

DSPE3001 TIME SERIES ANALYSIS AND FORECASTING (3-0-0)

Course Objectives:

- To equip students with the necessary tools and techniques to analyze and forecast time-series data effectively.
- Students will gain a deep understanding of time-series concepts such as trend, seasonality, and autocorrelation.
- Providing students with the skills to model various time-series components using appropriate statistical methods, including ARIMA (Auto Regressive Integrated Moving Average) models, exponential smoothing methods, and seasonal decomposition techniques.

Module- I: (10 hrs)

Basics of Time series: A model Building strategy, Time series and Stochastic process, Stationarity, Auto correlation, meaning and definition—causes of auto correlation—consequence of autocorrelation—test for auto-correlation. Study of Time Series model and their properties using correlogram, ACF and PACF. Yule walker equations

Module-II: (10 hrs)

Time Series Models: White noise Process, Random walk, MA, AR, ARMA and ARIMA models, Box- Jenkins's Methodology fitting of AR(1), AR(2), MA(1), MA(2) and ARIMA(1,1) process.

Module-III: (08 hrs)

Unit root hypothesis, Co integration, Dicky Fuller test unit root test, augmented Dickey – Fuller test Non-linear time series models, ARCH and GARCH Process, order identification, estimation and diagnostic tests and forecasting. Study of ARCH (1) properties. GARCH (Conception only) process for modelling volatility.

Module-IV: (10 hrs)

Study of ARCH (1) properties. GARCH (Conception only) process for modelling volatility. Multivariate Time series: Introduction, Cross covariance and correlation matrices, testing of zero cross correlation and model representation

Module-V: (07 hrs)

Volatility Models, State – Space Representation of the time series, Time-Series forecasting and performance Evaluation.

Course outcomes:

On the completion of the course, the students will be able to

- Understand the components of time series data and interpret their significance in real world applications.
- Identify and estimate cyclical patterns within time series data to facilitate informed decision-making.
- Explore the temporal dependencies between lagged values of the series to uncover underlying relationships and trends
- Conduct rigorous stationarity tests to assess the stability and characteristics of time series data.
- Apply ARIMA modelling techniques to forecast future trends and behaviors within time series data accurately.

Text Books:

1. Box, G.E.P and Jenkins G.M. (1970) Time Series Analysis, Forecasting and Control, Holden- Day.
2. Brockwell, P.J and Davis R.A. (1987) Time Series: Theory and Methods, Springer-Verlag.
3. Abraham, B. and Ledolter, J.C. (1983) Statistical Methods for Forecasting, Wiley
4. Anderson, T.W (1971) Statistical Analysis of Time Series, Wiley.

Reference Books:

1. Fuller, W.A. (1978) Introduction to Statistical Time Series, John Wiley.
2. Chatfield, C. (2004) The Analysis of Time Series-An Introduction, 6th edn, Chapman & Hall
3. Montgomery, D.C., Jennings, C.L. & Kulahci, M. (2015). Introduction to Time Series Analysis and Forecasting, 2nd Edition. Wiley.
4. Brockwell, P.J. & Davis R.A. (2016). Introduction to Time Series and Forecasting, 2nd Edition. Springer.