PG/IVS/MTM-403/15

M.Sc. 4th Semester Examination, 2015

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

(Magneto Hydro-dynamics & Soft Computing)

PAPER – MTM - 403

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate marks

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*) Explain Alfve'n waves.

(*b*) Explain Hartman number.

(*c*) What do you mean by Lorentz force ?

2. Show that for a conducting fluid in a magnetic field, the magnetic body force per unit volume viz.$\mu(\vec{\nabla}\times\vec{H})\times\vec{H}$ is equivalent to a tension $\mu\vec{H}^2$ per unit area along the lines of force together with a hydrostatic pressure $\frac{1}{2}\mu\vec{H}^2$. 8

3. (*a*) Deduce the equations of motion for a conducting fluid. 3

(*b*) What do you mean by Ferraro's law of isorotation ? 2

(*c*) Write down the fundamental equations of magneto hydrodynamics. 3

4. A viscous, incompressible conducting fluid of uniform density are confined between a channel made by an infinitely long conducting horizontal plate $y = 0$(lower) and a horizontal infinitely long non-conducting plate $y = h$(upper). Assume that there is no pressure gradient and a uniform magnetic field H_0 acts perpendicular to the

plates. The lower plate is at rest and the upper plate moves with uniform velocity U. Find the velocity of the fluid and the magnetic field. 8

[*Internal Assessment* : 5 Marks]

UNIT – II

(*Soft Computing*)

[*Marks* : 25]

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

5. Write the short note of any *two* of the following : 2×2

   (*i*) Soft computing

   (*ii*) Supervised learning in ANN

   (*iii*) Fuzzy Inference

   (*iv*) Roulette-wheel selection process.

6. (*a*) Define linearly separable and non-separable sets. Show that logical XOR cannot be classified by single layer perceptron. $2 + 3$

(*b*) Let $\tilde{A} = \tilde{B} = \{1, 5, 9, 10\}$ be some typical job performance indexes in an application, with the following discrete membership function for the fuzzy description "poor performance".

$$\mu\tilde{A}(a) = \begin{cases} 1{\cdot}0 & \text{if } a = 1 \\ 0{\cdot}5 & \text{if } a = 5 \\ 0{\cdot}2 & \text{if } a = 9 \\ 0{\cdot}0 & \text{if } a = 10 \end{cases}$$

Let R be a fuzzy relation between two numbers in $\tilde{A}$, meaning "very close to each other" and be defined by the following table :

R :	1	5	9	10
1	1·0	0·5	0·0	0·0
5	0·5	1·0	0·5	0·2
9	0·0	0·5	1·0	0·5
10	0·0	0·2	0·5	1·0

Suppose that one wants to perform the following fuzzy logic inference.

Promise	a has poor performance
Implication	a and b are very close to each other
Conclusion	b has some what poor performance

Compute its membership value $\mu\hat{B}(9)$. 3

7. (*a*) Solve the following classification $\{X_1^T = (0, 0), y_1 = 0\}$, $\{X_2^T = (0, 1), y_2 = 1\}$, $\{X_3^T = (1, 0), y_3 = 1\}$ and $X_4^T = (1, 1), y_4 = 1\}$ by using single layer perceptron network with initial weight $w_0 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ and bias $b_0 = 1$. 6

(*b*) Describe the significant of mutation in GA. 2

8. Maximize $f(x) = x^3 - 12x^2 + 45x$ in $0 \le x \le 4$ using real coded GA (one iteration only) given that the population size $N = 5$, cross-over probability $(P_c) = 0{\cdot}4$ and mutation probability $(P_c) = 0{\cdot}2$.

Initial population : 1·852, 3·828, 1·380, 1·472, 1·776

Random Nos. to be used for selection :

0·46, 0·30, 0·82, 0·90, 0·56,

Random Nos. to be used for cross-over :

0·9, 0·34, 0·13, 0·7, 0·09,

Random Nos. to be used for mutation :

0·85, 0·19, 0·45, 0·96

Permutation value (Δ) = 1·20
Random no.(r) = 0·55 } for random mutation. 8

[*Internal Assessment* : 5 Marks]
