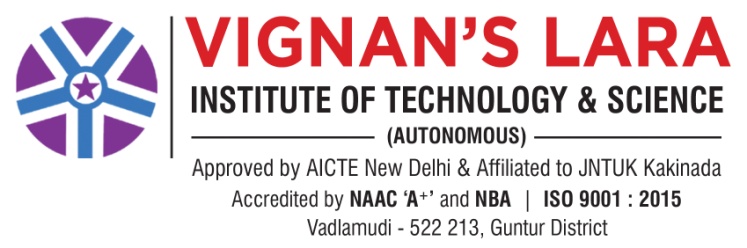
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**SUBJECT: MACHINE LEARNING**

**Regulation: R20 A.Y.:2024-25**

**Name of the Faculty: M.SUMAN Year & Sem: III-II**

**UNIT-1 Introduction to Machine Learning**

**Topic Name:** Introduction of Artificial Intelligence

1. Write about various fields that form the basis for Artificial Intelligence. [7M] , May-2024
2. Write a short note on fields that contribute to Artificial Intelligence.[7M], May-2024

**Topic Name:** Introduction of Machine Learning

1. Differentiate traditional and machine learning approaches with neat sketches.[7] July -2023.
2. What is Machine Learning? Explain any four applications with an example. [7M]

**Topic Name:** Introduction of Deep Learning

1. Describe the architecture and functionality of various layers of deep learning networks in detail. [7M], May-2024
2. Describe the following: i) Artificial Intelligence, ii) Machine Learning, iii) Deep Learning.[7] May-2024

**Topic Name:** Types of Machine Learning

1. a) Write a short note on applications of machine learning to classification problems. [7M] , May-2024

**Topic Name:** Main challenges of Machine Learning

1. What are the challenges encountered in the implementation of machine learning algorithms? [7M], May-2024
2. Can you name and explain four of the main challenges in Machine Learning? [7M] July -2023

Explain the following:

i) Insufficient Quantity of Training Data

ii) Non representative Training Data

iii)Poor Quality Data

iv) Over fitting and under fitting [7M] , May-2024

1. Explain the following:

i) Insufficient Quantity of Training Data

ii) Non representative Training Data

iii)Poor Quality Data

iv) Over fitting and under fitting [7M] , May-2024

**Topic Name:** Supervised learning &Un-supervised learning

1. Write a short note on Supervised and unsupervised machine learning algorithms. [7M], May-2024
2. Explain the application of machine learning in classification and prediction. [7M], May-2024
3. Would you frame the problem of spam detection as a supervised learning problem or an unsupervised learning problem? Explain. [7M] July -2023

**Topic Name:** Training & Test loss

1. How do you estimate the loss and accuracy of the machine learning model? Explain for training and test cases. [7M], May-2024
2. Explain Training and Test Loss while generating the models. [7M], July -2023.

**Topic Name:** Trade-off in statistical learning

1. What is the significance of using statistical foundations in machine learning? Explain various tradeoffs in statistical learning. [7M], May-2024
2. Explain Tradeoffs in Statistical Learning. [7M] July -2023

**Topic Name:** Estimating Risk Statistics

1. How do we estimate the risk and loss functions? Explain the role of statistics in it in detail. [7M], May-2024
2. What are the concepts of statistics used in machine learning? Explain in detail. [7M], May-2024
3. List and explain Risk statistics [7M] July -2023

**Topic Name:** Sampling distribution of an estimator & Empirical Risk minimization

1. Write a note on Empirical Risk Minimization. What is its significance in error minimization? May-2024

**Unit-2 SUPERVISED LEARNING (Regression & Classification)**

**Topic Name: Basic methods**

1. Write the induction and deduction steps followed in the classification model and explain the basis for training and testing with examples.[7] May/June – 2024.
2. Differentiate classification and regression problems and their solutions with examples. .[7] May/June – 2024.
3. What is the Sigmoid function? Where it can be used? Explain. [7M] , July -2023.

**Topic Name:** Distance based method

1. Explain the working principle of the distance-based model. Give example. [7] May/June – 2024

**Topic Name:** Nearest Neighbor method

1. Describe the importance of K-Values in nearest neighbour algorithms in detail. [7] May/June – 2024
2. Explain KNN algorithm with an example. [7M] , July -2023.

**Topic Name:** Decision Tree method

1. How can decision trees be used to classify the attributes? Explain the algorithm steps. [7] May/June – 2024
2. What is the decision tree? How to choose attribute selection in decision tree? [7M] , July -2023.
3. Explain about Decision tree classifier with an example. [7M] , July -2023.

**Topic Name:** Naïve Nayes method

1. What is Bayes theorem? Explain Naïve bayes with an example. [7M] , July -2023.

**Topic Name:** LINEAR MODEL: Linear Regression model

1. Write a note on linear regression. Implement the linear regression to predict the stock market price prediction.[7] May/June – 2024.
2. Discuss about Linear regression with an example [7M] , July -2023.

