Reg.No.:												

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN

[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]

Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 50001

B. E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2025

Seventh Semester

Computer Science and Engineering

U19CS730 – MACHINE LEARNING

(Regulation 2019)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Define inductive bias in the context of machine learning.	2	K1	CO1
2.	State the difference between maximally specific hypothesis and maximally general hypothesis in concept learning.	2	K2	CO1
3.	Define Bayes Theorem and mention its significance in Bayesian learning.	2	K1	CO2
4.	What is the basic idea behind Random Forest in comparison to a single decision tree?	2	K2	CO2
5.	State one real-world application where the k-Nearest Neighbour (k-NN) algorithm is effectively used.	2	K2	CO3
6.	How does PCA help in reducing the dimensionality of a dataset while retaining most of the information?	2	K2	CO3
7.	What is a Markov Decision Process (MDP) and why is it important in reinforcement learning?	2	K2	CO4
8.	How does Case-Based Reasoning (CBR) differ from traditional rule-based learning approaches?	2	K2	CO4
9.	What is the main idea behind Genetic Algorithms and how do they perform hypothesis space search?	2	K2	CO5
10.	How does the FOIL algorithm generate first-order rules in machine learning?	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Explain the process of concept learning as a search problem.	6	K2	CO1
		ii.	Discuss in detail the version space representation and the candidate elimination algorithm with suitable examples.	7		
			(OR)			
	b)	i.	Discuss the major perspectives and issues in designing a learning system.	6	K2	CO1
		ii.	Elaborate on various learning problems and explain how inductive bias affects the learning outcome.	7		
12.	a)		Explain the representation, basic algorithms, hypothesis search, and key issues involved in Decision Tree Learning using suitable examples and diagrams.	13	K2	CO2
			(OR)			
	b)		Derive the Maximum Likelihood and Least-Squared Error Hypothesis from Bayes' theorem and analytically compare the performance of Bayes Optimal Classifier and Naïve Bayes Classifier with appropriate illustrations.	13	K1	CO2
13.	a)		Given the following dataset of points with two features, apply the k-Means algorithm (k = 2) to perform one full iteration (assignment and update steps). Show all intermediate calculations and the updated cluster centroids. Data points: (2, 10), (2, 5), (8, 4), (5, 8), (7, 5), (6, 4)Initial centroids: $C_1 = (2, 10)$, $C_2 = (5, 8)$.	13	K3	CO3
			(OR)			
	b)		Using the Backpropagation Algorithm, compute the updated weights for a simple neural network with one input neuron, one hidden neuron, and one output neuron. Assume: • Input = 0.5 • Target output = 0.8 • Initial weights = 0.4 (input to hidden), 0.3 (hidden to output) • Learning rate = 0.2 • Activation function = sigmoid Show all steps of forward propagation, error calculation, and weight updates.	13	K3	CO3
14.	a)		Describe the concept of Instance-Based Learning and explain its key methods—Locally Weighted Regression, Radial Basis Functions, and Case-Based Reasoning.	13	K2	CO4
			(OR)			

	b) Explain the working of Reinforcement Learning with the help of a diagram of a learning agent.	13	K1	CO4
15.	a) Discuss with examples the concepts of genetic programming, models of evolution and learning, and parallelizing genetic algorithms.	13	K2	CO5
	(OR)			
	b) i. How are learning sets of rules performed in machine learning? ii. What is meant by induction as inverted deduction in machine learning, and how is it used to derive general rules from specific examples?	13	K3	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.	Questions	Marks	KL	CO
16.	a) Consider a simple Markov Decision Process with three states S_1, S_2, and S_3 and one action available in each state. The transition probabilities and rewards are given below:	15	K2	CO4

From State	To State	Transition Probability	Reward
S_1	S_2	0.8	+5
S_1	S_3	0.2	+2
S_2	S_1	0.6	+3
S_2	S_3	0.4	+4
S_3	S_1	1.0	+1

Let the **discount factor** (γ) = 0.9.
Assume initial value estimates: $V(S_1) = 0$, $V(S_2) = 0$, $V(S_3) = 0$
Perform **one iteration of Value Iteration** to compute the updated values $V(S_1)$, $V(S_2)$, and $V(S_3)$. Show all steps and intermediate calculations clearly.

(OR)

b)	i. How does the Random Forest algorithm work in machine learning?	6	K2	CO2
	ii. Explain its working principle, advantages over a single decision tree, and typical applications with suitable examples.	9		