

SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)
SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (COMMON TO IT DEPARTMENT)

QUESTION BANK



I SEMESTER

DS3162 - MACHINE LEARNING

Regulation – 2023

Academic Year 2026 – 2027 (ODD)

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SUBJECT : DS3162 - Machine Learning
SEM / YEAR: I Sem/ I Year

UNIT I INTRODUCTION AND MATHEMATICAL FOUNDATIONS			
What is Machine Learning? Need -History - Definitions - Applications - Advantages, Disadvantages & Challenges -Types of Machine Learning Problems - Mathematical Foundations - Linear Algebra & Analytical Geometry -Probability and Statistics Bayesian Conditional Probability -Vector Calculus& Optimization - Decision Theory - Information theory			
PART – A			
Q.No.	Questions	BT Level	Competence
1	What is machine learning? Give some examples.	BTL1	Remembering
2	Distinguish between Information theory and Decision theory	BTL2	Understanding
3	Point out few examples of machine learning applications.	BTL4	Analyzing
4	Enlist the types of machine learning techniques.	BTL1	Remembering
5	Describe the steps involved in machine learning process.	BTL2	Understanding
6	List the algorithms of concept learning.	BTL1	Remembering
7	Distinguish between supervised and unsupervised learning.	BTL2	Understanding
8	Define Activation Function.	BTL1	Remembering
9	Compare traditional programming and machine learning.	BTL2	Understanding
10	Mention the issues in machine learning.	BTL2	Understanding
11	Define Confusion Matrix.	BTL1	Remembering
12	State the difference between classification and regression.	BTL2	Understanding
13	Explain the useful perspective on machine learning.	BTL1	Remembering
14	Discuss about Bias Variance Trade off	BTL2	Understanding
15	Sketch a decision tree for playing tennis game.	BTL2	Understanding
16	What is a Linear Algebra?	BTL2	Understanding
17	List the applications of machine learning.	BTL1	Remembering
18	Elucidate about the Decision tree learning.	BTL1	Remembering
19	Mention the five popular algorithms of Machine Learning?	BTL1	Remembering
20	Define Vector Calculus and optimization.	BTL2	Understanding
21	Evaluate the relationship between AI and Machine learning.	BTL2	Understanding
22	Assess the role of Information gain in Decision trees.	BTL2	Understanding
23	Define Analytical Geometry	BTL1	Remembering
24	What is 'Training set' and 'Test set'?	BTL2	Understanding

PART – B			
1	(i) What is machine learning? Discuss about learning and machine learning. (8) (ii) Discuss the various types of machine learning. (8)	BTL4	Analyzing
2	Explain Supervised Learning with example. (16)	BTL2	Understanding
3	Explain the types of Machine Learning (16)	BTL5	Evaluating
4	(i) Describe in detail the rule for estimating training values. (8) (ii) State the final design of checkers learning system. (8)	BTL4	Analyzing
5	Write about the different issues in Machine Learning. (16)	BTL4	Analyzing
6	Write Short notes on (i) Attribute Selection (8) (ii) Entropy (4) (iii) Information gain (4)	BTL3	Applying
7	Illustrate the concept of Linear Algebra & Analytical Geometry (16)	BTL3	Applying
8	Explain in detail about Information theory (16)	BTL3	Applying
9	Explain in detail about Machine Learning Process with an example. (16)	BTL3	Applying
10	Explain the useful perspectives of machine learning in different Applications. (16)	BTL3	Applying
11	Illustrate the basic decision tree algorithm with an example. (16)	BTL3	Applying
12	Generalize the concept of Vector Calculus & Optimization with an example (16)	BTL4	Analyzing
13	Describe Training, Testing and Validation sets with examples (16)	BTL4	Analyzing
14	Explain confusion Matrix with an example. (16)	BTL3	Applying
15	Marie's marriage is tomorrow. In recent years, each year it has rained only 5 days. The weatherman has predicted rain for tomorrow. When it actually rains, the weatherman correctly forecasts rain 90% of the time. When it doesn't rain, the weatherman incorrectly forecasts rain 10% of the time. The question: What is the probability that it will rain on the day of Marie's wedding? (16)	BTL3	Applying
16	Summarize in detail about types of Regression and Classification in Supervised Learning (16)	BTL5	Evaluating
17	Explain the following (i) Statistics Bayesian Conditional Probability (8) (ii) Decision Theory (8)	BTL4	Analyzing

