(3 Hours) **Total Marks: 80**

N.B. : (1) Question No. 1 is compulsory.
(2) Attempt any three questions out of remaining five.

1 (a) Define Machine Learning and Explain with example importance of Machine Learning [05]

(b) Explain Multilayer perceptron with a neat diagram [05]

(c) Why is SVM more accurate than logistic regression? [05]

(d) Explain Radial Basis Function with example. [05]

2. (a) What is Dimensionality reduction? Describe how Principal Component Analysis is carried out to reduce dimensionality of data sets. [10]

(b) Find the singular value decomposition of [10]

$$A = \begin{bmatrix} 2 & 2 \\ -1 & 1 \end{bmatrix}$$

3 (a) For a unknown tuple t =<Outllook =Sunny,Temperature =Cool, Wind= Strong> use naïve Bayes classifier to find whether the class for PlayTennis is yes or no. The dataset is given below [10]

Outlook	Temperature	Wind	PlayTennis
Sunny	Hot	Weak	No
Sunny	Hot	Strong	No
Overcast	Hot	Weak	Yes
Rain	Mild	Weak	Yes
Rain	Cool	Weak	Yes
Rain	Cool	Strong	No
Overcast	Cool	Strong	Yes
Sunny	Mild	Weak	No
Sunny	Cool	Weak	Yes
Rain	Mild	Weak	Yes
Sunny	Mild	Strong	Yes
Overcast	Mild	Strong	Yes
Overcast	Hot	Weak	Yes
Rain	Mild	Strong	No

(b) List some advantages of derivative-based optimization techniques. Explain Steepest Descent method for optimization. [10]

4. (a) Given the following data for the sales of car of an automobile company for six consecutive years. Predict the sales for next two consecutive years. [10]

Years	2013	2014	2015	2016	2017	2018
Sales	110	100	250	275	230	300

(b) Explain various basic evaluation measures of supervised learning Algorithm for Classification. [10]

5. (a) Consider following table for binary classification. Calculate the root of the decision tree using Gini index. [10]

Customer Income	Gender	Car Type	Class
High	M	Family	C1
High	M	Sports	C1
High	M	Family	C2
Low	M	Family	C2
Low	F	Family	C2
Low	F	Sports	C1
Low	F	Sports	C2
High	M	Family	C1
High	F	Family	C2
High	F	Family	C2
High	F	Sports	C2
Low	M	Sports	C2
Low	F	Family	C2
Low	M	Sports	C1

(b) Define Support Vector Machine. Explain how margin is computed and optimal hyper-plane is decided. [10]

6. Write Short notes on any **four** [20]

(a) Hidden Markov Model

(b) EM Algorithm

(c) Logistic Regression

(d) McCulloch-Pitts Neuron Model

(e) DownHill simplex method.
