

K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

Nov – Dec 2024-25

(B. Tech / M. Tech.) Program: B.Tech Scheme I/II/IIB/III: IIB

Regular Examination: TY Semester: VI

Course Code: AIC602 and Course Name: Machine Learning

Date of Exam: 22/5/2025

Duration: 02.5 Hours

Max. Marks: 60

Instructions:

- (1) All questions are compulsory.
- (2) Draw neat diagrams wherever applicable.
- (3) Assume suitable data, if necessary.

(3) Assume suitable data, if necessary.

Q. No.	Question	Max. Marks	CO	BT level														
Q 1	Solve any two questions out of three: (05 marks each)	10																
a)	A binary classification model is used to detect whether a patient has a rare genetic disorder (Positive class) or not (Negative class). The model's performance on a test dataset is summarized as follows: True Negatives (TN): 95, True Positives (TP): 18 False Positives (FP): 4, False Negatives (FN): 13 Calculate the following performance metrics: Accuracy, Precision, Recall, F1-Score, Specificity		CO1	Un														
b)	What is over fitting and under fitting in linear regression? How can it be prevented ?		CO2	Un														
c)	What is a kernel in SVM? Why do we use kernels in SVM?		CO3	Un														
Q 2	Solve any two questions out of three: (05 marks each)	10																
a)	What is the gradient descent method? Explain it mathematically.		CO4	Un														
b)	Write a short note on Principal Component Analysis.		CO5	Un														
c)	What is the difference between the Markov model and Hidden Markov Model?		CO3	Un														
Q.3	Solve any two questions out of three. (10 marks each)	20																
a)	<table><tr><th>Age</th><th>Salary(in 1000s)</th><th>Table</th></tr><tr><td>25</td><td>3</td><td>0</td></tr><tr><td>35</td><td>4</td><td>0</td></tr><tr><td>45</td><td>5</td><td>1</td></tr><tr><td>50</td><td>6</td><td>1</td></tr></table> <p>The above data shows the database of an automobile company whether a person with the given age and salary has bought a car or not. For $\theta_0 = -5$, $\theta_1 = 0.01$ and $\theta_2 = 0.02$. Calculate predicted value, error and updated value of θ using logistic regression after iteration. Assume $\alpha = 0.01$.</p>		Age	Salary(in 1000s)	Table	25	3	0	35	4	0	45	5	1	50	6	1	CO2
Age	Salary(in 1000s)	Table																
25	3	0																
35	4	0																
45	5	1																
50	6	1																

K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

Nov – Dec 2024-25

(B. Tech / M. Tech.) Program: B.Tech Scheme I/II/IIB/III: IIB

Regular Examination: TY Semester: VI

Course Code: AIC602 and Course Name: Machine Learning

Duration: 02.5 Hours

Max. Marks: 60

Date of Exam: 22/5/2025

b)	<p>What is the difference between K-Means and Hierarchical Clustering? Find the clusters using single link technique. Use Euclidean distance and draw a dendrogram.</p> <table><tr><th>Point</th><th>X</th><th>Y</th></tr><tr><td>A</td><td>1</td><td>1.0</td></tr><tr><td>B</td><td>1.5</td><td>1.5</td></tr><tr><td>C</td><td>5.0</td><td>5.0</td></tr><tr><td>D</td><td>3.0</td><td>4.5</td></tr><tr><td>E</td><td>4.5</td><td>5.0</td></tr><tr><td>F</td><td>3.5</td><td>4.0</td></tr></table>	Point	X	Y	A	1	1.0	B	1.5	1.5	C	5.0	5.0	D	3.0	4.5	E	4.5	5.0	F	3.5	4.0		CO3	Ap																							
Point	X	Y																																														
A	1	1.0																																														
B	1.5	1.5																																														
C	5.0	5.0																																														
D	3.0	4.5																																														
E	4.5	5.0																																														
F	3.5	4.0																																														
c)	Given the points (4, 1), (4, -1), and (6, 0) belonging to the positive class, and the points (1, 0), (0, 1), and (0, -1) belonging to the negative class, how can we draw an optimal hyper plane to classify these points?		CO3	Ap																																												
Q.4	Solve any two questions out of three. (10 marks each)	20																																														
a)	Write a short note on derivative free optimization methods.		CO4	Un																																												
b)	Use Principal Component Analysis (PCA) to arrive at the transformed matrix for the given data: <table><tr><th>Feature</th><th>Exam-1</th><th>Exam-2</th><th>Exam-3</th><th>Exam-4</th></tr><tr><td>X1</td><td>4</td><td>8</td><td>13</td><td>7</td></tr><tr><td>X2</td><td>11</td><td>4</td><td>5</td><td>14</td></tr></table>		Feature	Exam-1	Exam-2	Exam-3	Exam-4	X1	4	8	13	7	X2	11	4	5	14	CO5	Ap																													
Feature	Exam-1		Exam-2	Exam-3	Exam-4																																											
X1	4	8	13	7																																												
X2	11	4	5	14																																												
c)	What is the difference between K-Means and KNN? Based on the performance of a student, classify whether a student will pass or fail, with (7.2, 78, 6) using KNN. Assign k=3. <table><tr><th>Sr.No</th><th>CGPA</th><th>Assessment</th><th>Project Submitted</th><th>Result</th></tr><tr><td>1</td><td>9.2</td><td>85</td><td>8</td><td>pass</td></tr><tr><td>2</td><td>8</td><td>80</td><td>7</td><td>pass</td></tr><tr><td>3</td><td>8.5</td><td>81</td><td>8</td><td>pass</td></tr><tr><td>4</td><td>6</td><td>45</td><td>5</td><td>fail</td></tr><tr><td>5</td><td>6.5</td><td>50</td><td>4</td><td>fail</td></tr><tr><td>6</td><td>8.2</td><td>72</td><td>7</td><td>pass</td></tr><tr><td>7</td><td>5.8</td><td>38</td><td>5</td><td>fail</td></tr><tr><td>8</td><td>8.9</td><td>91</td><td>9</td><td>pass</td></tr></table>	Sr.No	CGPA	Assessment	Project Submitted	Result	1	9.2	85	8	pass	2	8	80	7	pass	3	8.5	81	8	pass	4	6	45	5	fail	5	6.5	50	4	fail	6	8.2	72	7	pass	7	5.8	38	5	fail	8	8.9	91	9	pass	CO3	Ap
Sr.No	CGPA	Assessment	Project Submitted	Result																																												
1	9.2	85	8	pass																																												
2	8	80	7	pass																																												
3	8.5	81	8	pass																																												
4	6	45	5	fail																																												
5	6.5	50	4	fail																																												
6	8.2	72	7	pass																																												
7	5.8	38	5	fail																																												
8	8.9	91	9	pass																																												
