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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) Machine Learning belongs to (CO1,K1) 1
(a) AI (b) DBMS (c) OS (d) CN
- (1.2) Supervised learning needs(CO1,K1) 1
(a) Labeled data (b) Random data (c) Noise (d) Images
- (1.3) Decision tree used for(CO2,K1) 1
(a) Classification (b) Clustering (c) Sorting (d) Storage
- (1.4) Linear regression gives(CO2,K1) 1
(a) Continuous (b) Discrete (c) Random (d) None
- (1.5) Bagging technique improves model performance mainly by(CO3,K1) 1
(a) Reducing variance (b) Increasing bias (c) Removing data (d) Sorting data
- (1.6) Boosting method focuses on(CO3,K1) 1
(a) Misclassified samples (b) Random samples (c) Balanced data (d) Sorted data
- (1.7) Q-value represents(CO4,K1) 1
(a) Expected reward (b) Data size (c) Distance (d) Error
- (1.8) Policy in RL defines(CO4,K1) 1
(a) Action selection (b) Data cleaning (c) Sorting (d) Compression

- (1.9) Genetic Algorithm inspired from(CO5,K1) 1
 (a) Biology evolution (b) Physics laws (c) Chemistry rules (d) Mathematics only
- (1.10) GENETIC ALGORITHM searches solution using(CO5,K1) 1
 (a) Population (b) Single value (c) Graph (d) Table

2. Attempt all parts:-

- (2.1) Define variance(CO1,K2) 2
 (2.2) Define kernel function(CO2,K2) 2
 (2.3) Define ensemble learning(CO3,K2) 2
 (2.4) Define bias in estimator(CO4,K2) 2
 (2.5) Define crossover(CO5,K5) 2

SECTION-B

30

Answer any one of the following:-

- (3.1) Describe the steps involved in Machine Learning model development? (CO1,K2) 6
 (3.2) A dataset contains student study hours and marks obtained. Apply Linear Regression to predict marks for a student studying 8 hours. Explain the steps involved.(CO1,K3) 6

Answer any one of the following:-

- (3.3) Consider the following dataset:(CO2,K3) 6

	Outlook	Play Tennis
	Sunny	No
	Sunny	No
	Overcast	Yes
	Rainy	Yes
	Rainy	Yes

Tasks

1. Calculate the entropy of the dataset.
2. Calculate the entropy for attribute "Outlook".
3. Find the Information Gain of the attribute.

- (3.4) A company wants to classify loan approval.(CO2,K3) 6

Income Level	Loan Status
High	Approved
High	Approved
Medium	Rejected
Low	Rejected
Medium	Approved

Tasks

1. Calculate the Gini Index for each income category.
2. Find the weighted Gini Split.
3. Determine whether "Income Level" is a good splitting attribute.

Answer any one of the following:-

- (3.5) Examine the situations where AdaBoost may fail to provide accurate predictions? (CO3,K3) 6

(3.6) A hospital uses Random Forest for disease prediction.(CO3,K3) 6

Patient	Fever	Cough	Disease
P1	Yes	Yes	Flu
P2	Yes	No	Flu
P3	No	Yes	Cold
P4	No	No	Healthy

A new patient has:

- Fever = Yes
- Cough = Yes

Predictions from trees:

- Tree 1 → Flu
- Tree 2 → Flu
- Tree 3 → Cold
- Tree 4 → Flu

Determine the final disease prediction.

Answer any one of the following:-

(3.7) A robot vacuum cleaner learns the most efficient path to clean all rooms while avoiding obstacles. Explain how Reinforcement Learning helps the robot improve its performance over time.(CO4,K3) 6

(3.8) Drone navigates through a crowded city to deliver packages safely. Illustrate the role of agent actions and environmental feedback in improving navigation accuracy.(CO4,K3) 6

Answer any one of the following:-

(3.9) A company uses Genetic Algorithms for route optimization.Explain how selection, crossover, and mutation help in finding the shortest route.?(CO5,K3) 6

(3.10) Examine the relationship between fitness values and solution quality in Genetic Algorithms.(CO5,K3) 6

SECTION-C 50

4. Answer any one of the following:-

(4.1) Analyze the bias–variance tradeoff and its effect on Machine Learning model performance.(CO1,K4) 10

(4.2) Analyze how training and testing datasets support effective model evaluation and optimization.(CO1,K4) 10

5. Answer any one of the following:-

(5.1) A bank uses Logistic Regression for loan approval prediction.(CO2,K3) 10

Given:

- Weight = 0.06
- Salary = 40
- Bias = -1

Tasks

1. Compute the linear output z .
2. Calculate the sigmoid probability.
3. Determine whether the loan is Approved or Rejected using threshold = 0.5.

(5.2) Suppose a company wants to predict salary based on years of experience.(CO2,K3) 10

Experience (Years)	Salary (₹)
1	20000
3	35000
5	50000
7	65000

predicts future salary values using Linear Regression and also draw line of regression

6. Answer any one of the following:-

(6.1) A Bagging classifier consists of 5 decision trees.(CO3,K3) 10
Predictions for a test sample are:

Tree	Prediction
T1	Yes
T2	No
T3	Yes
T4	Yes
T5	No

a) Determine the final prediction using majority voting.

b) Explain how bagging improves prediction stability

(6.2) Compare different distance measures based on their suitability for various data types.(CO3,K3) 10

7. Answer any one of the following:-

(7.1) Illustrate state and action representation in Reinforcement Learning with suitable examples.?(CO4,K3) 10

(7.2) An agent has the following Q-values for a state:(CO4,K3) 10

Action	Q-Value
Left	5
Right	9
Up	3
Down	7

Tasks

1. Identify the optimal action chosen by the agent.

2. Justify your answer based on Q-values.

8. Answer any one of the following:-

(8.1) Investigate the step-by-step working procedure of Genetic Algorithms in achieving global optimization.(CO5,K5) 10

(8.2) Compare and evaluate different selection techniques used in evolutionary computation with examples.(CO5,K5) 10