2026

COMPUTER SCIENCE — HONOURS

Paper : DSCC-15

(Linear Algebra and Statistical Method)

Full Marks : 75

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer ***any five*** questions : 2×5

   (a) When are two vectors said to be orthogonal?

   (b) What is the identity transformation?

   (c) Define basis of a vector space.

   (d) Define Eigenvalue, Eigenvector of a Matrix.

   (e) What is a nominal variable? Explain with example.

   (f) State the difference between a vector and a scalar in an n-dimensional space.

   (g) When are two vectors said to be equal vectors?

   (h) Define dot product and cross product of two vectors.

Section - A

Answer ***any three*** questions.

2. (a) Define identity matrix and zero matrix.

   (b) Define symmetric and skew-symmetric matrices. 2+3

3. (a) Define kernel and image of a linear transformation.

   (b) For $T(x, y)=(x + y, y)$, find $T(1, 2)$ and $T(2, -1)$. 2+3

4. (a) Define correlation and distinguish between positive and negative correlation.

   (b) Calculate Karl Pearson's coefficient of correlation for :

X	10	20	30	40	50
Y	15	25	35	45	55

2+3

5. (a) Define a probability distribution. Mention any two common probability distributions.

   (b) A coin is tossed 3 times. Find the probability distribution of the number of heads. 2+3

6. (a) What is a stem-and-leaf plot?

(b) Construct a stem-and-leaf plot for : 12, 15, 18, 21, 22, 25, 31, 33, 35, 39. 2+3

Section - B

Answer *any five* questions. 2×5

7. (a) What is ANOVA?

(b) Explain why is ANOVA preferred over multiple t-tests when comparing more than two means.

(c) Three teaching methods are applied to three groups of students. Their scores are :

Method A	70	72	74
Method B	65	67	69
Method C	75	77	79

Set up the null and alternative hypotheses and prepare the ANOVA table structure. 2+3+5

8. (a) Define Principal Component Analysis.

(b) Explain the role of eigenvalues and eigenvectors in PCA.

(c) Find the characteristic equation and eigenvalues of

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 1 \\ 0 & 1 & 2 \end{bmatrix}$$ 2+3+5

9. (a) What is Gauss-Jordan method?

(b) Distinguish between Gaussian elimination and Gauss-Jordan method.

(c) Solve by Gauss-Jordan method :

$$x + y + z = 3$$
$$2x + 3y + z = 7$$
$$x - y + 2z = 4$$ 2+2+6

10. (a) Define inverse of a matrix.

(b) State the condition for a matrix to have an inverse.

(c) Find the inverse of

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$ 2+3+5

11. (a) State any two important properties of the normal distribution.

(b) A random variable X is uniformly distributed over the interval [10, 30]. Find :

(i) $P(12 < X < 20)$

(ii) $P(X > 25)$

(iii) the mean of the distribution.

(c) Distinguish between discrete and continuous probability distributions with one example of each.

2+6+2

12. (a) Define skewness. Explain the difference between positive skewness and negative skewness.

(b) Define range and standard deviation. Why is standard deviation considered a better measure of dispersion than range?

(c) The following data shows the marks obtained by 10 students in a statistical test :
42, 48, 50, 55, 60, 62, 65, 70, 75, 83. Find the mean and standard deviation of the data. 3+3+4

13. (a) Define linear dependence and linear independence.

(b) Check whether the vectors (1, 2, 3), (2, 4, 6), (1, 0, 1) are linearly independent.

(c) Determine whether the vectors (1, 0, 1), (0, 1, 1), (1, 1, 2) span R^3. 2+4+4

14. The following frequency distribution shows the makrs obtained by 50 students in a test :

Marks (Class Interval)	**Frequency**
0 – 10	4
10 – 20	6
20 – 30	10
30 – 40	12
40 – 50	9
50 – 60	6
60 – 70	3

(a) Compute the mean, median and mode of the data.

(b) Identify whether any outlier class exists and justify your answer. (2+3+3)+2