, 1.0)$} and

$\tilde{C}$ = {$(a, 0.9), (b, 0.0.5), (c, 0.1)$} .

Determine the fuzzy relation of the following rule :

" IF x is $\tilde{A}$ THEN y is $\tilde{B}$ ELSE y is $\tilde{C}$ ". 3

(b) What do you mean by fuzzy inference system (FIS) ? Write the steps of Mamdani's metho in FIS . (2+3)

7. Using Binary Coded Genetic Algorithm, solve the following (one iteration only) 8

Max $f(x) = x^2, 0 < x < 31$

Given

POP_SIZE = N =4 , P_c = 1.0, P_m = 0.04

Random Nos. for selection : 0.11, 0.24, 0.45, 0.85

Random Nos. for Mutation:

0.045, 0.6, 0.8, 0.9, 0.5, 0.58, 0.95, 0.70, 0.78, 0.48, 0.65, 0.03, 0.99, 0.85

Positions for crossover :

POS1 = 4, POS2 = 2

Initial population :

01101, 11000, 01000, 10011

8. (a) Verify the output of logical OR function by a single perceptron Given initial weights = W = $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$, and initial bias = b = -1. (4)

(b) Write short note of the following terms :

(i) Network topology (ii) Perceptron learning rule . (2+2)

[Internal Assessment : 05 Marks]