April 2025
B.A./B.Sc.
Sixth Semester
CORE – 14
STATISTICS
Course Code: STC 6.21
(Multivariate Analysis & Index Numbers)

Total Mark: 70 *Pass Mark: 28*
Time: 3 hours

Answer five questions, taking one from each unit.

UNIT–I

1. (a) Write down the assumptions of bivariate normal distribution and derive it. 3+5=8
   (b) Determine the constant k for bivariate normal distribution. 6

2. (a) Obtain the marginal distribution of the random variable X of bivariate normal distribution. 8
   (b) Show that for the bivariate normal distribution $f(x, y)$ is a probability density function. 6

UNIT–II

3. (a) Give the definition of multivariate normal distribution and derive it. 2+7=9
   (b) If X have a multivariate normal distribution with covariance matrix $\Sigma = \begin{bmatrix} 1 & p & p^2 \\ p & 1 & 0 \\ p^2 & 0 & 1 \end{bmatrix}$, then show that the conditional distribution of (X_1, X_2) given $X_3 = x_3$ is also multivariate normal with mean $\mu = \begin{bmatrix} \mu_1 + p^2(x_3 - \mu_3) \\ \mu_2 \end{bmatrix}$ and covariance matrix $\begin{bmatrix} 1-p^4 & p \\ p & 1 \end{bmatrix}$. 5

4. (a) If $X \sim N_p(\mu, \Sigma)$, then determine the value of the constant k of multivariate normal distribution. 8
   (b) Obtain the moment generating function of multivariate normal distribution. 6

UNIT–III

5. (a) Write notes on the following: 2+2+3=7
   (i) Standard scores
   (ii) Percentile scores
   (iii) Scaling of ratings in terms of normal probability curve
   (b) Describe the split-half method of estimating reliability stating its merits and demerits. What is the effect of test length on the reliability of a test? 4+3=7

6. (a) Write a note on normalised scores. Mention its range. What are normalized standard scores? How can normalized scores be converted to t-scores? 2+1+2+2=7
   (b) Describe the method of estimating the validity of a test. How does the test length affect its validity? Write down the formula for index of reliability. 3+3+1=7

UNIT–IV

7. (a) Define index numbers with example. What are the sources of data for construction of index numbers? 4+3=7
   (b) What are the different types of averages used to construct index numbers? Which is the most appropriate average? 2+1=3
   (c) What is factor reversal test? Show that Fisher's index number satisfies the factor reversal test. 2+2=4

8. (a) Describe the simple and weighted method of construction of index numbers. 2+2=4
   (b) Define Marshall-Edgeworth price and quantity index numbers. 2+2=4
   (c) Prove that Fisher's ideal index number lies between Laspeyre's and Paasche's index numbers. What are the sources of errors in the construction of price and quantity index numbers? 4+2=6

UNIT–V

9. (a) Write a short note on consumer price index number. Discuss the steps to be followed in the construction of consumer price index number. 4+5=9
   (b) What is the index number of agricultural production? 3
   (c) Mention four national level consumer price indices. 2

10. (a) What is cost of living index numbers? Mention its uses. 2+4=6
    (b) What do you understand by deflating of index numbers? Give the formula for real wage. 3+1=4
    (c) Write a short note on index of industrial production (IIP). 4