2020

Ref No.: Ex/EE/PE/H/T/415C/2024

B.E. ELECTRICAL ENGINEERING FOURTH YEAR FIRST SEMESTER - 2024

SUBJECT: ADVANCED COMPUTING TECHNIQUES(HONS.)

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)"? Discuss (i) Forward (ii) Backward and (iii) Central Difference Scheme with respect to FDM. 8

   (b) A differential equation is given by 8

   $\frac{d^2x(t)}{dx^2} + x(t) = 0$ with the conditions $x(0) = 1$ and $x'(0) = 0$

   Solve this equation by finite difference method and highlight the percentage of error with respect to step size that you have chosen.

2. (a) What is Finite Element Method (FEM)? Discuss in details how potential at any point of an octagonal geometry can be evaluated by using FEM. 12

   (b) Highlight some of the areas where FEM can be applied. 4

3. (a) What do you understand by ANN? Discuss about the similarity and dissimilarity (if any) of ANN with an actual neural network. 2+4

   (b) Show how an ANN can be "Trained" using an algorithm of your choice. 6

   (c) Elaborate the types of learning processes in ANN. 4

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) Discuss how the potential of a point of a two dimensional system can be evaluated with the help of potentials of the another four points with unequal distance. 6

   (b) A curve is represented by $y = x^2$ $(-1 \leq x \leq 1)$. Show how the choice of suitable elements can approximate the area under the curve with the help of FEM. Comment on the different elements and associated percentage error in estimating the area. 10

[Turn over

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No. of Questions		**PART -II** **Answer any Three** **(Two marks reserved for neatness)**	**Marks**
1)		A manufacturing firm produces two machine parts using lathes, milling machines, and grinding machines. The different machining times required for each part, the machining times available on different machines, and the profit on each machine part are given in the following table.	(16)

Type of Machine	Machining time required (min)		Maximum time available per week (min)
	Machine part I	Machine Part II	
Lathes	10	5	2500
Milling Machines	4	10	2000
Grinding Machines	1	1.5	450
Profit per unit	Rs 50	Rs 100	

Determine the number of parts I and II to be manufactured per week to maximize the profit. Use the Simplex method of linear programming. (Do Not use the graphical method of solving LPP)

2)	(a)	Explain gradient direction is the direction of steepest ascent? In this regard, also explain Cauchy's Steepest Descent Method in connection to a Non-Linear Programming problem.	(8)
	(b)	Use gradient method to minimize the following function: $f(x_1, x_2) = 2x_1^2 + 2x_2^2 + 2x_1x_2 - 4x_1 - 6x_2$ Starting point $\left(\frac{1}{2}, \frac{5}{4}\right)$.	(8)
3)	a)	Write the K-T conditions for the following NLP problem: Minimize $f(x) = (x_1^2 + x_2 - 11)^2 + (x_1 + x_2^2 - 7)^2$ Subject to $g_1(x) = 26 - (x_1 - 5)^2 - x_2^2 \geq 0$ $g_2(x) = 20 - 4x_1 - x_2 \geq 0$ $g_3(x) = x_1 \geq 0$ $g_4(x) = x_2 \geq 0$	(8)
	b)	Illustrate the method of "Lagrange multiplier".	(8)

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4)	(a)	Illustrate the implementation of the "Simulated Annealing" optimization technique with a suitable example.	(8)
	(b)	Illustrate with a suitable example the "Genetic Algorithm" optimization technique.	(8)
5)		Solve the following integer programming problem using the Branch and Bound technique. The solution of the individual LP problems has to be found using the graphical method. (use graph paper) Maximize $Z = 5x_1 + 4x_2$ Subject to: $x_1 + x_2 \le 5$ $10x_1 + 6x_2 \le 45$ $x_1, x_2 \ge 0$ and integer	(16)