**Topic Name:** Logistic Regression model

1. Explain the working principle of logistic regression. How is it different from linear regression? Give an example. [7] May/June – 2024.
2. What is the purpose of sigmoid function in Logistic Regression? Explain. [7M] , July -2023.

**Topic Name:** Support Vector machines

1. Support Vector Machines outperform other linear models. Justify this statement. [7] May/June – 2024
2. What is a support vector? Explain the importance of maximal margin in support vector machine. [7] [7M] , July -2023.

**Topic Name:** BINARY CLASSIFICATION: Multi-class structured outputs

1. What is ranking in binary classification in Machine Learning? What is the best algorithm for raking? [7M] , July -2023.

**Topic Name:** MINIST method

1. What is multi-class classification? With MNIST data sets, explain the algorithm [7] May/June – 2024
2. Explain about MNIST dataset. Describe the procedure to apply classification technique. [7M] , July -2023.

**Topic Name:** Ranking method

1. What is ranking? How do we determine it? Explain with any classification algorithm [7] May/June – 2024

**Unit-III ENSEMBLE LEARNING and RANDOM FOREST**

**Topic Name:** Introduction

1. How will ensemble methods yield better performance than normal learning algorithms? Explain various ensemble learning methods in detail. May/June – 2024
2. Illustrate the stacking mechanism in ensemble techniques. [7M] , July -2023.

**Topic Name:** Voting classifiers method

1. Write a note on Hard voting classifier predictions. Explain with an example. May/June – 2024
2. Write the working principle of the voting classifier. Explain its limitations and handle them with other ensemble methods May/June – 2024
3. What is the difference between hard and soft voting classifiers? Explain them. [7M] , July -2023.

**Topic Name:** Bagging & pasting method

1. Discuss the most popular Ensemble methods given. i) Bagging ii) Boosting iii) Stacking [7M] May/June – 2024

**Topic Name:** Random forest method

1. Explain the working principle of the Random forest algorithm. How do we identify the feature’s importance in it? Discuss. May/June – 2024
2. Expand the construction of random forests and important parameters to be considered during construction. May/June – 2024
3. Discuss about Extra trees. Are Extra-Trees slower or faster than regular Random Forests? Explain. [7M] , July -2023.
4. What is Bagging technique? Explain about Random Forest Algorithm. [7M] , July -2023.

**Topic Name:** Boosting & Stacking method and revision

1. Explain what is boosting , Adaboost and gradient boosting algorithms. May/June – 2024
2. What is Bagging and pasting? Explain it’s implementation with scikit-learn. [7M] , July -2023.
3. Define Boosting? Explain about Gradient Boosting technique. [7M] , July -2023.

**Topic Name:** SUPPORT VECTOR MACHINE:

1. Explain the following Support Vector Machine models. i) Linearly separable case ii) Linearly inseparable case May/June – 2024

**Topic Name:** Linear SVM Classification, Nonlinear SVM Classification

1. With a neat sketch, explain the marginal planes used in linear SVM classification. May/June – 2024
2. Differentiate SVM classification with linear and non linear input data sets. May/June – 2024
3. Explain about Linear SVM Classification in detail. Compare it with nonlinear model. [7M] , July -2023.
4. What are support vectors? Describe Large margin classification in SVM. [7M] , July -2023.

**Topic Name:** SVM Regression

1. Write a short note on the implementation of SVM regression. How is it different from classification? [7] May/June – 2024
2. Describe Gaussian RBF kernel in SVM. [7M] , July -2023.
3. Explain SVM regression in detail with a neat diagram. [7M] , July -2023.

**Topic Name:** Naïve Bayes Classifiers.

1. Implement Naïve Bayes classifier to classify the loan application as rejected/accepted based on the history of the customer with a limit on total loan amount of 50000/- Rs. May/June – 2024
2. Describe the working principle of Naïve Baye’s algorithm. How does it handle the dependency between attributes of data? Explain. May/June – 2024
3. Explain about Naïve Bayes classifier algorithm with an example. [7M] , July -2023.

**Unit-IV Unsupervised Learning Techniques**

**Topic Name:** Clustering Technique

1. Can we perform data cleaning and data reduction preprocessing techniques with clustering algorithms? Discuss in detail. ? [7] May/June – 2024
2. How can we use clustering for Preprocessing? Explain. [7M] , July -2023.
3. What are the main applications of clustering algorithms? Illustrate. [7M] , July -2023.
4. Write a note clustering? Why is clustering considered unsupervised? Explain various clustering techniques in detail. ? [7] May/June – 2024

**Topic Name:** K-Means Clustering Technique

1. Write a detailed note on a kernel trick that implicitly maps instances into a very high-dimensional space. How do we perform complex nonlinear projections for dimensionality reduction with this? ? [7] May/June – 2024
2. What is k-means clustering? ii) When to use k-means clustering to analyze data? ii) How to implement k-means clustering? iii) How to select a meaningful number of clusters? ? [7] May/June – 2024
3. Describe K means clustering algorithm. [7M] , July -2023.

