S.No. : 249

NAI4401

No. of Printed Pages : 05

Following Paper ID and Roll No. to be filled in your Answer Book.

PAPER ID : 33902 Roll No. 1 2 4 0 [redacted]

B. Tech Examination 2026

(Even Semester)

CONCEPTS OF MACHINE LEARNING WITH PYTHON

Time : Three Hours] *[Maximum Marks : 60*

Note :– Attempt all questions.

SECTION – A

1. Attempt all parts of the following : $8 \times 1 = 8$

   (a) What is the AUC-ROC curve?

   (b) What is normalization in machine learning?

   (c) How do you handle missing data in dataset?

   (d) What are "Outliers" in dataset?

   (e) Explain about "Iris" dataset.

[P. T. O.

(f) Explain what is "over-fitting" in machine learning?

(g) What are the different variants of "Gradient Descent" algorithm?

(h) What is loss function in machine learning?

SECTION – B

2. Attempt any two part of the following : $2 \times 6 = 12$

(a) Explain various learning paradigms of machine learning with advantage, disadvantage, and applications of each learning paradigm.

(b) What are ensemble learning models? Explain bagging and boosting techniques in detail.

(c) Explain decision tree model in detail along with its advantages, disadvantages, and real-world application.

(d) Explain logistic regression in machine learning. Discuss its concept, mathematical model, working principle and applications.

SECTION – C

Note:- Attempt all questions. Attempt any two parts from each question. $5 \times 8 = 40$

3. (a) Explain probably approximately correct(PAC) learning in detail with mathematical formulation.

(b) Explain the role of NumPy and Pandas libraries in machine learning along with few python functions of each of these library.

(c) Explain principal component analysis(PCA) in machine learning. Define the role of covariance matrix, eigenvalues and eigenvectors in determining principal components.

4. (a)

		Predicted	
		True Positive	False Positive
		120	2
Actual		False Negative	True Negative
		5	73

From the above given confusion matrix, calculate following performance evaluation metrics for machine learning experiments:

Accuracy, precision, recall, sensitivity and F1 score. Also write respective python commands for each of these metric.

(b) Explain the architecture of a multilayer perceptron with an example. How does it differ from a single-layer perceptron?

(c) Explain the working of the Naive Bayes algorithm step by step, including prior probability, likelihood probability, posteiror probability and classification decision rule.

5. (a) What is imbalanced dataset? Explain various techniques for handling imbalanced datasets.

(b) Explain support vector machine. Define the terms hyperplane, support vectors, kernel, hard and soft margin. Describe the significance of kernal functions in SVM.

(c) Differentiate between binary classiffication, multi-classification and multi-label classification with examples and use-case scenarios.

6. (a) What is clustering in machine learning? Explain how the K-means algorithm performs unsupervised learning with a suitable example.

(b) What is meant by lazy learning in KNN? How does KNN make predictions for classification problems? Mention one limitation of the KNN algorithm.

(c) Describe linear regression model. Differentiate between simple linear regression and multiple linear regression.

⌘⌘⌘