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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: VI - THEORY EXAMINATION (2025 - 2026)

Subject: Machine Learning

Time: 3 Hours

Max. Marks: 100

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

20

1. Attempt all parts:-

- | | | |
|-------|---|---|
| (1.1) | What is the application of machine learning methods to a large database called? (CO1,K1) | 1 |
| | <ul style="list-style-type: none"> (a) Big data computing (b) Internet of Things (c) Data mining (d) Artificial Intelligence | |
| (1.2) | Identify the kind of learning algorithm for “facial identities for facial expressions”.(CO1,K1) | 1 |
| | <ul style="list-style-type: none"> (a) Prediction (b) Recognition Patterns (c) Recognizing anomalies (d) Generating patterns | |
| (1.3) | What is the L1 norm also known as? (CO2,K2) | 1 |
| | <ul style="list-style-type: none"> (a) Manhattan norm (b) Euclidean norm (c) Chebyshev norm (d) None of the above | |
| (1.4) | What is an upper triangular matrix? (CO2, K2) | 1 |
| | <ul style="list-style-type: none"> (a) A matrix where all elements below the main diagonal are zero (b) A matrix where all elements above the main diagonal are zero (c) A matrix where all elements on the main diagonal are zero (d) A matrix where all elements are zero | |

- (1.5) Which of the following is a common metric used in cross validation to estimate the generalization error of a model? (CO3,K2) 1
- (a) Mean squared error
 - (b) Mean absolute error
 - (c) Accuracy
 - (d) Cross-entropy loss
- (1.6) Which of the following is a common optimization algorithm used in ANNs for updating the weights during training? (CO3,K2) 1
- (a) Gradient descent
 - (b) Naive Bayes
 - (c) K-means clustering
 - (d) Decision trees
- (1.7) When is appropriate to use Logistic Regression? (CO4,K2) 1
- (a) When the dependent variable is binary
 - (b) When the dependent variable is not binary
 - (c) When the independent variables are binary
 - (d) When the independent variables are not binary
- (1.8) . Formula for Bayes theorem is _____ (CO4,K1) 1
- (a) $P(A|B) = \frac{P(B|A)P(A)}{P(B)}$
 - (b) $P(A|B) = \frac{P(A)}{P(B)}$
 - (c) $P(A|B) = \frac{P(B|A)}{P(B)}$
 - (d) $P(A|B) = \frac{1}{P(B)}$
- (1.9) Which of the following is an example of a real-world application of machine learning in healthcare? (CO5,K2) 1
- (a) Diagnosing rare diseases
 - (b) Manufacturing medical devices
 - (c) Developing new drugs
 - (d) Conducting clinical trials
- (1.10) Which of the following is an example of a real-world application of machine learning in personalized medicine? (CO5,K2) 1
- (a) Predicting disease outbreaks
 - (b) Developing new vaccines
 - (c) Tailoring treatment plans to individual patients
 - (d) Analyzing population health trends

2. Attempt all parts:-

- (2.1) Discuss with examples some useful applications of machine learning..(CO1,K2) 2
- (2.2) Compute the indicated products. 2

$$\begin{bmatrix} 3 & -1 & 3 \\ -1 & 0 & 2 \end{bmatrix} \begin{bmatrix} 2 & -3 \\ 1 & 0 \\ 3 & 1 \end{bmatrix} \quad (\text{CO2,K3})$$

- (2.3) What is the difference between LDA and PCA? (CO3,K2) 2
- (2.4) Explain unsupervised learning?(CO4,K2) 2
- (2.5) How is machine learning used in DNA sequence analysis? (CO5,K2) 2

SECTION-B

30

Answer any one of the following:-

- (3.1) Define Machine Learning. Discuss with examples why machine learning is important. (CO1,K2) 6
- (3.2) Discuss Concept learning as search with respect to General to specific ordering of hypothesis. (CO1,K2) 6

Answer any one of the following:-

- (3.3) Explain vector arithmetic. Define L1 and L2 norms and compare them with suitable examples.(CO2,K2) 6
- (3.4) 6

Given $A = \begin{bmatrix} 0 & -1 & 2 \\ 2 & -2 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 1 \\ 1 & 0 \\ 1 & 1 \end{bmatrix}$. find the product AB and also find (AB)⁻¹. (CO2, K3)

Answer any one of the following:-

- (3.5) What is a convolutional layer, and how does it work in a CNN? (CO3, K2) 6
- (3.6) What is the difference between a classification tree and a regression tree? (CO3, K2) 6

Answer any one of the following:-

- (3.7) Explain classification in supervised learning. Discuss the Support Vector Machine (SVM) with suitable examples. (CO4, K2) 6
- (3.8) Explain clustering in unsupervised learning. Describe the K-Means algorithm with steps and an example. (CO4,K2) 6

Answer any one of the following:-

- (3.9) How is machine learning used in network intrusion detection and prevention? (CO5,K2) 6
- (3.10) What are some challenges associated with using machine learning in healthcare? (CO5,K2) 6

SECTION-C

50

4. Answer any one of the following:-

- (4.1) How is Candidate Elimination algorithm different from Find-S Algorithm. Explain in detail.(CO1,K2) 10
- (4.2) Explain the concept of linear separability in machine learning, and how it relates to perceptrons? What are some examples of problems that are linearly separable, and how are they solved using perceptrons? (CO1,K2) 10

5. Answer any one of the following:-

(5.1) 10

$$\text{If } A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$$

find the matrix represented by

$$A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I \quad (\text{CO2,K3})$$

(5.2) 10

$$\text{If } A = \begin{bmatrix} 8 & -4 \\ 2 & 7 \end{bmatrix}$$

determine the eigen values of $B = 2A^2 - \frac{1}{2}A + 3I$

(CO2,K3)

6. Answer any one of the following:-

(6.1) Explain Artificial Neural Networks (ANN). Describe the architecture, working, and learning process with a neat diagram..(CO3,K2) 10

(6.2) What is PCA stand for, and why is it used in data analysis? (CO3, K2) 10

7. Answer any one of the following:-

(7.1) What is clustering, and how is it used in machine learning? Can you explain the difference between clustering and classification, and what are some examples of use cases for clustering algorithms? (CO4,K2) 10

(7.2) Explain ensemble learning techniques such as bagging and boosting. How do they improve model performance? (CO4,K2) 10

8. Answer any one of the following:-

(8.1) Discuss various real-world applications of Machine Learning with suitable examples. Explain how ML is transforming modern industries.(CO5.K2) 10

(8.2) Explain the applications of Machine Learning in cybersecurity. Discuss intrusion detection, fraud detection, and spam filtering.(CO5,K2) 10