Stat 142 (Time Series Analysis)

Course Outline

Course Information

Course Code: Stat 142

Course Title: Time Series Analysis

Pre-requisite: Stat 134 (Regression Analysis)

Credit: 3.0 units

Semester Offered: Second Semester

Number of Contact Hours per Week: 2 hours lecture (3-5 M) and 3 hours laboratory (1-4 Th) per week

Course Description: Classical methods, ARIMA models, Box-Jenkins method, intervention analysis, GARCH models, regression with time series data, applications

Course Outcomes

1. Articulate basic concepts in time series analysis;
2. Apply smoothing methods for time series;
3. Demonstrate decomposition of time series; and
4. Develop models forstationary and nonstationary time series

Topical Outline

Module 1. . Introduction to Time Series Analysis

1. Basic Terms in Time Series Analysis
2. Components of a time series
3. Overview of forecasting methods

Module 2. Simple Smoothing Methods

1. Moving averages
2. Simple exponential smoothing
3. Smoothing methods for trend and seasonality

Module 3. Trend-Seasonal Smoothing Methods

1. Differencing
2. Estimating trend using the first difference
3. Double moving average
4. Brown's double exponential smoothing
5. Holt's two-parameter trend model

Module 4. Decomposition Methods and Seasonal Indices

1. Additive and multiplicative seasonality
2. Classical decomposition
3. The X11 and X12 procedures

Module 5. Models for Stationary Time Series

1. Autoregressive processes
2. Moving average processes
3. ARIMA processes

Module 6. Nonstationary Time Series Models and ARCH and GARCH

1. The Box-Jenkins Method
2. SARIMA models
3. Introduction to ARCH and GARCH models

Course Requirements and Grading System

1. Quizzes (15%)
2. Problem Sets (25%)
3. Long Examinations (60%)

Rating (%)	Grade Equivalent
98-100	1.00
95-97	1.25
90-94	1.50
85-89	1.75
80-84	2.00
75-79	2.25
70-74	2.50
65-69	2.75
60-64	3.00
53-59	3.25
46-52	3.50
39-45	3.75
32-38	4.00
25-31	4.25
18-24	4.50
11-17	4.75
0-10	5.00

Suggested References

1. Shmueli, G. and Lichtendahl, K. Jr (2019). Practical Time Series Forecasting with R: A Hands-on Guide, 2nd Ed. Axelrod Schnall Publishers
2. Shumway, R. H. and Stoffer, D. S. (2019). Time Series: A Data Analysis Approach Using R, CRC Press Taylor & Francis Group.
3. Huang, C and A. Petukhina (2022). Applied Time Series Analysis and Forecasting with Python. Springer Nature Switzerland AG
4. Montgomery, D. C., Jennings, C. L., and Kulachi, M. (2015). Introduction to Time Series Analysis and Forecasting, 2nd Edition. John Wiley & Sons, Inc.
5. Wei, W. W. S. (2006). Time Series Analysis: Univariate and Multivariate Methods, 2nd Edition. Pearson Education Inc.
6. Bisgaard, S. and Kulachi, M. (2011). Time Series Analysis and Forecasting by Example. John Wiley & Sons, Inc.
7. Box, G. E. P. et al (2016). Time Series Analysis: Forecasting and Control, 5th Edition. John Wiley & Sons, Inc.
8. https://online.stat.psu.edu/stat510