**Topic Name:** Limits of K-Means Clustering Technique

1. Initializing the k- centroids in k-means plays a vital role in yielding better performance by the k-means clustering algorithm. Discuss with example. ? [7] May/June – 2024
2. Explain the following with respect to the K-Means clustering algorithm. i) The objective ii) How k-means clustering works iii) Implementation of K-Means Clustering ? [7] May/June – 2024

**Topic Name:** Using Clustering for Image Segmentation and Processing, Semi supervisory learning.

1. Consider an image with multiple objects. Explain the steps to be followed to perform clustering for image segmentation. ? [7] May/June – 2024
2. How can we use clustering for image segmentation? Explain. [7M] , July -2023.

**Topic Name:**  DBSCAN

1. Write the algorithmic steps to be followed for clustering using the DBSACN algorithm. ? [7] May/June – 2024 [7M] , July -2023.
2. How to cluster the high dimensional data with density based clustering algorithm? Explain the step-by-step process. ? [7] May/June – 2024
3. What is Density based clustering? Describe DBSCAN clustering algorithm. [7M] , July -2023.

**Topic Name:** Gaussian Mixtures.

1. What is a Gaussian mixture? What tasks can you use it for? Explain. [7M] , July -2023.

**Topic Name:** Dimensionality Reduction: The Curse of Dimensionality

1. Explain the following dimensionality reduction techniques. Projection and Manifold Learning. ? [7] May/June – 2024
2. What are the main motivations for reducing a dataset’s dimensionality? What are the main drawbacks? [7M] , July -2023.
3. How can you evaluate the performance of a dimensionality reduction algorithm on your dataset? Explain. [7M] , July -2023.

**Topic Name:** PCA Using Scikit-Learn

1. How is dimensionality reduction handled by Principal Component Analysis? Explain in detail. ? [7] May/June – 2024
2. Explain the following with respect to principal component analysis: Randomization and Kernel Trick. ? [7] May/June – 2024
3. Can PCA be used to reduce the dimensionality of a highly nonlinear dataset? Explain [7M] , July -2023.
4. Explain the concept of PCA for Compression. [7M] , July -2023.

**Topic Name:** Randomized PCA

1. In what cases would you use Incremental PCA, Randomized PCA & Kernel PCA? Explain. [7M] , July -2023.

**Topic Name:** Kernel PCA.

1. Explain about Kernel PCA in detail. [7M] , July -2023.

**Unit-V NEURAL NETWORKS and DEEP LEARNING:**

**Topic Name**: Introduction to Artificial Neural Networks with Keras

1. Relate Multi-Layer Perceptron and Backpropagation. Describe various activation functions used in it.
2. Write a note on the functions of perceptron and its implementation of logical operations. Discuss its limitations.
3. What are the various structures of artificial neural networks? Explain in detail.
4. Write an algorithm to train the multi-layer perceptron.
5. Explain the biological neuron simulation as an artificial neuron. Describe its architecture and functions.
6. How Biological Neurons related to ANN? Explain.
7. Name three popular activation functions. Can you draw and explain them?
8. Explain about Logical Computations with Neurons. [7M] b) Differentiate Forward and Backward propagations in ANN .
9. Explain about Perceptron ANN architecture with a neat sketch.
10. Explain about Multi Layer Perceptron (MLP) ANN architecture.

**Topic Name:** Implementing MLPs with Keras**,**

1. Present an algorithm for Training an MLP. Use Keras for implementation and explanation.
2. Explain the following with an application where a student dataset is considered to predict the grade as Pass/Fail a) Load Data b) Define Keras Model c) Compile Keras Model d) Fit Keras Model e) Evaluate Keras Model f) Tie It All Together g) Make Predictions
3. Give the overview of the five steps in the neural network model life-cycle in Keras: Define, Compile, Fit, Evaluate the Network and Make Predictions.
4. Answer the following a) Define a neural network in Keras b) How to compile a Keras model using the efficient numerical backend? c) How to train a model on data? d) How to evaluate a model on data? e) How to make predictions with the model?
5. Build a spam classifier and perform all required operations using Keras. Use the Multi-layer Perceptron algorithm as a predictive model that predicts the email class as spam or ham.
6. Why would you want to use the Data API? Explain about Data API? [7M] b) Illustrate the two types of implementation of Keras API.
7. How is data loaded with TesorFlow? Illustrate the steps.
8. What are the benefits of splitting a large dataset into multiple files? Explain about tf.keras while using dataset?

**Topic Name:** Installing TensorFlow 2 and Loading Data with Tensor Flow.

1. How do we install Tensor flow? Explain the steps and detail the libraries used to implement machine learning algorithms
2. Explain about the step-by-step procedure to install TensorFlow 2.
3. What types of neural network layers does Keras support? Explain them.