UNIT II SUPERVISED LEARNING			
Introduction-Discriminative and Generative Models -Linear Regression - Least Squares - Under-fitting / Over fitting -Cross-Validation - Lasso Regression- Classification - Logistic Regression- Gradient Linear Models -Support Vector Machines -Kernel Methods -Instance based Methods - K-Nearest Neighbors - Tree based Methods -Decision Trees -ID3 - CART - Ensemble Methods - Random Forest - Evaluation of Classification Algorithms			
PART – A			
Q.No.	Questions	BT Level	Competence
1	Outline the difference between supervised learning and unsupervised learning.	BTL1	Remembering
2	State the k-nearest neighbor learning algorithm.	BTL1	Remembering
3	State the objective of the Least Squares method in linear regression?	BTL1	Remembering
4	What is a random forest?	BTL1	Remembering
5	State the standard approach to supervised learning.	BTL1	Remembering
6	How does a decision tree classify the data?	BTL1	Remembering
7	How can over fitting be avoided?	BTL2	Understanding
8	Brief what is ‘Over fitting’ in Machine learning?	BTL2	Understanding
9	What is a Linear Regression?	BTL2	Understanding
10	Give the disadvantages of the linear regression model.	BTL2	Understanding
11	State the difference between classification and regression.	BTL2	Understanding
12	Define Ensemble Methods	BTL1	Remembering
13	What are tree-based methods?	BTL1	Remembering
14	Give the difference between stochastic gradient descent (SGD) and gradient descent (GD)?	BTL2	Understanding
15	What are the different types of least squares?	BTL2	Understanding
16	List the difference between least squares regression and multiple regression?	BTL1	Remembering
17	Give the difference between K-means and KNN?	BTL2	Understanding
18	What are types of classification models?	BTL1	Remembering
19	Define the cost function used in simple linear regression	BTL2	Understanding
20	Express the basic concept involved in CART.	BTL2	Understanding
21	Explain the Limitation of Genetic Algorithm.	BTL2	Understanding
22	Define the concept of margin in a Support Vector Machine.	BTL1	Remembering
23	Define the concept of ID3.	BTL1	Remembering
24	Define Genetic Programming.	BTL1	Remembering
PART – B			
1	Explain the principle of the gradient descent algorithm. Accompany your explanation with a diagram (16)	BTL4	Analyzing
2	Elaborate on logistics regression with an example. Explain the process of computing coefficients. (16)	BTL4	Analyzing
3	What is a classification tree? Illustrate the steps to construct a classification tree. List and explain about the different procedures used. (16)	BTL3	Applying
4	(i) Write in detail about Decision Tree. (8) (ii) Write in detail Classification and Regression Tree (CART) (8)	BTL4	Analyzing
5	Illustrate the concept of Support Vector Machine with necessary examples.	BTL4	Analyzing

6	Illustrate Logistic Regression as a Probabilistic Discriminative Model and explain in detail (16)	BTL3	Applying
7	Explain in detail about Reinforcement Learning with example. (16)	BTL3	Applying
8	Show when and why you would use random forests vs SVM? (16)	BTL6	Creating
9	Explain in detail about Gaussian mixture models and expectation maximization? (16)	BTL4	Analyzing
10	List non-parametric techniques and Explain K-nearest neighbor estimation.(16)	BTL5	Evaluating
11	Explain the various ensemble learning techniques?(16)	BTL4	Analyzing
12	Explain the following (i) Linear regression (8) (ii) Logistic Regression (8)	BTL4	Analyzing
13	(i) Describe ensemble methods. (8) (ii) Explain random forest algorithm in detail. (8)	BTL3	Applying
14	Explain details about KNN algorithm? (16)	BTL4	Analyzing
15	Describe the general procedure of random forest algorithm (16)	BTL5	Evaluating
16	Design a random forest model for a classification problem and analyze its performance.	BTL5	Evaluating
17	(i) Write about the ID3.(8) (ii) Generalize how Classification is done with an Example.(8)	BTL6	Creating

