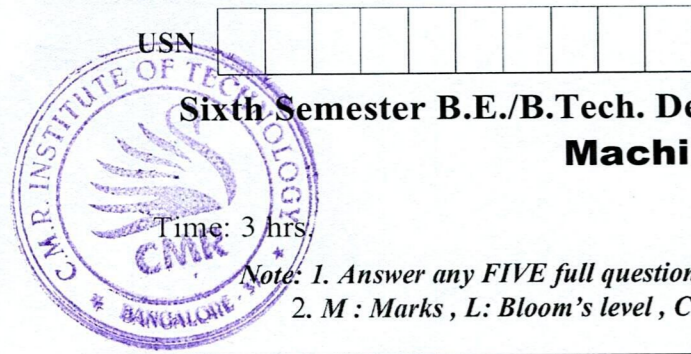


CBCS SCHEME

BCS602



Sixth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Machine Learning

Time: 3 hrs.

Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks, L: Bloom's level, C: Course outcomes.*

Module – 1				M	L	C																																																											
Q.1	a.	Explain the machine learning process and its applications with a suitable diagram.	6	L2	CO1																																																												
	b.	Explain the purpose of dimensionality reduction and its importance in the domain of machine learning.	8	L2	CO1																																																												
	c.	Write short notes on the following : i) Min-Max Scaling ii) Z-score iii) Mean iv) Standard Deviation v) Median vi) Dispersion.	6	L2	CO1																																																												
OR																																																																	
Q.2	a.	Explain the elements of Big Data, data types, and Big Data analytics in relation to Machine Learning.	6	L2	CO1																																																												
	b.	Explain data collection and data pre-processing.	8	L2	CO1																																																												
	c.	Explain the removal of noise or outlier data with a suitable example.	6	L2	CO1																																																												
Module – 2																																																																	
Q.3	a.	Explain the Gaussian Elimination Algorithm and Solve the following problem $x + y + z = 2$ $x + 2y + 3z = 5$ $2x + 3y + 4z = 11$	10	L3	CO2																																																												
	b.	Explain the Types of Machine Learning (ML)	4	L2	CO2																																																												
	c.	Illustrate PCA, why it is important, and write the PCA Algorithm.	6	L3	CO2																																																												
OR																																																																	
Q.4	a.	Solve the problem using the Find – S Algorithm :	10	L3	CO2																																																												
		<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>S. No</th> <th>Horns</th> <th>Tail</th> <th>Tusks</th> <th>Paws</th> <th>Fur</th> <th>Color</th> <th>Hooves</th> <th>Size</th> <th>Elephant</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>No</td> <td>Short</td> <td>Yes</td> <td>No</td> <td>No</td> <td>Black</td> <td>No</td> <td>Big</td> <td>Yes</td> </tr> <tr> <td>2</td> <td>Yes</td> <td>Short</td> <td>No</td> <td>No</td> <td>No</td> <td>Brown</td> <td>Yes</td> <td>Medium</td> <td>No</td> </tr> <tr> <td>3</td> <td>No</td> <td>Short</td> <td>Yes</td> <td>No</td> <td>No</td> <td>Black</td> <td>No</td> <td>Medium</td> <td>Yes</td> </tr> <tr> <td>4</td> <td>No</td> <td>Long</td> <td>No</td> <td>Yes</td> <td>Yes</td> <td>White</td> <td>No</td> <td>Medium</td> <td>No</td> </tr> <tr> <td>5</td> <td>No</td> <td>Short</td> <td>Yes</td> <td>Yes</td> <td>Yes</td> <td>Black</td> <td>No</td> <td>Big</td> <td>Yes</td> </tr> </tbody> </table>	S. No	Horns	Tail	Tusks	Paws	Fur	Color	Hooves	Size	Elephant	1	No	Short	Yes	No	No	Black	No	Big	Yes	2	Yes	Short	No	No	No	Brown	Yes	Medium	No	3	No	Short	Yes	No	No	Black	No	Medium	Yes	4	No	Long	No	Yes	Yes	White	No	Medium	No	5	No	Short	Yes	Yes	Yes	Black	No	Big	Yes			
S. No	Horns	Tail	Tusks	Paws	Fur	Color	Hooves	Size	Elephant																																																								
1	No	Short	Yes	No	No	Black	No	Big	Yes																																																								
2	Yes	Short	No	No	No	Brown	Yes	Medium	No																																																								
3	No	Short	Yes	No	No	Black	No	Medium	Yes																																																								
4	No	Long	No	Yes	Yes	White	No	Medium	No																																																								
5	No	Short	Yes	Yes	Yes	Black	No	Big	Yes																																																								

