

Use a separate Answer-Script for each part

No. of Questions	PART -I Answer any Three (Two marks reserved for neatness)	Marks
1)	A Mining company has 1000 tons of B1 grade ore, 2000 tons of B2 grade ore, and 500 tons of B3 grade ore. Three products, X1, X2, and X3, can be made from these ores at one of its subsidiaries. Management wishes to determine how much of each product to make from the available ores so as to maximize the profit from the overall operation. Ore requirements per unit of product produced are as follow. (1) Product X1, requires 5 tons of grade B1 ore, 10 tons of grade B2 ore, and 10 tons of grade B3 ore. (2) Product X2 requires 5 tons of grade B1 ore, 8 tons of grade B2 ore, and 5 tons of grade B3 ore. (3) Product X3 requires 10 tons of grade B1 ore, 5 tons grade B2 ore, and none of grade B3 ore. Each unit of Product X1 contributes Rs 100 to profit and each unit of Product X2 contributes Rs 200 per unit to profit. Profit contribution from Product X3 is Rs 50 per unit. a. Set up the appropriate linear program b. Determine the optimal mix of products X1, X2, and X3. c. Identify any existing unused resource. d. What is the optimal profit from the mining company's operation at the subsidiary?	(16)
2)	(a) Consider the following problem: $\text{Minimize } f(X) = x_1^2 + x_2^2 + x_3^2$ subject to $x_1 + x_2 + x_3 \geq 5$ $2 - x_2 x_3 \leq 0$ $x_1 \geq 0, x_2 \geq 0, x_3 \geq 2$ Determine whether the Kuhn-Tucker conditions are satisfied at the following points: $X_1 = \left(\frac{3}{2}, \frac{3}{2}, 2\right), X_2 = \left(\frac{4}{3}, \frac{2}{3}, 3\right), X_3 = (2, 1, 2)$ (b) Illustrate the Lagrange Multiplier method of soiving optimization problems.	(10)
	(b) Illustrate the Lagrange Multiplier method of soiving optimization problems. (please turn over)	(6)

B.E. ELECTRICAL ENGINEERING FOURTH YEAR SECOND SEMESTER EXAM 2025**SUBJECT: - ADVANCED COMPUTING TECHNIQUES(HONS.)****Full Marks: 100****Time: Three hours****(50 marks for this part)**

3)

Solve the following problem using the Non-linear Simplex algorithm

Minimize

$$f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$$

The initial simplex is formed by the points A = (4, 4), B = (5,4) and C= (4,5) and the parameters of the algorithm are, $\alpha = 1.0$, $\beta= 0.5$ and $\gamma = 2.0$, where the notation have their usual meanings. Permissible error for convergence, $\epsilon = 0.2$. (Minimum Three iterations needs to be shown)

(16)

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.

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

(16)

5)

a)

Illustrate briefly the “genetic algorithm” optimization technique.

(8)

b)

Illustrate in brief the “simulated annealing” method of optimization.

(8)

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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 II	Marks
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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. 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. Derive the equations used for solving the above problem. 6+4

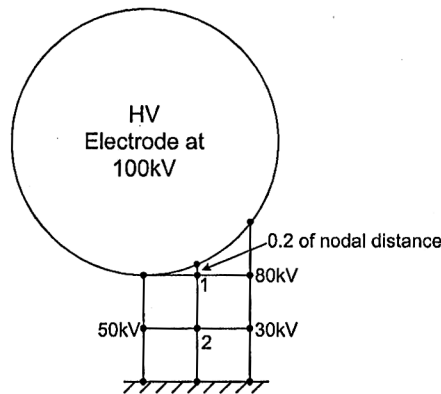


Fig. 1.

2. (a) 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. 7

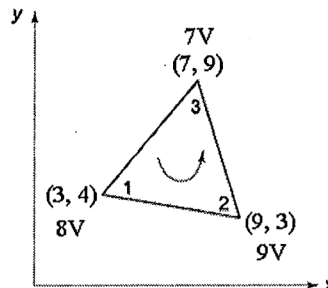


Fig. 2.

[Turn over

- (b) What is Finite Element Method (FEM)? In which areas FEM can be applied? State the various steps need to be followed for evaluating potential at any point by using FEM. 9
3. (a) What is ANN? Discuss about the similarity and dissimilarity (if any) of ANN with an actual neural network. 2+4
- (b) Consider the ANN Network of Fig. 3. 10

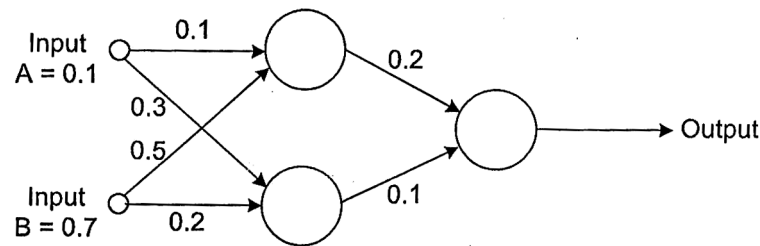


Fig. 3.

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 = 1
 (iii) Perform a forward pass once more and comment on the result
4. (a) State differences between Crisp Logic and Fuzzy Logic. 4
- (b) Explain (i) Crisp Set, (ii) Fuzzy Set and (iii) Membership Function with respect to Fuzzy Logic. 6
- (c) Discuss how temperature is controlled in an electrical heater by fuzzy logic. 6
5. (a) A differential equation is given by $\frac{d^2y}{dx^2} - y = 0$, 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. 8
- (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. 8