Course Title:	**Applied Time Series Analysis**
Course Code:	**CSTA-202**
Semester:	**VIII**
Credit Hours:	**03**

Learning Outcomes

By the end of this course, students will be able to:

1. Apply the fundamentals of time series analysis, including stationarity, autocorrelation, and model selection.
2. Operate and implement AR, MA, and ARIMA models, understanding their applications and limitations in various time-series contexts.
3. Utilize the Box-Jenkins methodology for effective time-series forecasting and model diagnostics.
4. Develop and assess forecasting models, applying best practices and accuracy measures to real-world data scenarios.

Unit – I Stationarity in Time Series Analysis

Special feature of time series data: Mean, variance, Autocorrelation Function, Partial autocorrelation Function. Apply the concept of stationarity to the analysis of time series data across various disciplines. Differentiate between stationary and non-stationary time series and understand their implications for analysis and forecasting.

Unit – II Time-Series and Regression Models

Run and interpret time-series models and regression models specific to time-series data. Develop proficiency in applying different types of models, such as autoregressive (AR), moving average (MA), and autoregressive integrated moving average (ARIMA) models.

Unit – III Box-Jenkins Methodology

Use the Box-Jenkins approach to model and forecast time-series data empirically. Identify appropriate model parameters and diagnostic checking to ensure the adequacy of fitted models.

Unit – III Multivariate Time-Series Models

Use multivariate time-series models such as vector autoregression (VAR) to analyze time-series data. Understand the dynamic relationships between multiple time-series variables and the application of impulse response functions and variance decompositions.

Unit – IV Forecasting

Understand the fundamental principles and techniques of forecasting. Apply various forecasting methods, including exponential smoothing, Holt-Winters method, and machine learning approaches. Evaluate forecast accuracy using measures such as Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and Mean Absolute Percentage Error (MAPE). Develop and implement forecasting models in R, and assess their performance for real-world applications.

Suggested books:

1. Cryer, J. D., & Chan, K.-S. (2008). *Time series analysis: With applications in R*. Springer.
2. Shumway, R. H., & Stoffer, D. S. (2017). *Time series analysis and its applications: With R examples* (4th ed.). Springer.
3. Hyndman, R. J., & Athanasopoulos, G. (2021). *Forecasting: Principles and practice* (3rd ed.). OTexts.
4. Tsay, R. S. (2014). *Multivariate time series analysis: With R and financial applications*. John Wiley & Sons.
5. Teetor, P. (2011). *R cookbook: Proven recipes for data analysis, statistics, and graphics*. O'Reilly Media.
6. Shmueli, G., & Lichtendahl, K. C. Jr. (2018). *Practical time series forecasting with R: A hands-on guide* (2nd ed.). Axelrod Schnall Publishers.
7. Diebold, F. X. (2019). *Elements of forecasting* (4th ed.). Cengage Learning.