PRN No.	

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PAPER CODE	U314 - 214 (ES

(AY:2024-25) December 2024 (ENDSEM) EXAM

TY B.TECH (SEMESTER - I)

COURSE NAME: Multivariate Analysis **Branch:** AI & DS **COURSE CODE:** ES31204AD

(T.Y B.Tech PATTERN 2020R1)

Time: [1Hr 30 Min] **[Max. Marks: 40]**

(*) Instructions to candidates:

1) **Figures to the right indicate full marks. Use of scientific calculator is allowed**
2) **Use suitable data wherever required**
3) **All questions are compulsory. Solve any two sub question each from Questions 1 and 2**
4) **Solve any one sub question (2 marks) from Questions 3 ,4 ,5 and 6 and sub question of 4 marks is compulsory from questions 3,4,5,and 6**

Q. No.	Question Description	Max. Marks	CO mapped	BT Level
Q.1	a) Describe the different data types commonly use in multivariate analysis. Give any two examples of continuous and categorical data types.	[4]	CO1	Understand (Level 2)
	b) Consider variable A and B with the following data: A = [3, 7,2,8] and B= [5, 1, 6, 4] Calculate mean , standard deviation, sample covariance and correlation.	[4]	CO1	Understand (Level 2)
	c) Illustrate the concepts of dependence and interdependence techniques and their types in multivariate analysis	[4]	CO1	Apply (Level 3)
Q2	a) Given two random variables X1 and X2 with sample values: $X_1 = [2,4,6] \quad X_2 = [3,5,7]$ Let Y = 2 X1+3 X2 . Calculate the sample mean and variance of Y.	[4]	CO2	Apply (Level 3)
	b) Given the following test scores in Mathematics and Science for 5 students: Mathematics: [80,90,75,85,70] Science: [70,85,80,90,80] Compute the correlation matrix to analyze the relationships between the subjects.	[4]	CO2	Apply (Level 3)
	c) Consider the following sample of three observations on two variables X1 and X2	[4]	CO2	Apply (Level 3)

	$A = \begin{bmatrix} 2 & 4 \\ 1 & 3 \\ 5 & 6 \end{bmatrix}$ (a) Compute the sample mean vector. (b) Compute the sample covariance matrix. (c) Compute the correlation matrix.			
Q3	a) Explain major difference in MANOVA and ANOVA with suitable example. OR b) Apply the concept of confidence region using an example. c) Let X1, X2, X3 and X4 be independent and identically distributed 3 X1 random vectors with $\mu = \begin{bmatrix} 3 \\ -1 \\ 1 \end{bmatrix}$ and $\Sigma = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 1 & 0 \\ 1 & 0 & 2 \end{bmatrix}$ find the mean and variance of the linear combination $a'X_1$ of the thr components of X_1 where $a = [a_1\ a_2\ a_3]'$.	[2] [2] [4]	CO3 CO3 CO3	Unders (Level Appl (Level App (Level
Q4	a) Given that a matrix A below and point for which we want to calculate the Mahalanobis distance is X. $A = \begin{bmatrix} 2 & 4 \\ 1 & 3 \\ 5 & 6 \end{bmatrix}$ $x = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$ Inverse of the Covariance Matrix (S^{-1}): $S^{-1} = \begin{bmatrix} 28 & -38 \\ -38 & 52 \end{bmatrix}$ OR b) In the Bonferroni approach, if you conduct 5 tests with a family-wise significance level of 0.05, what is the significance level for each test? c) A random sample size of 20 from a normal population gives a sample mean of 40, standard deviation of 6. Test the hypothesis that population mean is 44. Check whether there is any difference between mean. Given t table value = 2.093	[2] [2] [4]	CO4 CO4 CO4	App (Leve Under (Leve App (Leve
Q.5	a) Explain the "elbow method" in k-means clustering. OR b) Illustrate common methods used to extract factors in factor analysis. c) Apply the following data of two variables: Variable 1: [2,4,1,3] Variable 2: [3,7,5,6]	[2] [2] [4]	CO5 CO5 CO5	Under (Leve Under (Leve App

	Covariance matrix is given as $$\text{Cov} = \begin{bmatrix} 1.67 & 2.33 \\ 2.33 & 3.67 \end{bmatrix}$$ Perform principal component analysis (PCA) and compute the first principal components.			Apply (Level 3)
Q.6	a) Define Endogenous variables and Exogenous variables in Structural Equation Modelling OR b) Explain Confirmatory Factor Analysis with example c) An unfair coin is flipped 100 times and 61 heads are observed. The coin either has probability 1/3,1/2 or 2/3 of flipping a head each time it is flipped. Which of the three is the MLE.	[2] [2] [4]	CO6 CO6 CO6	Understand (Level 2) Understand (Level 2) Apply (Level 3)