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

Nov–Dec 2023
(M.Tech.) Program **Artificial Intelligence** Scheme :**II**
Examination: **FY** Semester:**I**
Course Code: **PCEC103** and Course Name: **Mathematical Foundations of Data Science**

Date of Exam: 28/12/23. 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)	Explain Probability theory?	2	1	U
ii)	Explain Manhattan Distance?	2	2	U
iii)	Explain Estimates of Location?	2	3	U
iv)	Compare the Directional hypothesis with Non-Directional hypothesis?	2	5	An
v)	Explain Chi-Square 'Goodness of Fit Test'?	2	5	U
vi)	Solve to find the conjugate transpose of a matrix A? $A = \begin{bmatrix} 1+2i & 3-i & 4 \\ -2i & 5i & 6-3i \\ 7 & 8+2i & 9i \end{bmatrix}$	2	2	Ap
vii)	Explain local optima?	2	6	U
viii)	Explain the selection bias?	2	4	U
Q.2	**Solve any four questions out of six.**	16		
i)	Explain the importance of Linear Algebra, Probability Theory, Calculus and Optimization from a data science perspective?	4	1	U
ii)	Explain singular value decomposition (SVD) in detail ?	4	2	U
iii)	Explain the three main types of Exploratory Data Analysis (EDA)	4	3	U
iv)	State the Random sampling formula and explain the type of Random sampling in detail ?	4	4	U

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v)	What is A/B testing? How does A/B Testing work? Explain it in detail ?	4	5	U
vi)	What is Macro and Micro averaging? Explain Micro averaging in detail ?	4	6	U
Q.3	**Solve any two questions out of three.**	16		
i)	What is continuous probability distribution? Explain Exponential and Weibull distribution using continuous probability distribution ?	8	4	Ap
ii)	Differentiate the Z-test with T-Test and evaluate the following using suitable test : A Telecom service provider claims that individual customers pay on an average 400 rs. per month with standard deviation of 25 rs. A random sample of 50 customers bills during a given month is taken with a mean of 250 and standard deviation of 15. What to say with respect to the claim made by the service provider? Draw the region diagram to explain it. (Take significance level = 0.05)	8	5	An
iii)	What is the AUC-ROC curve? Analyze one example in detail on the following various distribution conditions. i) AUC=1 ii)AUC=0.7 iii) AUC=0.5 iv) AUC=0	8	6	An
Q.4	**Solve any two questions out of three.**	16		
i)	Find all the Eigenvalues and Eigenvectors of a matrix B = $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$	8	2	Ap
ii)	Explain Constrained and Unconstrained optimization problems in detail	8	6	U
iii)	Explain the 'Estimates of Variability' in detail using one example? Solve and calculate the Mean ,Squared Deviation, Variance, and Standard Deviation for: if your friends have just measured the heights of your dogs (in millimeters), the heights (at the shoulders) are 600mm, 470mm, 170mm, 430mm and 300mm.	8	3	Ap

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