UNIT III UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING			
Introduction - Clustering Algorithms - K - Means - Hierarchical Clustering - Cluster Validity - Dimensionality Reduction - Principal Component Analysis - Recommendation Systems - EM algorithm. Reinforcement Learning - Elements - Model based Learning - Temporal Difference Learning.			
PART – A			
Q.No	Questions	BT Level	Competence
1	What is the purpose of the Expectation-Maximization (EM) algorithm in GMM?	BTL1	Remembering
2	What is Reinforcement learning model?	BTL1	Remembering
3	What is expectation maximization algorithm used for?	BTL1	Remembering
4	What is the role of centroids in the K-means algorithm?	BTL1	Remembering
5	What is Principal Component Analysis?	BTL1	Remembering
6	What is the main objective of clustering?	BTL2	Understanding
7	What is meant by Nearest Neighbour methods.	BTL2	Understanding
8	State one major limitation of K-means clustering.	BTL2	Understanding
9	Give the examples of unsupervised learning?	BTL2	Understanding
10	How do you implement expectation maximization algorithm?	BTL2	Understanding
11	What is the Expectation-Maximization (EM) algorithm and how is it used in GMMs?	BTL1	Remembering
12	State the objective function of K-means clustering.	BTL1	Remembering
13	What is the role of centroids in K-means?	BTL1	Remembering
14	What is a Gaussian Mixture Model (GMM)?	BTL2	Understanding
15	How is perceptron learning algorithm used?	BTL2	Understanding
16	State the significance of Gaussian mixture model?	BTL2	Understanding
17	Define EM algorithm.	BTL1	Remembering
18	How K-Means Algorithm is used in Unsupervised Learning?	BTL2	Understanding
19	How Expectation maximization is used in Gaussian mixture models?	BTL2	Understanding
20	What is difference between K means and Gaussian mixture?	BTL1	Remembering
21	What is k-means unsupervised learning?	BTL1	Remembering
22	What is the principle of maximum likelihood?	BTL1	Remembering
23	Why is the smoothing parameter h need to be optimal?	BTL2	Understanding
24	Give the basic idea behind the K-Nearest Neighbors (KNN) algorithm?	BTL2	Understanding
PART – B			
1	Explain the Principle Component Analysis with Analysis.	BTL4	Analyzing
2	Explain various learning techniques involved in unsupervised learning.(16)	BTL4	Analyzing
3	Analyze the applications of clustering and identify advantages and disadvantages of clustering algorithms. (16)	BTL3	Applying
4	Illustrate in detail the different ensemble learning techniques. (16)	BTL3	Applying
5	Elaborate on the steps in expectation-maximization algorithm. (16)	BTL5	Evaluating
6	Explain about EM algorithm. (16)	BTL4	Analyzing
7	(i)Describe the PCA relation with MLP. (8) (ii)Explain Kernel PCA Algorithm.(8)	BTL3	Applying

8	Discuss the Probabilistic Learning methods involved in Machine Learning.(16)	BTL3	Applying
9	Explain the concept and algorithm involved in Unsupervised Learning Environment. (16)	BTL6	Creating
10	Explain the importance of Eigen values and Eigen vectors in machine learning with an example application such as Principal Component Analysis (PCA)	BTL3	Applying
11	Compose the application of EM in unsupervised learning. Provide an example of clustering using EM and GMM.	BTL6	Creating
12	Explain briefly about unsupervised learning structure? (16)	BTL4	Analyzing
13	Explain the working of the K-Nearest Neighbors (KNN) algorithm. How is it used for both classification and regression?	BTL5	Evaluating
14	(i)Explain the concepts of clustering approaches. (8) (ii)How it differ from classification (8)	BTL4	Analyzing
15	Describe the K-means clustering algorithm. Explain the steps with mathematical formulation and give a real-world example.	BTL3	Applying
16	Discuss challenges in reinforcement learning and solutions.	BTL5	Evaluating
17	Explain the Gaussian Expectation-Maximization Algorithm with necessary example.	BTL5	Evaluating

