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

B.Tech

SEM: V - 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-a. Identify the kind of learning algorithm for “facial identities for facial expressions”. 1
(CO1, K2)
- (a) Prediction
 - (b) Recognition Patterns
 - (c) Recognizing anomalies
 - (d) Generating patterns
- 1-b. In language understanding, the levels of knowledge do not include: (CO1, K2) 1
- (a) Phonological Knowledge
 - (b) Syntactic Knowledge
 - (c) Logical Knowledge
 - (d) Empirical Knowledge
- 1-c. CART algorithm generates trees that are (CO2, K2) 1
- (a) Binary
 - (b) Multiway
 - (c) Not for regression
 - (d) Unsupervised
- 1-d. Neural networks are inspired by (CO2, K2) 1
- (a) Biological neurons
 - (b) Rule-based systems
 - (c) Decision trees
 - (d) Linear regression

- 1-e. Tick the following which is required by K-means clustering. (CO3, K1) 1
- (a) defined distance metric
 - (b) number of clusters
 - (c) initial guess as to cluster centroids
 - (d) all of the mentioned
- 1-f. Movie Recommendation systems are an example of: 1. Classification 2. Clustering 3. Reinforcement Learning 4. Regression (CO3, K1) 1
- (a) 2 Only
 - (b) 1 and 2
 - (c) 2 and 3
 - (d) None of the mentioned
- 1-g. Why is XGBoost efficient for large datasets? (CO4, K2) 1
- (a) A) Uses single decision tree
 - (b) B) Uses distributed and parallel processing
 - (c) C) Ignores missing values
 - (d) D) Avoids feature selection
- 1-h. Probability update in Bayesian learning uses: (CO4, K1) 1
- (a) A) Bayes theorem
 - (b) B) Linear regression
 - (c) C) Gradient descent
 - (d) D) Clustering
- 1-i. Illustrate the purpose of the Q-function in Q-Learning. (CO5, K3) 1
- (a) The reward at next state
 - (b) The expected cumulative reward for action-state pair
 - (c) The probability of action selection
 - (d) The environment dynamics
- 1-j. Implement RL in E-Commerce to improve outcomes. (CO5, K3) 1
- (a) Predict stock prices
 - (b) Segment customers
 - (c) Optimize product recommendation
 - (d) Detect anomalies in sales
2. Attempt all parts:-
- 2.a. Define the role of Machine Learning in our daily life. (CO1, K2) 2
- 2.b. Describe the purpose of multiple linear regression. (CO2, K2) 2
- 2.c. List the steps to handle categorical variables in ML Algorithm. (CO3, K2) 2
- 2.d. Demonstrate the calculation of posterior probability in a Naïve Bayes example (CO4, K2) 2
- 2.e. Identify the main components of an RL environment. (CO5, K2) 2

SECTION-B

30

- 3.a. Answer any one of the following:-

3.a.(i)	Explain the role of a model in Machine Learning and how it is used for making predictions. (CO1, K2)	6
3.a.(ii)	Explain methods for evaluating the effectiveness of a Machine Learning model, highlighting the roles of training, validation, and test datasets with examples. (CO1, K5)	6
3.b.	Answer any one of the following:-	
3.b.(i)	Discuss market basket analysis in retail analytics. (CO2,K2)	6
3.b.(ii)	Explain SVM concepts including hyperplane and margin. (CO2, K3)	6
3.c.	Answer any one of the following:-	
3.c.(i)	Discuss in detail about working of KNN classifier algorithm with suitable example. (CO3, K2)	6
3.c.(ii)	Compare Hierarchical Clustering and k-Means Clustering (CO3, K3)	6
3.d.	Answer any one of the following:-	
3.d.(i)	Illustrate Naïve Bayes Classifier using a numeric example (CO4, K2)	6
3.d.(ii)	Analyze the impact of Bagging on variance reduction (CO4, K3)	6
3.e.	Answer any one of the following:-	
3.e.(i)	Explain the working principle of Reinforcement Learning with a real-life example. (CO5, K2)	6
3.e.(ii)	Analyze the role of agent-environment interaction in RL. (CO5, K3)	6
<u>SECTION-C</u>		50
4.	Answer any <u>one</u> of the following:-	
4-a.	Discuss the concepts of underfitting and overfitting in machine learning, including causes, effects, and strategies to handle them. (CO1, K2)	10
4-b.	Describe version spaces and consistent hypotheses in concept learning, and illustrate their representation using a detailed example. (CO1, K3)	10
5.	Answer any <u>one</u> of the following:-	
5-a.	Given dataset: $Y=[45,55,65,75,85]$, $X_1=[1,2,3,4,5]$, $X_2=[2,4,6,8,10]$, calculate multiple linear regression coefficients. (CO2, K3)	10
5-b.	Construct ID3 tree for dataset: Outlook=[Sunny, Sunny, Overcast, Rain, Rain], Play=[No, No, Yes, Yes, Yes], calculate information gain for root selection. (CO2, K3)	10
6.	Answer any <u>one</u> of the following:-	
6-a.	Differentiate unsupervised learning with supervised learning. Explain with some examples.(CO3, K4)	10
6-b.	Name the three broad categories of clustering techniques. Explain the characteristics of each briefly. (CO3, K2)	10
7.	Answer any <u>one</u> of the following:-	
7-a.	Illustrate Bayesian Belief Networks for risk management. (CO4, K3)	10
7-b.	Analyze trade-offs between bias and variance in ML with daily life example. Explain with the help of suitable graphical representation. (CO4,K4)	10
8.	Answer any <u>one</u> of the following:-	

- 8-a. Analyze the exploration-exploitation dilemma and propose strategies to balance it effectively in E-Commerce RL applications. (CO5, K4) 10
- 8-b. Analyze a case study of personalized treatment in healthcare using RL and discuss how the agent adapts over time. (CO5, K4) 10

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