BCS602

		b. Write a short note on Binomial Distribution, Poisson Distribution and Bernoulli Distribution.	4	L2	CO2																																												
		c. Explain LU Decomposition and solve the following problem $A = \begin{bmatrix} 2 & 3 & 1 \\ 4 & 7 & 3 \\ 6 & 18 & 5 \end{bmatrix}$	6	L3	CO2																																												
Module – 3																																																	
Q.5	a.	Explain the KNN algorithm and solve the following problem : In the KPSC exam, candidates secured the following marks. Based on those obtained marks, categorize whether the candidate is eligible for the exam or not using K-Nearest Neighbors. Given instance as follows :	10	L3	CO3																																												
		<ul style="list-style-type: none"> General Studies X(O1) = 07 Computer Science Y(O2) = 6 Language = 4 K = 3 nearest neighbors <p>Note : Training data is provided, where O represents observable values.</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>General Studies</th> <th>Computer Science</th> <th>Languages</th> <th>Eligible</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>3</td> <td>5</td> <td>Fail</td> </tr> <tr> <td>6</td> <td>7</td> <td>8</td> <td>Pass</td> </tr> <tr> <td>6</td> <td>8</td> <td>6</td> <td>Pass</td> </tr> <tr> <td>5</td> <td>5</td> <td>4</td> <td>Fail</td> </tr> <tr> <td>8</td> <td>8</td> <td>9</td> <td>Pass</td> </tr> </tbody> </table>				General Studies	Computer Science	Languages	Eligible	4	3	5	Fail	6	7	8	Pass	6	8	6	Pass	5	5	4	Fail	8	8	9	Pass																				
General Studies	Computer Science	Languages	Eligible																																														
4	3	5	Fail																																														
6	7	8	Pass																																														
6	8	6	Pass																																														
5	5	4	Fail																																														
8	8	9	Pass																																														
		b. Explain the Local Weighted KNN, Logistic Regression, and Nearest centroid classifier algorithms.	10	L3	CO3																																												
OR																																																	
Q.6	a.	Explain Linear Regression and Polynomial Regression and solve a Linear Regression problem : Apply linear regression technique to predict the 7 th week sales	10	L3	CO3																																												
		<p style="text-align: center;">Table : Sample data</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>X</th> <th>Y</th> </tr> <tr> <th>(week)</th> <th>(Sales in Thousands)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.2</td> </tr> <tr> <td>2</td> <td>1.8</td> </tr> <tr> <td>3</td> <td>2.6</td> </tr> <tr> <td>4</td> <td>3.2</td> </tr> <tr> <td>5</td> <td>3.8</td> </tr> </tbody> </table>				X	Y	(week)	(Sales in Thousands)	1	1.2	2	1.8	3	2.6	4	3.2	5	3.8																														
X	Y																																																
(week)	(Sales in Thousands)																																																
1	1.2																																																
2	1.8																																																
3	2.6																																																
4	3.2																																																
5	3.8																																																
		b. Explain ID3 algorithm and solve the following problem :	10	L3	CO3																																												
		<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Age</th> <th>Competition</th> <th>Type</th> <th>Profit</th> </tr> </thead> <tbody> <tr> <td>Old</td> <td>Yes</td> <td>S/W</td> <td>Down</td> </tr> <tr> <td>Old</td> <td>No</td> <td>S/W</td> <td>Down</td> </tr> <tr> <td>Old</td> <td>No</td> <td>H/W</td> <td>Down</td> </tr> <tr> <td>Mid</td> <td>Yes</td> <td>S/W</td> <td>Down</td> </tr> <tr> <td>Mid</td> <td>Yes</td> <td>H/W</td> <td>Down</td> </tr> <tr> <td>Mid</td> <td>No</td> <td>H/W</td> <td>Up</td> </tr> <tr> <td>Mid</td> <td>No</td> <td>S/W</td> <td>Up</td> </tr> <tr> <td>New</td> <td>Yes</td> <td>S/W</td> <td>Up</td> </tr> <tr> <td>New</td> <td>No</td> <td>H/W</td> <td>Up</td> </tr> <tr> <td>New</td> <td>No</td> <td>S/W</td> <td>Up</td> </tr> </tbody> </table>	Age	Competition	Type	Profit	Old	Yes	S/W	Down	Old	No	S/W	Down	Old	No	H/W	Down	Mid	Yes	S/W	Down	Mid	Yes	H/W	Down	Mid	No	H/W	Up	Mid	No	S/W	Up	New	Yes	S/W	Up	New	No	H/W	Up	New	No	S/W	Up			
Age	Competition	Type	Profit																																														
Old	Yes	S/W	Down																																														
Old	No	S/W	Down																																														
Old	No	H/W	Down																																														
Mid	Yes	S/W	Down																																														
Mid	Yes	H/W	Down																																														
Mid	No	H/W	Up																																														
Mid	No	S/W	Up																																														
New	Yes	S/W	Up																																														
New	No	H/W	Up																																														
New	No	S/W	Up																																														

