U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: VII**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 21AE7DEMLA **Max Marks: 100**
Course: Machine Learning in Aerospace Engineering

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Identify the type of machine learning problem for each of the following scenarios. Justify your answers. a) Predicting if a new image has cat or dog based on the historical data of other images of cats and dogs, where you are supplied the information about which image is cat or dog. b) Predict which team will win a tournament. c) Predicting the monthly sales of a cloth store in rupees. d) Learning to drive a cycle. e) Group audio files based on language of the speakers.	*CO1*	*PO 1*	**5**
	b)		Alice is hired by a credit card company to develop a system for identifying fraudulent transactions. Propose a Machine Learning solution for this scenario. Specify the type of learning, features alice would use, and potential algorithms. Discuss how you would evaluate the model's performance.	*CO1*	*PO1*	**5**
	c)		Compare and contrast supervised and unsupervised machine learning algorithms, highlighting their respective principles, applications, and challenges. Provide examples to support your explanations and evaluate the significance of labeled versus unlabeled data in the context of machine learning.	*CO1*	*PO1*	**10**
			OR			
2	a)		Are stochastic processes important for machine learning? Explain	*CO1*	*PO1*	**10**
	b)		Explain Machine learning with its limitations and when should you use Machine Learning along with the steps involved.	*CO1*	*PO1*	**10**
			UNIT - II			

<table>
<tr><td></td><td>3</td><td>a)</td><td>Explain the advantages of employing SVM kernels in non-linear SVM. Provide a concise scenario or example, emphasizing the impact of kernel choice on the model's effectiveness in handling non-linear data.</td><td>CO2</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Compute the principal component of following data-
CLASS 1: X = 2 , 3 , 4 Y = 1 , 5 , 3

CLASS 2: X = 5 , 6 , 7 Y = 6 , 7 , 8</td><td>CO2</td><td>PO3</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>4</td><td>a)</td><td>Given the Positively labeled data points (3,1)(3,-1)(6,1)(6,-1) and Negatively labeled data points (1,0)(0,1)(0,-1)(-1,0), Using the concept of Linear Support Vector Machine, obtain the corresponding hyperplane. Justify your answer with appropriate equations.</td><td>CO2</td><td>PO3</td><td>8</td></tr>
<tr><td></td><td></td><td>b)</td><td>What is linear regression and explain how linear regression is advantageous over non-linear?</td><td>CO2</td><td>PO1, PO2</td><td>4</td></tr>
<tr><td></td><td></td><td>c)</td><td>Evaluate the mathematical foundations, limitations, and advanced applications of Principal Component Analysis (PCA), emphasizing its role in solving complex problems with high-dimensional datasets.</td><td>CO2</td><td>PO2</td><td>8</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - III</td><td></td><td></td><td></td></tr>
<tr><td></td><td>5</td><td>a)</td><td>Consider a Natural Language Processing (NLP) system for sentiment analysis in customer reviews. Determine the inductive biases that could be introduced by the choice of training data in decision tree learning. How might these biases affect the system's ability to accurately assess sentiment across different demographics?</td><td>CO3</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Let's consider a dataset to predict whether a customer will purchase a product based on two features: Age (Young, Middle-aged, Senior) and Income (Low, Medium, High) in table. Learn a decision tree, find the approximate entropy H(Passed).

<table><tr><th>Age</th><th>Income</th><th>Purchase (Yes/No)</th></tr><tr><td>Young</td><td>Low</td><td>No</td></tr><tr><td>Young</td><td>Medium</td><td>No</td></tr><tr><td>Senior</td><td>Low</td><td>Yes</td></tr><tr><td>Senior</td><td>High</td><td>Yes</td></tr></table></td><td>CO3</td><td>PO3</td><td>10</td></tr>
</table>

			Middle-aged | High | Yes Middle-aged | Medium | No Senior | Medium | Yes Young | Low | No Young | High | Yes			
		OR					
6	a)	NASA wants to discriminate between Aliens and Humans based on the characteristics in the dataset given below. Find the entropy and Information gain of the attribute "color". Clearly outline the procedural steps along with computational details.		*CO3*	*PO3*	**10**
	b)	Illustrate the working of decision tree algorithm with suitable equations. Emphasize on the issues in decision tree learning.		*CO3*	*PO1*	**10**
		UNIT - IV				
7	a)	Explain the fundamentals of neural networks, encompassing neuron structure, activation functions with a neat sketch.		*CO4*	*PO1*	**10**
	b)	Describe the architecture and learning process of perceptrons, emphasizing the role of weights and bias. subsequently, elucidate the backpropagation algorithm, detailing its steps, the significance of error calculation, weight adjustment, and the impact of the learning rate in optimizing perceptrons during training.		*CO4*	*PO2*	**10**
		OR				
8	a)	Explain Hebb network and Hebb rule for implementing AND logic function.		*CO3*	*PO1*	**10**
	b)	What do you mean by perceptron and its types?		*CO3*	*PO1*	**10**
		UNIT - V				
9	a)	In a neighbourhood, 90% children were falling sick due flu and 10% due to measles and no other disease. The probability of observing rashes for measles is 0.95 and for flu is 0.08. If a child develops rashes, find the child's probability of having flu.		*CO4*	*PO2*	**5**

ETB ID	Color	Appendages	Height	Smell	Classification
1	Green	3	Tall	Yes	Alien
2	Red	2	Short	No	Human
3	Green	4	Tall	No	Alien
4	Blue	2	Short	Yes	Alien
5	Red	4	Tall	Yes	Alien
6	Green	2	Short	No	Human
7	Blue	3	Tall	No	Alien
8	Red	3	Short	Yes	Human
9	Red	2	Tall	No	Human
10	Green	4	Short	Yes	Alien

		b)	Explain Gibbs algorithm.	*CO4*	*PO1*	**8**
		c)	What is the Naive Bayes Algorithm and explain with its applications? What are the advantages and disadvantages?	*CO4*	*PO1*	**7**
			OR			
	10	a)	Derive an equation for the concept Maximum Likelihood and Least Squared Error Hypothesis.	*CO4*	*PO1*	**8**
		b)	i. Consider the given sample dataset. Using the Naive Bayes classifier, classify the new instance: (Cow, Medium, Black) to the suitable target class of whether a person would enjoy petting an animal or not. ii. Clearly outline the steps involved in developing a Naive Bayes classifier.	*CO4*	*PO3*	**12**

	Animals	Size of Animal	Body Color	Can we Pet them
0	Dog	Medium	Black	Yes
1	Dog	Big	White	No
2	Rat	Small	White	Yes
3	Cow	Big	White	Yes
4	Cow	Small	Brown	No
5	Cow	Big	Black	Yes
6	Rat	Big	Brown	No
7	Dog	Small	Brown	Yes
8	Dog	Medium	Brown	Yes
9	Cow	Medium	White	No
10	Dog	Small	Black	Yes
11	Rat	Medium	Black	No
12	Rat	Small	Brown	No
13	Cow	Big	White	Yes

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