

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

Nov – Dec 2024-25

(B. 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.

Q. No.	Question	Max. Marks	CO	BT level																																																																																									
Q 1	Solve any two questions out of three: (05 marks each)	10																																																																																											
a)	Differentiate between Supervised and Unsupervised Learning.		CO1	Un																																																																																									
b)	Write expressions for hypothesis, cost function and parameters using gradient descent for linear regression. Explain each term in short.		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 role of the covariance matrix in PCA, and how is it computed?		CO5	Un																																																																																									
b)	Explain the purpose of the sigmoid (logistic) function in logistic regression.		CO2	Un																																																																																									
c)	State differences between derivative based and derivative free optimization methods.		CO4	Un																																																																																									
Q.3	Solve any two questions out of three. (10 marks each)	20																																																																																											
a)	Build a decision tree for the given dataset using CART. <table><tr><th>Sr.no</th><th>Age</th><th>Income</th><th>student</th><th>Credit rating</th><th>Buys Computer</th></tr><tr><td>1</td><td>Youth</td><td>High</td><td>No</td><td>Fair</td><td>No</td></tr><tr><td>2</td><td>Youth</td><td>High</td><td>No</td><td>Excellent</td><td>No</td></tr><tr><td>3</td><td>middle-aged</td><td>High</td><td>No</td><td>Fair</td><td>Yes</td></tr><tr><td>4</td><td>Senior</td><td>Medium</td><td>No</td><td>Fair</td><td>Yes</td></tr><tr><td>5</td><td>Senior</td><td>Low</td><td>Yes</td><td>Fair</td><td>Yes</td></tr><tr><td>6</td><td>Senior</td><td>Low</td><td>Yes</td><td>Excellent</td><td>No</td></tr><tr><td>7</td><td>middle-aged</td><td>Low</td><td>Yes</td><td>Excellent</td><td>Yes</td></tr><tr><td>8</td><td>Youth</td><td>Medium</td><td>No</td><td>Fair</td><td>No</td></tr><tr><td>9</td><td>Youth</td><td>Low</td><td>Yes</td><td>Fair</td><td>Yes</td></tr><tr><td>10</td><td>Senior</td><td>High</td><td>Yes</td><td>Fair</td><td>Yes</td></tr><tr><td>11</td><td>Youth</td><td>Medium</td><td>Yes</td><td>Excellent</td><td>Yes</td></tr><tr><td>12</td><td>middle-aged</td><td>Medium</td><td>No</td><td>Excellent</td><td>Yes</td></tr><tr><td>13</td><td>middle-aged</td><td>High</td><td>Yes</td><td>Fair</td><td>Yes</td></tr><tr><td>14</td><td>Senior</td><td>Medium</td><td>No</td><td>Excellent</td><td>No</td></tr></table>		Sr.no	Age	Income	student	Credit rating	Buys Computer	1	Youth	High	No	Fair	No	2	Youth	High	No	Excellent	No	3	middle-aged	High	No	Fair	Yes	4	Senior	Medium	No	Fair	Yes	5	Senior	Low	Yes	Fair	Yes	6	Senior	Low	Yes	Excellent	No	7	middle-aged	Low	Yes	Excellent	Yes	8	Youth	Medium	No	Fair	No	9	Youth	Low	Yes	Fair	Yes	10	Senior	High	Yes	Fair	Yes	11	Youth	Medium	Yes	Excellent	Yes	12	middle-aged	Medium	No	Excellent	Yes	13	middle-aged	High	Yes	Fair	Yes	14	Senior	Medium	No	Excellent	No	CO2
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b)	How is regression different from Classification? The marks obtained by a student are dependent on her/his study time. Given the study time in minutes and marks out of 2000, find the relationship between study time and marks using the concept of linear regression. Also predict the marks for a student if she/he studied for 790 minutes. <table><tr><th>Sr.No.</th><th>Study Time</th><th>Marks obtained</th></tr><tr><td>1</td><td>350</td><td>520</td></tr><tr><td>2</td><td>1070</td><td>1600</td></tr><tr><td>3</td><td>630</td><td>1000</td></tr><tr><td>4</td><td>890</td><td>850</td></tr><tr><td>5</td><td>940</td><td>1350</td></tr><tr><td>6</td><td>500</td><td>490</td></tr></table>	Sr.No.	Study Time	Marks obtained	1	350	520	2	1070	1600	3	630	1000	4	890	850	5	940	1350	6	500	490		CO2	Ap																								
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c)	Explain in brief the working of SVM.		CO3	Un																																													
Q.4	Solve any two questions out of three. (10 marks each)	20																																															
a)	Describe Downhill Simplex method. Why is it called the Derivative free method?		CO4	Un																																													
b)	Write a PCA algorithm using mathematical expressions. Suppose we have the following 2D dataset (2 features, 3 data points): <table><tr><th>Sample</th><th>X1</th><th>X2</th></tr><tr><td>A</td><td>2</td><td>0</td></tr><tr><td>B</td><td>0</td><td>2</td></tr><tr><td>C</td><td>3</td><td>1</td></tr></table> Reduce 2D data to 1D using PCA, which retains most of the variance.	Sample	X1	X2	A	2	0	B	0	2	C	3	1		CO5	Ap																																	
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c)	How is KNN different from k-means clustering? Based on the table given below, Use Lazy Learning algorithm to classify Drew, a blue-eyed person with long hair and over 170cm, as “male” or “female”. <table><tr><th>Name</th><th>over 170cm</th><th>Eye</th><th>Hair length</th><th>Male/female</th></tr><tr><td>Drew</td><td>No</td><td>Blue</td><td>Short</td><td>Male</td></tr><tr><td>Claudia</td><td>Yes</td><td>Brown</td><td>Long</td><td>Female</td></tr><tr><td>Drew</td><td>No</td><td>Blue</td><td>Long</td><td>Female</td></tr><tr><td>Drew</td><td>No</td><td>Blue</td><td>Long</td><td>Female</td></tr><tr><td>Alberto</td><td>Yes</td><td>Brown</td><td>Short</td><td>Male</td></tr><tr><td>Karin</td><td>No</td><td>Blue</td><td>Long</td><td>Female</td></tr><tr><td>Nina</td><td>Yes</td><td>Brown</td><td>Short</td><td>Female</td></tr><tr><td>Sergio</td><td>Yes</td><td>Blue</td><td>Long</td><td>Male</td></tr></table>	Name	over 170cm	Eye	Hair length	Male/female	Drew	No	Blue	Short	Male	Claudia	Yes	Brown	Long	Female	Drew	No	Blue	Long	Female	Drew	No	Blue	Long	Female	Alberto	Yes	Brown	Short	Male	Karin	No	Blue	Long	Female	Nina	Yes	Brown	Short	Female	Sergio	Yes	Blue	Long	Male		CO3	Ap
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