CMRIT LIBRARY
RANGALORE - 560 037

Module – 4																													
Q.7	a.	Explain Baye's Theorem and Bayes' optimal classifier.	8	L2	CO4																								
	b.	Explain the Naïve Bayes algorithm and solve the problem using the Naïve Bayes classifier. Classify using Naïve Bayes' for the new sample : (fruit = {yellow, sweet, long}) Data : <table border="1" data-bbox="528 310 926 445"> <thead> <tr> <th>Fruit</th> <th>Yellow</th> <th>Sweet</th> <th>Long</th> </tr> </thead> <tbody> <tr> <td>Orange</td> <td>350</td> <td>450</td> <td>0</td> </tr> <tr> <td>Banana</td> <td>400</td> <td>300</td> <td>350</td> </tr> <tr> <td>Others</td> <td>50</td> <td>100</td> <td>50</td> </tr> </tbody> </table>	Fruit	Yellow	Sweet	Long	Orange	350	450	0	Banana	400	300	350	Others	50	100	50	12	L3	CO4								
Fruit	Yellow	Sweet	Long																										
Orange	350	450	0																										
Banana	400	300	350																										
Others	50	100	50																										
OR																													
Q.8	a.	Write a note on : i) Perceptron ii) Different types of Artificial Neural Network with a suitable diagram.	8	L2	CO4																								
	b.	Explain the ANN Node structure and all its associated activation function with suitable mathematical notations.	12	L2	CO4																								
Module – 5																													
Q.9	a.	Write a short note on Clustering and classification along with advantages and disadvantages of the clustering algorithm.	6	L2	CO5																								
	b.	Explain the proximity measures.	6	L2	CO5																								
	c.	Explain the Mean Shift Clustering Algorithm and solve the following problem. Start with point P1(1, 1) P1 = (1, 1) P2 = (2, 1) P3 = (2, 2) P4 = (8, 8) P5 = (9, 8) P6 = (8, 9) Mean shift clustering using a bandwidth (radius) of 4 units. Stopping threshold : Stop when the new center moves less than 0.01	8	L3	CO5																								
OR																													
Q.10	a.	Explain the K-Mean clustering algorithm and solve the following problem. <table border="1" data-bbox="629 1390 836 1663"> <thead> <tr> <th>Point</th> <th>X</th> <th>Y</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>1</td> <td>1</td> </tr> <tr> <td>B</td> <td>1.5</td> <td>2</td> </tr> <tr> <td>C</td> <td>3</td> <td>4</td> </tr> <tr> <td>D</td> <td>5</td> <td>7</td> </tr> <tr> <td>E</td> <td>3.5</td> <td>5</td> </tr> <tr> <td>F</td> <td>4.5</td> <td>5</td> </tr> <tr> <td>G</td> <td>3.5</td> <td>4.5</td> </tr> </tbody> </table> Lets apply K-Means with K = 2	Point	X	Y	A	1	1	B	1.5	2	C	3	4	D	5	7	E	3.5	5	F	4.5	5	G	3.5	4.5	12	L3	CO5
Point	X	Y																											
A	1	1																											
B	1.5	2																											
C	3	4																											
D	5	7																											
E	3.5	5																											
F	4.5	5																											
G	3.5	4.5																											
	b.	Short note on : Monte Carlo method, temporal difference learning, Q-learning and SARSA learning.	8	L2	CO5																								
