



ST JOSEPH'S UNIVERSITY, BENGALURU -27
M.Sc. STATISTICS – 4th SEMESTER
SEMESTER EXAMINATION: APRIL 2024
(Examination conducted in May / June 2024)
STDE 0520: Time Series Analysis
(For current batch students only)

Registration Number:

Date & Session:

Time: 2 Hours

Max Marks: 50

This paper contains TWO printed pages and ONE part

PART-A

Answer any FIVE of the following

10 X 5 = 50

1. A) Define Time Series. Derive the k^{th} difference equation of k^{th} order polynomial trend in a time series.
B) Define covariance stationary time series. Consider a time series $\{X_t\}$ where $X_t = A\cos(\omega t) + B\sin(\omega t)$, where ω is a constant. A and B are independent with mean 0 and variance 1. Examine whether $\{X_t\}$ is covariance stationary time series
(5+5)
2. A) Obtain the ACF and PACF for $X_t = 0.4X_{t-1} + \varepsilon_t$. Plot the graph of ACF and PACF. Hence give the comments on graphs.
B) Define ARMA(p, q) process. Derive ACF for ARMA(1,1) process. (5+5)
3. A) Obtain the h -step forecast at $t=n$ for an ARIMA(1,1,1) in difference equation form and compute its MSE.
B) What do you mean by single Exponential smoothing? How will this help you in forecasting a given time series. (6+4)
4. A) What are the different methods of diagnostic checking in time series? Explain the role of residuals analysis in model checking.
B) Derive the conditional maximum likelihood estimator for ARMA(p, q) process. (4+6)

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5. A) Explain Minimum Mean Square Error (MMSE) forecast. Show that MMSE forecasting at the origin 't' is the conditional expectation at the origin 't'.

B) Define AR(p) model. Derive invertibility and stationarity conditions for AR(p) models. (5+5)

6. A) Define seasonality in a time series. Describe test for seasonality in a times series.

B) Show that stationary AR(1) process can be expressed as infinite order of Moving Average process.

C) Derive the h-step ahead forecast for the time series $\{X_t\}$ with mean μ , where

$$(X_t - \mu) = \beta(X_{t-1} - \mu) + \varepsilon_t \quad (3+2+5)$$

7. A) Define ARCH(m) model. Explain test for ARCH effect.

B) Derive the maximum likelihood for ARCH (1) model. (4+6)
