# Stat 142 (Time Series Analysis)

Course Outline

## Course Information

1. *Course Code*: Stat 142
2. *Course Title*: Time Series Analysis
3. *Course Description*: Classical methods, ARIMA models,Box-Jenkins method, intervention analysis, GARCH models, regression with time series data, applications
4. *Prerequisite*: Stat 134 (Regression Analysis)
5. *Credit*: 3 units
6. *Semester Offered*: Second
7. *Number of hours per week*: 2 hours lecture (2-4 Monday) & 3 hours laboratory (2-5 Tuesday)

## Course Outcomes

1. Articulate with concepts in time series analysis
2. Demonstrate decomposition of time series
3. Apply smoothing methods for time series
4. Develop models for stationary and non-stationary time series

## Course Topics

1. Introduction to time series analysis
   1.1. Basic terms in time series analysis
   1.2. Components of time series
   1.3. Overview of forecasting methods
2. Time series decomposition
   2.1. Classical decomposition
   2.2. Methods used by official statistics agencies
   2.3. STL decomposition

3. Smoothing time series
   3.1. Simple exponential smoothing
   3.2. Smoothing methods with trend
   3.3. Smoothing methods with seasonality
4. ARIMA models
   4.1. Stationarity and differencing
   4.2. Autoregressive models
   4.3. Moving average models
   4.4. Non-seasonal ARIMA models
   4.5 Seasonal ARIMA models
5. Volatility models
   5.1. Autoregressive conditional heteroscedasticity (ARCH) model
   5.2. Generalized autoregressive conditional heteroscedasticity (GARCH) model
6. Other models for time series (optional)
   6.1. Autoregressive distributed lag (ARDL) model
   6.2. Nonlinear autoregressive distributed lag (NARDL) model
   6.3. Generalized additive models (GAM)

## References


1. Hyndman, R.J., & Athanasopoulos, G. (2021) Forecasting: principles and practice, 3rd edition, OTexts: Melbourne, Australia. OTexts.com/fpp3.
2. Shmueli, G. and Lichtendahl, K. Jr (2019). Practical Time Series Forecasting with R: A Hands-on Guide, 2nd Ed. Axelrod Schnall Publishers
3. Shumway, R. H. and Stoffer, D. S. (2019). Time Series: A Data Analysis Approach Using R, CRC Press Taylor & Francis Group.
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. Bisgaard, S. and Kulachi, M. (2011). Time Series Analysis and Forecasting by Example. John Wiley & Sons, Inc.
6. Box, G. E. P. et al (2016). Time Series Analysis: Forecasting and Control, 5th Edition. John Wiley & Sons, Inc.
7. https://online.stat.psu.edu/stat510/

## Class Requirements

1. Quizzes (10%)
2. Exercises (30%)
3. Long Exams (60%)

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