2023

M.Sc.

4th Semester Examination

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

PAPER : MTM-402

Full Marks : 40

Time : 2 hours

The figures in the right-hand margin indicate marks.
The symbols used have their usual meanings.

(MTM-402)

UNIT—1

(*Marks* : 20)

1. Answer *any* **two** questions from the following : $2\times2=4$

(*a*) What are the causes of uncertainty?

(b) Justify, why any interval number $I = [a, b]$ does not hold $I - I = 0$?

(c) Let $f(x) = x^2 - 1$. Find $f(\widetilde{A})$, where $\widetilde{A} = \{(-2, 0{\cdot}41), (-1, 0{\cdot}75), (0, 1{\cdot}0), (1, 0{\cdot}32), (2, 0{\cdot}96), (3, 0{\cdot}2)\}$.

(d) Show that union of two convex fuzzy sets is not a convex fuzzy set in general.

2. Answer *any* **two** questions from the following : 4×2=8

(a) Prove that the fuzzy sets satisfy the distributive laws under the standard fuzzy union and intersection.

(b) Let $\widetilde{A} = (0, 3, 5)$ be a triangular fyzzy number. Show that $\widetilde{A}^2$ is not a triangular fuzzy number in general.

(c) Show that $2(-1, 0, 5) + (1, 3, 5, 7) = (-1, 3, 5, 17)$ using α-cut method.

(d) Define the interval number. Write different arithmetic operations on interval numbers.

Answer *any* **one** question from the following : 8×1=8

3. *(a)* *(i)* What do you mean by symmetric and non-symmetric fuzzy LPP?

(ii) Explain the Werner's method to convert the fuzzy LPP to corresponding crisp LPP. 2+6

(b) *(i)* Illustrate the Bellman and Zadeh principle of optimality of a fuzzy LPP with an example.

(ii) Let the fuzzy LPP with fuzzy resources be

Maximize $Z = 2x_1 + x_2$

subject to

$$3x_1 + x_2 \leq \widetilde{13}$$
$$4x_1 + 3x_2 \leq \widetilde{16}$$
$$x_1 + 2x_2 \leq \widetilde{10}$$
$$\text{and } x_1, x_2 \geq 0$$

and the tolerances as $p_1 = 2$, $p_2 = 4$ and $p_3 = 3$. Convert the fuzzy LPP to an equivalent crisp parametric programming problem. 3+5

UNIT—2

(*Marks* : **20**)

1. Answer *any* **two** questions from the following : $2\times2=4$

   (a) Write the different features of soft computing.

   (b) Find the weights and threshold values of an ANN that should classify the following input/output pairs :

x_1	x_2	$x_1 \wedge x_2$
0	0	0
0	1	0
1	0	0
1	1	1

   (c) Write the drawbacks of gradient-based optimization techniques over GA.

   (d) How does fuzzy logic differ from usual logic?

2. Answer *any* **two** questions from the following : 4×2=8

(a) Let $X = \{1, 2, 3, 4\}$ and $Y = \{a, b, c\}$ be two universes of discourses. Also, let $\tilde{A} = \{(1, 0{\cdot}2), (2, 0{\cdot}5), (3, 0{\cdot}7), (4, 1{\cdot}0)\}$, $\tilde{B} = \{(1, 0{\cdot}3), (2, 0{\cdot}4), (3, 0{\cdot}8), (4, 0{\cdot}7)\}$ and $\tilde{C} = \{(a, 0{\cdot}1), (b, 0{\cdot}6), (c, 0{\cdot}9)$. Determine the fuzzy relation of the following fuzzy rule : "If x is $\tilde{A}$ AND x is $\tilde{B}$, THEN y is $\tilde{C}$".

(b) Explain different learning processes of ANN.

(c) Realise a Hebb net for the logical AND function with bipolar inputs and targets.

(d) Explain Roulette-wheel selection procedure for real coded GA.

3. Answer *any* **one** question from the following : 8×1=8

(a) Describe the binary coded GA procedure to maximize a real valued funciton $y = f(x_1, x_2)$ in $a \leq x_1, x_2 \leq b$.

(b) Write the iterative computation to classify the following patterns by perceptron learning rule :

$\{[(1, 1, 1), 1], [(1, 1, -1), 1], [(1, -1, -1), -1], [(-1, 1, -1), -1]\}$.

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