D 11246 (Pages : 2) Name.............................

Reg. No..........................

THIRD SEMESTER P.G. DEGREE EXAMINATION, NOVEMBER 2021

(CCSS)

Statistics

STA 3E 01—TIME SERIES ANALYSIS

(2019 Admissions)

Time : Three Hours Maximum : 80 Marks

Section A

Answer any **four** *questions.*
Each question carries 4 *marks.*

I. (a) When do you recommend multiplicative model for decomposing time series ? Describe a suitable model.

(b) What is simple exponential smoothing ? How do you implement it for a given time series data ?

(c) When do you say that a time series is invertible ? Explain it with an example.

(d) Does the method of differencing always provide a stationary series ? Justify your answer.

(e) Propose an estimator for the mean of a weakly stationary time series and state its asymptotic properties.

(f) Obtain a 1-step ahead forecast for a stationary AR(2) process.

(g) Obtain the spectral density function of a stationary AR(1) process.

(h) State any three special features of financial time series which makes them different from the classical time series. Propose a suitable model for analyzing financial time series.

(4 × 4 = 16 marks)

Section B

Answer **either** *(A)* **or** *(B) of all questions.*
Each question carries 16 *marks.*

II. A. (a) What are the major objectives of analysing a time series ?

(b) Describe steps involved in time series model building.

(c) Consider the linear model $X_t = a + bt + S_t + \epsilon_t$, where $\{\epsilon_t\}$ is weakly stationary, $\{S_t\}$ is a seasonal factor at time t and $S_t = S_{t-12}$ for all t. (i) Is $\{X_t\}$ a stationary sequence ? (ii) If not, suggest a method of extracting a stationary version of it. (iii) Justify that the extracted sequence is stationary.

(4 + 4 + 8 = 16 marks)

Or

Turn over

B. (a) Describe Winters method of smoothing of multiplicative seasonal time series. How do you determine the smoothing coefficients and initial values ?

(b) Describe Ljung-Box test for model checking in time series.

(c) Obtain the spectral density function of an invertible MA(I) process.

(8 + 4 + 4 = 16 marks)

III. A. (a) Obtain the explicit form of the ACF of an ARMA (1, 1) process.

(b) Determine the PACF of an AR(2) process.

(8 + 8 = 16 marks)

Or

B. (a) Define an ARIMA (p, d, q) model. Obtain the random shoch form of an ARIMA (1, 1, 1) model.

(b) Derive the conditions for the weak stationarity of an ARMA (p, q) process.

(8 + 8 = 16 marks)

IV. A. (a) Derive a computation formula of an l-step ahead forecast for a weakly stationary general linear process.

(b) Let $\{a_t\}$ be a white noise process and define a stationary AR(1) model $X_t = \mu + \alpha(X_{t-1} - \mu) + a_t$. Obtain the least squres estimators (LSE) of α and μ based on a realization of size n from this model.

(6 + 10 = 16 marks)

Or

B. (a) Obtain the ACF of a stationary AR(p) process and explain how to obtain Yule-Walker estimates of the parameters.

(b) How do you determine the order of an ARMA(p, q) model for a given set of data ?

(c) Describe the method of back-casting in estimation. When do you use this method ?

(8 + 4 + 4 = 16 marks)

V. A. (a) Define spectral distribution of a time series and state its properties.

(b) Show that the spectral density function and autocovariance function determine uniquely each other for a weakly stationary time series.

(4 + 12 = 16 marks)

Or

B. Obtain the acf of $\{Y_t^2\}$, where $\{Y_t\}$ is a stationary GARCH (1, 1) process. (16 marks)

[4 × 16 = 64 marks]