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Printed Page:-3 **Subject Code:- AMTAI0212**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
M.Tech
SEM: II - THEORY EXAMINATION (2025 - 2026)
Subject: Neural Network

Time: 3 Hours **Max. Marks: 70**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 15

1. Attempt all parts:-

(1.1) Gradient descent aims to: (CO1,K1) 1

(a) Increase cost
(b) Maximize loss
(c) Delay training
(d) Minimize error

(1.2) The width parameter in RBFN controls: (CO2,K1) 1

(a) Decision boundary curvature
(b) Speed of convergence
(c) Spread of basis functions
(d) Output scaling

(1.3) For a Hopfield network with stored patterns [1, -1], [-1, 1], the result of an input [1, 1] ? (CO3, K2) 1

(a) It will converge to one stored pattern
(b) It will oscillate
(c) It will be rejected
(d) It will form a new pattern

(1.4) In ART, stable category learning is ensured by: (CO4, K1) 1

(a) Maximum weight decay
(b) High learning rate
(c) Vigilance test
(d) Random weight initialization

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(1.5) Logicon networks operate based on (CO5,K1) 1

(a) Logical inference projections
(b) Statistical backpropagation
(c) Hybrid clustering
(d) Kernel composition

2. Attempt all parts:-

(2.1) Classify the structure of a feedforward neural network. (CO1, K2) 2

(2.2) Define the role of dilation and translation in wavelet functions. (CO2, K1) 2

(2.3) Summarize the energy of a Hopfield state vector using the energy function. (CO3, K2) 2

(2.4) Name the key feature that differentiates FWCN from adaptive networks. (CO4, K1) 2

(2.5) Illustrate the significance of hidden units in a Boltzmann machine. (CO5, K2) 2

SECTION-B 20

Answer any one of the following:-

(3.1) Explain how recurrent neural networks handle sequence-based input compared to feedforward networks. (CO1, K2) 4

(3.2) Classify the process of forward propagation in a simple neural network with one hidden layer. (CO1, K2) 4

Answer any one of the following:-

(3.3) Explain the Madaline Rule I and Rule II and compare their effectiveness in different learning scenarios. (CO2, K2) 4

(3.4) Show the structure of an RBF network and explain the role of the Gaussian function in hidden neurons. (CO2, K1) 4

Answer any one of the following:-

(3.5) Explain the dual-mode learning capability of BAMs and how they adapt to both forward and reverse input queries. (CO3, K2) 4

(3.6) Construct the learning rule typically applied in autoassociative networks and describe its significance in preserving input-output symmetry. (CO3, K3) 4

Answer any one of the following:-

(3.7) Explain how such networks maintain learning capability without the backward correction typically seen in traditional models. (CO4, K2) 4

(3.8) Explain the sequence of training phases in full counterpropagation, distinguishing between unsupervised and supervised components. (CO4, K2) 4

Answer any one of the following:-

(3.9) Show the structure of a Boltzmann machine with special emphasis on the roles of visible and hidden units. (CO5, K2) 4

(3.10) Outline the trade-offs between learning speed and network complexity in probabilistic neural models. (CO5, K2) 4

SECTION-C 35

4. Answer any one of the following:-

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(4.1)	Interpret the role of cost functions like cross-entropy and MSE in guiding network training and explain how their gradients behave. (CO1, K2)	7
(4.2)	Explain the behavior of the softmax function in a multi-class classification layer and illustrate its probabilistic interpretation. (CO1, K2)	7

5. Answer any one of the following:-

(5.1)	Explain in detail how the choice of activation function influences the decision boundaries formed by a perceptron and illustrate your explanation with suitable graphical interpretations. (CO2, K1)	7
(5.2)	Provide a thorough description of how Tree Neural Networks represent hierarchical structured data such as parse trees and explain the recursive nature of their computations. (CO2, K2)	7

6. Answer any one of the following:-

(6.1)	Explain the logic behind constructing an outer product matrix for pattern storage in autoassociative models and discuss limitations. (CO3, K2)	7
(6.2)	Demonstrate the typical convergence behavior of an iterative autoassociative memory and elaborate on its convergence conditions. (CO3, K2)	7

7. Answer any one of the following:-

(7.1)	Analyze the reset mechanism in ART and explain how it enables stability-plasticity balance. (CO4, K3)	7
(7.2)	Examine the consequences of improperly tuned parameters (e.g., neighborhood function) on the final feature map. (CO4, K4)	7

8. Answer any one of the following:-

(8.1)	Explain how the characteristics of the Cauchy distribution influence the design of receptive fields. (CO5, K2)	7
(8.2)	Compare how LPNs integrate symbolic logic inference with vector-based neural computation. (CO5, K2)	7