Ref No.: Ex/EE/5/T/523A/2024

BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) FIFITH YEAR SECOND SEMESTER - 2024

SUBJECT: ADVANCED COMPUTING TECHNIQUES

Time: Three Hours | Full Marks 100 (50 Marks for each part)

Use a separate Answer-Script for each part

Two marks are reserved for neat and well-organized answers

Question No.	Part I	Marks

Answer any three questions

1. (a) What do you understand by finite difference method (FDM)? With suitable example, show how 2D FDM equations can be formed in the case of a homogeneous dielectric material for unequal nodal distance. 2+6

(b) Form the set of finite difference equations and solve them to find the voltages at node 1 and node 2 for the system in air as shown in Fig. 1. 8

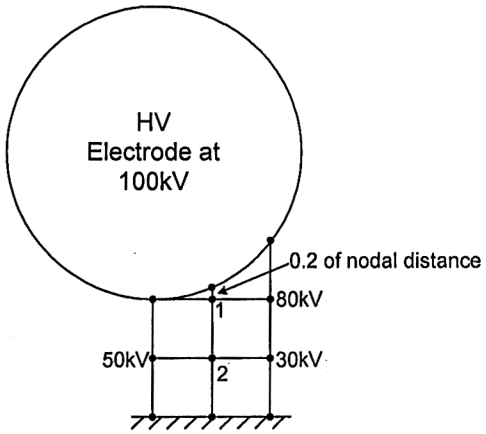

Fig. 1.

2. (a) What is Finite Element Method (FEM)? Discuss in details how potential at any point of a hexagonal geometry can be evaluated by using FEM. 2+8

(b) A triangular lamina has the following coordinates and node voltages as shown in Fig. 2. Find the potential inside the element at (5, 5) by applying FEM. 6

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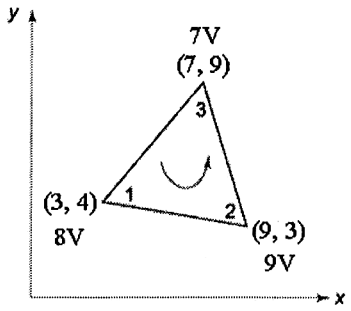

Fig. 2.

3. (a) What is an Artificial Neural Network (ANN)? What are the importance and uses of ANN? Give some applications of ANN. 2+2+2

(b) Consider the ANN Network of Fig. 3. 10

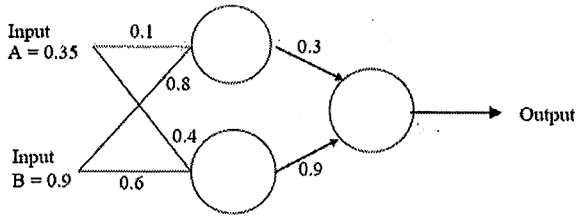

Fig. 3.

Assuming that the neurons have a sigmoid activation function $\left[Output = \frac{1}{1+e^{-Input}}\right]$

(i) Perform a forward pass on the network
(ii) Perform a reverse pass training with target = 0.5
(iii)Perform a forward pass once more and comment on the result

4. (a) Differentiate between Crisp set and Fuzzy set with example. Elaborate some important Fuzzy set operations. 2+6

(b) Give the scheme of implementing a Fuzzy Logic Controller in a system of your choice. Define the input and output parameters along with their dependencies. 8

5. (a) Write short notes on following topic 6
(i) Central difference method
(ii) Fuzzy membership function

(b) A differential equation is given by $y'' + y = 0$, with the constraints $y(0) = 1$ and $y'(0) = 0$. Use forward difference scheme of FDM and solve the equation. Comment on the percentage error versus the chosen step size. 10

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Full Marks: 100

Time: Three hours (**50** marks for this part)

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No. of Questions		PART -II Answer any Three (Two marks reserved for well organized answers)	Marks
1)	a)	Use the method of Lagrange multipliers to maximize x^3y^5 subject to the constraint $x + y = 8$.	(8)
	b)	Use the Newton's method to minimize the function $f(x_1, x_2) = 8x_1^2 + 4x_1x_2 + 5x_2^2$ starting from the initial point $X_1 = (10,10)$.	(8)
2)		Solve the following LP problem using simplex algorithm. Maximize $Z = 3x_1 - 2x_2$ Such that, $2x_1 + 3x_2 \leq 6$ $5x_1 + 2x_2 \leq 10$ $x_1, x_2 \geq 0$	(16)
3)	a)	Explain Cauchy's Steepest Descent method of solving Non-Linear optimization problems.	(8)
	b)	Explain the SIMPLEX Direct Search method in connection to an NLP problem.	(8)
4)		Four persons A, B, C, D are to be assigned with four tasks 1, 2, 3, 4 such that the total number of hours needed to complete the jobs is minimum. No person can be assigned with more than one job. Solve the assignment problem using Branch and Bound method. Number of hours by each of the persons to complete each of the four tasks is given below.	(16)

Persons	Jobs			
	1	2	3	4
A	6	5	8	3
B	10	6	4	15
C	13	7	2	11
D	13	9	7	10

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Full Marks: 100

Time: Three hours **(50** marks for this part)

5)	a)	Briefly Discuss Simulated Annealing.	(8)
	b)	Briefly discuss Genetic Algorithm.	(8)