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Printed Page:-4 **Subject Code:- BMICSML0501**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
M.Tech (Integrated)
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". (CO1, K2) 1

(a) Prediction
(b) Recognition Patterns
(c) Recognizing anomilies
(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

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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

SECTION-C 50

4. Answer any one 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 one of the following:-

5-a.	Given dataset: Y=[45,55,65,75,85], X1=[1,2,3,4,5], X2=[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 one 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 one 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 one of the following:-

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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