[This question paper contains 4 printed pages.]

8202 *Your Roll No.* .....

B.Sc. (G) / II / NS **BS**

MATHEMATICAL SCIENCES (STATISTICS)

Paper IV – Applied Statistics

Time : 3 Hours *Maximum Marks : 38*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any **six** *questions.*

1. (a) Explain the additive and multiplicative models in a time series, stating clearly the assumptions involved.

   (b) Explain the seasonal component in a time series. Describe the 'ratio-to-trend' and the 'link relative' methods for measuring seasonal indices. (3,3½)

2. Let X_j be the price relative $\frac{b_{ij}}{p_{oj}}$, Y_j be the quantity relative $\frac{q_{ij}}{q_{oj}}$, w_j be the weights of X_j and Y_j, for the jth commodity, where $j = 1, 2, ---, n$. Show that

$$\frac{P_{oi}^{La}}{P_{oi}^{Pa}} = 1 - \frac{\gamma_{XY}\,\sigma_X\,\sigma_Y}{V_{oi}}$$

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where the notations have their usual meanings.

Further, deduce the conditions under which Laspeyre's price index P_{0i}^{La} is greater than, equal to or less than Paasche's price index P_{0i}^{Pa}. (6½)

3. (a) If the r^{th} sample mean is the first to exceed UCL, show that

$$E(r) = \frac{1}{p_n}$$

where p_n is the probability of the mean of sample of size n exceeding UCL.

(b) What is a p-chart ? How are its control limits calculated ? Discuss the methods used for constructing the p-chart when the number of articles inspected varies. (3,3½)

4. (a) In a single sampling plan of attributes with lot size N, sample size n and allowable defectives c, how will you obtain the probability of acceptance of the lot if the lot fraction defective is p ? How will you modify the above expression using (i) Binomial approximation and (ii) Poisson approximation ?

(b) Explain the concepts of producer's and consumer's risks in sampling inspection schemes. Define the ASN and AOQ in the case of Double Sampling Inspection Plan and indicate their usefulness in choosing a sampling scheme. (3,3½)

5. (a) What do you mean by the following rates in Vital Statistics and discuss their importance :

(i) Crude death Rate (ii) Standardised death Rate and (iii) General Fertility Rate. Briefly indicate how these rates can be used in population projection.

(b) Explain the following symbols as used in a life table : l_x, T_x, e^0_x, m_x and q_x. Also, prove that

(i) $e^0_x = \frac{T_x}{l_x}$, (ii) $q_x = \frac{2m_x}{2 + m_x}$. (3½,3)

6. (a) What are the usual sources of data on vital events ? Indicate the types of error that are usually found to occur in census data on age. How would you adjust for such errors ?

(b) Starting from a suitable assumption regarding the relative growth rate of population derive the logistic equation. Describe any one method of fitting this curve ? Is this curve suitable for representing the growth of Indian population ? (3,3½)

7. (a) Describe, in brief, the functions of the Central Statistical Organisation and name at least five of its publications.

(b) State the difference between the de-jure and de-facto methods of conducting a census of population. What are the special features of the census of population in India ? (3,3)

8. Write short notes on any **three** of the following :

(i) Variate Difference method

(ii) Family Budget Survey

(iii) Statistical basis of Shewhart's 3σ control limits

(iv) Tests of consistency for an index number

(v) Price Statistics in India (2,2,2)