UNIT IV PROBABILISTIC METHODS FOR LEARNING			
Introduction -Naïve Bayes Algorithm -Maximum Likelihood -Maximum Apriori -Bayesian Belief Networks - Probabilistic Modelling of Problems -Inference in Bayesian Belief Networks - Probability Density Estimation - Sequence Models - Markov Models - Hidden Markov Models			
PART – A			
Q.No.	Questions	BT Level	Competence
1	What is Maximum Likelihood Estimation (MLE)?	BTL1	Remembering
2	Give the formula for Maximum A Priori (MAP) estimation.	BTL2	Understanding
3	Define Bayesian Belief Network (BBN).	BTL1	Remembering
4	What is probabilistic modelling of problems?	BTL1	Remembering
5	State the purpose of inference in Bayesian Belief Networks.	BTL1	Remembering
6	What is Probability Density Estimation?	BTL1	Remembering
7	Describe sequence models in probabilistic learning.	BTL2	Understanding
8	Define Markov Model.	BTL1	Remembering
9	What is a Hidden Markov Model (HMM)?	BTL1	Remembering
10	List the components of a Hidden Markov Model.	BTL1	Remembering
11	What is the independence assumption in Naïve Bayes?	BTL1	Remembering
12	Give an example of where Naïve Bayes is used.	BTL2	Understanding
13	What is the difference between MLE and MAP?	BTL2	Understanding
14	Define conditional independence in BBN.	BTL1	Remembering
15	What is d-separation in Bayesian networks?	BTL1	Remembering
16	Describe kernel density estimation for PDE.	BTL2	Understanding
17	What are transition probabilities in Markov models?	BTL1	Remembering
18	Give the applications of Hidden Markov Models.	BTL2	Understanding
19	What is the Viterbi algorithm used for in HMM?	BTL1	Remembering
20	Define emission probabilities in HMM.	BTL1	Remembering

21	What is the role of prior probability in MAP?	BTL2	Understanding
22	List types of inference in BBN.	BTL1	Remembering
23	Describe the forward algorithm in HMM.	BTL2	Understanding
24	What is the Baum-Welch algorithm?	BTL1	Remembering
PART – B			
1	Explain the variants of Naïve Bayes algorithm like Gaussian and Multinomial with examples.	BTL4	Analyzing
2	Discuss Maximum Likelihood estimation and derive it for a binomial distribution.	BTL5	Evaluating
3	Illustrate Maximum A Priori estimation with a coin toss example.	BTL3	Applying
4	Illustrate Bayesian Belief Networks with a diagram and example.	BTL3	Applying
5	Explain probabilistic modelling for weather prediction with an example.	BTL4	Analyzing
6	Discuss exact inference methods in Bayesian Belief Networks like enumeration.	BTL6	Creating
7	Explain approximate inference in BBN using sampling techniques.	BTL4	Analyzing
8	(i) Describe sequence models. (8) (ii) Give their applications. (8)	BTL3	Applying
9	Explain non-parametric methods for PDE like histograms.	BTL4	Analyzing
10	Explain Hidden Markov Models (HMM) in detail.	BTL4	Analyzing
11	Explain first-order Markov Models with a state transition example.	BTL3	Applying
12	Discuss the evaluation problem in Hidden Markov Models using forward algorithm.	BTL5	Evaluating
13	Explain the decoding problem in HMM using Viterbi algorithm with example.	BTL3	Applying
14	Discuss the learning problem in HMM using Baum-Welch algorithm.	BTL4	Analyzing
15	Compare Naïve Bayes with logistic regression for classification tasks.	BTL5	Evaluating
16	Explain variable elimination for inference in BBN with a small network example.	BTL4	Analyzing
17	Illustrate Kernel Density Estimation for PDE using a dataset.	BTL3	Applying

