Dr. A.P.J. Abdul Kalam Technical University (AKTU) · B.Tech Theory Examination

Machine Learning Techniques

BCS055 · Jan 2025

Time: 3 Hours **Max. Marks: 70**

Attempt all Sections.
In case of any missing data; choose suitably.

SECTION A

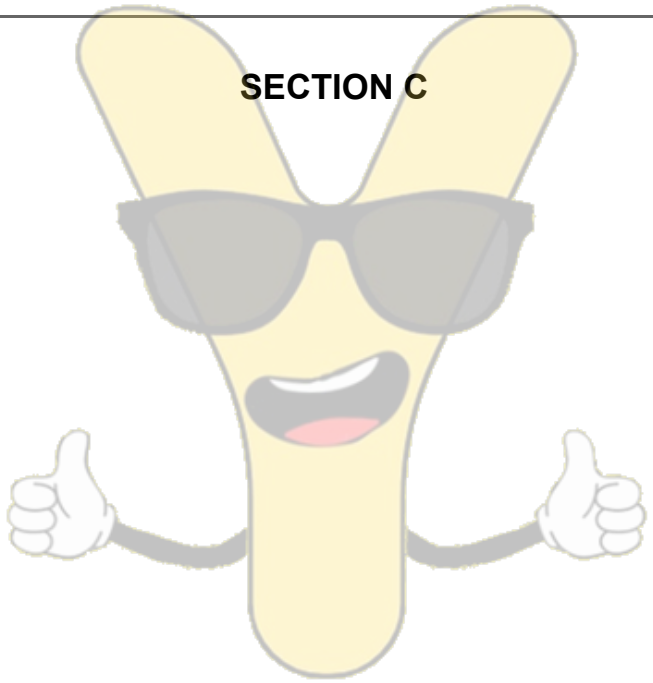
1(a)	What constitutes a well-defined learning problem in machine learning? Give an example.	2	U1
1(b)	How does machine learning differ from data science, and how do they complement each other?	2	U1
1(c)	Explain the role of the sigmoid function in logistic regression.	2	U2
1(d)	What is the significance of the decision surface in Support Vector Machines (SVM)?	2	U2
1(e)	What is overfitting in decision tree learning, and how can it be avoided?	2	U3
1(f)	Explain the role of the activation function in a perceptron.	2	U4
1(g)	Describe the role of the reward function in reinforcement learning.	2	U5

SECTION B

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2(a)	Describe the steps involved in designing a machine learning system. Illustrate each step with a real-world example.	7	U1
2(b)	Explore the difference between Simple Linear Regression and Multiple Linear Regression. How does the inclusion of multiple features affect the model?	7	U2
2(c)	Illustrate the steps of the ID3 algorithm, including how it selects attributes and constructs the tree.	7	U3
2(d)	Discuss the Self-Organizing Map (SOM) algorithm. How does SOM work for clustering and dimensionality reduction? Explain the differences between SOM and supervised learning models.	7	U4
2(e)	What is the role of the Q-learning function in reinforcement learning? Explain how it helps the agent learn optimal actions and policies.	7	U5

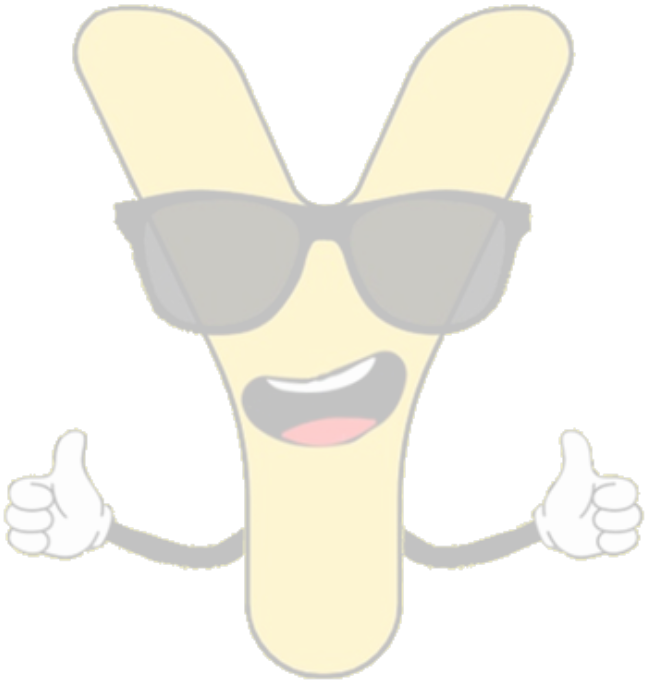
SECTION C



3(a)	Discuss the history of machine learning. Highlight major milestones and advancements in the field.	7	U1
3(b)	Compare and contrast supervised, unsupervised, and reinforcement learning. Provide examples where each type is applicable.	7	U1
4(a)	Consider the following weather data to determine whether or not a person will play tennis on a given day based on weather conditions: Day | Outlook | Temperature | Humidity | Wind | Play Tennis? 1 | Sunny | Hot | High | Weak | No 2 | Overcast | Hot | High | Weak | Yes 3 | Rainy | Cool | Normal | Weak | No 4 | Overcast | Cool | Normal | Strong | Yes 5 | Rainy | Mild | Normal | Weak | Yes 6 | Sunny | Mild | Normal | Strong | No 7 | Overcast | Mild | High | Strong | Yes 8 | Overcast | Hot | Normal | Weak | No Apply Naïve Bayes Classifier to predict whether the person will play or not play tennis on given condition {Outlook = Sunny, Temperature = Cool, Humidity = High, Wind = Strong}	7	U2
4(b)	Fit a linear regression model for the dataset (x, y): (1, 1.5), (2, 3.0), (3, 4.5), (4, 6.0) and predict y for x = 5.	7	U2
5(a)	Describe the concept of locally weighted regression (LWR). How does it differ from traditional regression models, and what are its practical applications?	7	U3
5(b)	Given the following dataset with two attributes (A and B), and a target variable (T): A | 1 | 2 | 1 | 2 | 1 | 2 B | 2 | 3 | 3 | 2 | 2 | 3 T | Yes | No | Yes | No | Yes | No Calculate the entropy before the split and after the split on attribute A. Which attribute (A or B) gives the highest information gain?	7	U3
6(a)	Derive the mathematical steps involved in backpropagation for training a neural network.	7	U4
6(b)	Explain the architecture and functioning of Convolutional Neural Networks (CNNs).	7	U4
7(a)	Explain the concept of Reinforcement Learning (RL). Discuss how it differs from supervised and unsupervised learning.	7	U5

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7(b)	Explain the components of a genetic algorithm. Discuss the role of chromosomes, genes, and the population in the GA cycle.	7	U5



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