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

Nov – Dec 2023
(B.Tech) Program: Computer Engineering/IT/EXTC/AIDS Scheme II
Examination: TY   Semester: V
Course Code: HAIMLC501/HDSC501 and   Course Name: Mathematics for AIML/
Mathematics for Data Science

Date of Exam: 12/12/2023 | Duration: 2.5 Hours | Max. Marks: 60

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

		Max. Marks	CO	BT level
Q 1	Solve any six questions out of eight:	12		
i)	Find the Eigen values of $\begin{bmatrix} 10 & 0 & 2 \\ 0 & 10 & 4 \\ 2 & 4 & 2 \end{bmatrix}$		CO1	A
ii)	State Central Limit Theorem.		CO2	A
iii)	How to draw Time-series graph and Exponential graph?		CO3	U
iv)	List types of Qualitative data.		CO3	U
v)	Differentiate univariate graphical EDA and multivariate graphical EDA.		CO4	A
vi)	Identify Different optimization techniques.		CO5	A
vii)	Explain the Newton Method to solve optimization problem.		CO5	U
viii)	What is Principal Component Analysis?		CO6	U
Q.2	Solve any four questions out of six.	16		
i)	Apply Gauss Elimination Method to solve $x + 3y - 2z = 5 , 2x + y - 3z = 1 , 3x + 2y - z = 6$		CO1	A
ii)	A restaurant manager is designing a system that is intended to decrease the variance of the time customers wait before their meals		CO2	A

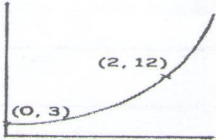|			
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	are served. Under the old system, a random sample of 10 customers had a variance of 400. Under the new system, a random sample of 21 customers had a variance of 256. At α = 0.10, is there enough evidence to convince the manager to switch to the new system? Assume both populations are normally distributed.[F table value is 1.96]		
iii)	Differentiate between Continuous data and Discrete data with an example.	CO3	A
iv)	Discuss about different types of data visualization techniques.	CO4	A
v)	Find the approximate solution Using Bisection method for $f(x) = x^2 + \frac{54}{x}$; in the range $(2,5)$ and for $\epsilon = 10^{-3}$.	CO5	A
vi)	Write a short note on Minimal polynomial.	CO6	U
Q.3	Solve any two questions out of three.	16	
i)	Find the dimension and basis for the four fundamental subspaces for $A = \begin{bmatrix} 1 & 3 & 3 & 2 \\ 2 & 6 & 9 & 7 \\ -1 & -3 & 3 & 4 \end{bmatrix}_{3 \times 4}$	CO1	A
ii)	Consider the given data set, apply Naïve Bayes algorithm and predict that if the fruit has following properties then which type of the fruit it is. Fruit{Yellow,Sweet,Long}	CO4	A

Frequency Table:

Fruit	Yellow	Sweet	Long	Total
Mango	350	450	0	650
Banana	400	300	350	400
Others	50	100	50	150
Total	800	850	400	1200

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iii)	Use steepest descent method for $f(x_1, x_2) = 4x^2 - 4xy + 2y^2 = c^2$ with initial point $x_0 = (2, 3)$.		CO5	A
Q.4	Solve any two questions out of three.	16		
i)	A soap manufacturing company was distributing a particulars brand of soap through large number of retail shops. Before heavy advertising campaign the mean sales per week per shop was 140 dozen, after the campaign a sample of 26 shops was taken and mean sale was found to be 147 dozen with standard deviation of 16 can you consider the advertisement effective.		CO2	A
ii)	The sketch shows a curve with equation y = ab^x where a and b are constants and b > 0 The curve passes through the points (0, 3) and (2, 12) Calculate the value of a and b.		CO3	
iii)	Use PCA to combine the two blood pressure variables into just one variable based on given data from six individuals.		CO6	A

Feature	Example 1	Example2	Example3	Example4	Example5	Example6
Systolic BP	126	128	128	130	130	132
Diastolic BP	78	80	82	82	84	86

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