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| Registration Number: |
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# ST.JOSEPH'S UNIVERSITY, BENGALURU -27
## BCA(DATA ANALYTICS) – IV SEMESTER
## SEMESTER EXAMINATION: APRIL 2024
**(Examination conducted in May / June 2024)**
## BCADA 4322: MULTIVARIATE STATISTICS
**(For current batch students only)**

**Time : 2 hrs** **Maximum marks : 60 marks**

**This paper contains TWO printed pages and THREE parts. Statistical table will be provided.**

## PART A

**Answer ALL questions** **(2x5=10)**.

1. What is the role of eigen value?
2. Define normal distribution.
3. What is the distribution of error terms in linear regression?
4. Which test is used to check for model adequacy in regression?
5. Define Hotelling's $T^2$.

## PART B

**Answer any FIVE questions** **(5x4=20)**

6. Explain the role of multivariate analysis in agriculture.
7. Find the eigen values of $\begin{bmatrix} 3 & 4 \\ 0 & 5 \end{bmatrix}$
8. State and prove necessary and sufficient condition for the two multivariate normal vectors to be independent.
9. Write probability density function of multivariate normal distribution.
10. What are the least square estimates of parameters of simple linear model?
11. How do you obtain first two principal components?
12. Define factor model with assumptions.

## PART C

**Answer any THREE questions** **(10x3=30)**

13. What are the assumptions of multiple linear regressions? A Statistics Professor wants to use the number of absences from class during the Semester (X) to predict the final exam score (Y) . A regression model is fit based on data collected from a class during a recent semester with the following results .

$$Y = 85.0 - 5X$$

What is the interpretation of dependent variable, intercept and slop of the model?

14. When do we use principal component analysis (PCA)? Discuss the steps involved in PCA.

15. Write a few properties of multivariate normal distribution. A random sample with n=20 were collected from a bivariate normal process. The population mean vector, sample mean vector and covariance matrix are given below. Obtain Hotelling's $T^2$.

$$\bar{x} = \begin{bmatrix} 10 \\ 20 \end{bmatrix} \quad \mu = \begin{bmatrix} 9 \\ 18 \end{bmatrix} \; and \sum = \begin{bmatrix} 40 & -50 \\ -50 & 100 \end{bmatrix}$$

16. If $\underline{X}^T = [X_1, X_2, X_3]$ is a random vector with variance covariance matrix

$$\Sigma = \begin{bmatrix} 1 & -2 & 0 \\ -2 & 5 & 0 \\ 0 & 0 & 2 \end{bmatrix}$$

Calculate the principal components