[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 8534 **HC**

Unique Paper Code : 32377905

Name of the Paper : TIME SERIES ANALYSIS

Name of the Course : **Statistics : DSE for Honours**

Semester : V

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions.

1. (a) What do you understand by a time series? Explain in detail the trend and the irregular components of a time series.

   (b) With which component of a time series would you mainly associate each of the following :

   (i) Strike in a factory, delaying production for 10 days

   (ii) Heavy sales on the occasion of Diwali

   (iii) Sales of departmental stores during the busy hours

P.T.O.

iv) General decline in the infant mortality rate in India since independence. State reasons for your answers. (7,8)

2. In the usual notations, prove that

$$\frac{1}{m}[m]U_0 = \left[U_0 + \frac{m^2-1}{24}\delta^2 U_0\right]$$

where $\frac{1}{m}[m]$ stands for the simple average of 'm' terms. Further, show that

$$\frac{1}{m_1 m_2 \ldots m_r}[m_1][m_2]\ldots[m_r]U_0 = \left[U_0 + \frac{m_1^2 + m_2^2 + \cdots + m_r^2 - r}{24}\delta^2 U_0\right]$$

Hence deduce Spencer's 21-point formula. (15)

3. (a) Explain variate-difference method for trend analysis. How is the appropriate order of differencing determined?

   (b) Explain the method of 'partial sums' for fitting the modified exponential curve to a given time-series data. (10,5)

4. (a) What do you understand by seasonal variations in a time-series? Give one example. Explain the Link Relative method of computing the indices of Seasonal variations.

(b) Describe the mathematical models of a time series. How can an additive model be considered as a particular type of multiplicative model? What are the limitations of the hypothesis of decomposition of a time series? (10,5)

5. (a) What is periodogram? Discuss how the periodogram becomes helpful to determine the periodicity hidden in a time series.

(b) Explain the Slutzky-Yule effect in the context of a time series known to be composed of the trend, oscillatory and the random components. (10,5)

6. (a) How will you obtain the autoregressive parameters in terms of autocorrelations of a AR(p) process? Hence, in particular, obtain the estimates of the parameters for AR(2) process.

(b) Obtain the autocorrelation function of the MA(2) process

$$y_t = \epsilon_t + 0.8\,\epsilon_{t-1} + 0.4\,\epsilon_{t-2}$$

given that $\{\epsilon_t\}$ is a discrete-time random process, such that $E(\epsilon_t) = 0$, $V(\epsilon_t) = \sigma^2$ and successive values of ϵ_ts are independent. (10,5)

7. Write notes on any **two** of the following :

(a) Merits and limitations of trend fitting by the principle of least-squares.

(b) Correlogram of moving average.

(c) Exponential Smoothening procedure for forecasting. (7½,7½)