UNIT V NEURAL NETWORKS AND DEEP LEARNING

Neural Networks - Biological Motivation- Perceptron - Multi-layer Perceptron - Feed Forward Network –
Back Propagation-Activation and Loss Functions- Limitations of Machine Learning - Deep Learning-
Convolution Neural Networks - Recurrent Neural Networks - Use cases

PART – A

Q.No.	Questions	BT Level	Competence
1	Name any two activation functions	BTL1	Remembering
2	Which activation function is used in multilayer perceptron?	BTL1	Remembering
3	Does MLP have activation function?	BTL1	Remembering
4	What is the role of an activation function in a neural network?	BTL1	Remembering
5	What is the problem with ReLU?	BTL1	Remembering
6	What is perceptron and its types?	BTL1	Remembering
7	Why is ReLU better than softmax?	BTL2	Understanding
8	Draw the architecture of multilayer perceptron	BTL2	Understanding
9	Why do you require Multilayer Perceptron?	BTL2	Understanding
10	What are the activation functions of MLP?	BTL2	Understanding
11	What are the types of activation function?	BTL2	Understanding
12	What is Convolutional Neural Network?	BTL1	Remembering
13	What is Recurrent Neural Network?	BTL1	Remembering
14	Give some Limitations of machine learning	BTL1	Remembering
15	What is Deep Learning?	BTL1	Remembering
16	Give the advantages of Multilayer Perceptron?	BTL2	Understanding
17	What do you mean by activation function?	BTL2	Understanding
18	Name the two parts of MLP.	BTL1	Remembering
19	How many layers are there in perceptron?	BTL1	Remembering
20	Explain the structure of CNN Architecture	BTL1	Remembering
21	List the Components of CNN	BTL1	Remembering
22	List the Components of RNN	BTL1	Remembering
23	State one key limitation of the Perceptron model.	BTL2	Understanding
24	Give the difference between a perceptron and a MLP?	BTL2	Understanding

PART – B

1	Explain a deep feed forward network with a neat sketch. (16)	BTL4	Analyzing
2	Explain in detail about gradient descent optimization? (16)	BTL4	Analyzing
3	Draw the architecture of a single layer perceptron (SLP) and explain its operation. Mention its advantages and disadvantages. (16)	BTL5	Evaluating
4	How do you tune hyper parameters for better neural network performance? Explain in detail. (16)	BTL3	Applying
5	Explain in detail about Perceptron and its types? (16)	BTL4	Analyzing
6	(i) Explain the steps in the back propagation learning algorithm.(8) (ii)What is the importance of it in designing neural networks? (8)	BTL4	Analyzing
7	(i) Draw the architecture of a Multilayer perceptron (MLP) and explain its operation. (8) (ii)Mention its advantages and disadvantages. (8)	BTL3	Applying

8	Illustrate deep learning concepts and its evolution.(16)	BTL3	Applying
9	With a neat illustration, Explain in detail the Neural Network Process with an example.	BTL4	Analyzing
10	Design a simple MLP for a classification task and explain training.	BTL6	Creating
11	Illustrate the factors that affect the performance of multilayer feed-forward neural network. (16)	BTL3	Applying
12	Explain detail about activation functions? (16)	BTL4	Analyzing
13	Elaborate the process of training hidden layers by ReLU in deep networks(16)	BTL4	Analyzing
14	Explain about ReLu, Hyper parameter tuning, Normalization, Regularization, Dropout? (16)	BTL4	Analyzing
15	Describe back propagation and features of back propagation. (16)	BTL5	Evaluating
16	Develop a Back propagation algorithm for Multilayer Feed forward neural network consisting of one input layer, one hidden layer and output layer from first principles. (16)	BTL5	Evaluating
17	Explain in detail the back propagation algorithm in neural network(16)	BTL5	Evaluating