Jimma University

College of Natural Sciences

Department of Statistics

Time Series Analysis Course outline

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| **Course Guide Book**  **Course** **Titles**/**Code**: Time Series Analysis (Stat 2042)  **Credit**: 6 EtCTS  **Credit hours**: 4hrs  **Module title/code**: Statistical Modeling I (Stat-M 2041)  **Course Type**: Core  **Prerequisite**(s):  **Academic** **Year**: 2020  **Semester**: II  **Student’s** **College**/**Faculty/School**: College of Natural Science  **Department/Program/Course Team** : Statistics  **Study Program**: Undergraduate  **Enrollment: 2nd year**  **Address: Jimma University**  **Instructor’s Name: Jaleta A.**  **Contact hour: Every working hour** |

**Course description**

Definition and concepts; Objectives; Time series data, Components of time series analysis; Additive and multiplicative models; Tests of randomness; Constant mean model, estimation methods; Linear trend estimation using moving average, Least squares, Exponential smoothing methods; Seasonal variation, estimation using simple average, moving average, dummy variable, exponential smoothing; Cyclical variation; Introduction to Box-Jenkins models: Stationary, Autoregressive (AR), Moving Average (MA), Autoregressive Moving Average (ARMA), ARIMA models; Forecasting Methods.

**Objectives**

The objectives of the course are:

* to introduce students to the theory and methods of time series analysis;
* to equip students with skills of applying various time series models;
* to enable students to use standard software for related computations;

**Learning outcomes**

At the end of the course students are expected to

* demonstrate basic time series concepts, theories and methods;
* distinguish among different components of time series and type of models to apply;
* model time series data and select model ;
* use statistical software for analyzing time series data;
* Make forecasting and interpret the results.

**Course Outline**

**1. Introduction**

1.1 Definition

1.2 Objectives of Time Series Analysis

1.3 Significance of Time Series Analysis

1.4 Components of Time Series

1.5 Models of Time Series

1.6 Editing of Time Series Data

**2. Tests of Randomness**

2.1 Turning point Test

2.2 Difference sign test

2.3 Phase length Test

2.4 Rank Test

**3. Estimation of trend componen**t

3.1 Constant mean model and its estimation

Free-hand Method, Method of semi-averages, Least squares method, Moving average, Exponential smoothing method

3.2 Linear Trend and its estimation Least squares method, Moving average method, Exponential smoothing method

3.3 Non-linear trend and its estimation

Polynomial trend

**4. Estimation of Seasonal Component**

4.1 Simple Average Method

4.2 Link Relative Method

4.3 Ratio-to-Moving Average Method

4.4 Ratio-to-Trend Method

4.5 Use of Dummy variables

4.6 Smoothing models for Seasonal Data

4.7 Uses and limitations of seasonal Indexes

4.8 Deseasonalization of Data

4.9 Cyclical component and its estimation

4.10 Irregular component and its estimation

**5. Introduction to Box-Jenkins Models**

5.1 Introduction

5.2 The concept of Stationarity

5.3 ARIMA models

5.4 Methodological tools for model identification

Autocorrelation function, Partial autocorrelation function

5.5 Stages of Box-Jenkins methodology

**6. Model Identification and Estimation**

6.1 Introduction

6.2 Autoregressive models

6.3 Moving average models

6.4 Autoregressive moving average models:

6.5 Autoregressive integrated moving average models

6.6 Seasonal ARIMA

6.7 Estimation of parameters

6.8 Diagnostic checking

**7. Forecasting**

7.1 Need and use of forecasting

7.2 Some forecasting methods

Averaging methods, Exponential smoothing methods, Box-Jenkins methods, Decomposition methods

7.3 Accuracy of forecasting methods

**Textbook**

Chatfield, C. (2003). The Analysis of Time Series: An Introduction.

**References**

1. Shumway, R.H. and Stoffer, D.S. (2006). Time Series Analysis and Its Applications: With R Examples.
2. Brockwell, P.J. and Davis, R.A. (2009). Time Series: Theory and Methods.
3. Montgomery, D.C. and Johnson, L.A. and Gardiner, J.S. (1990). Forecasting and Time Series Analysis.
4. Cryer, J.D and Chan, K.S. (2009). Time Series Analysis: With Applications in R.
5. Box, G.E.P, Jenkins, G.M., and Reinsel, G.C. (2008). Time Series Analysis: Forecasting and Control.
6. Brillinger, D.R. (2001). Time Series: Data Analysis and Theory.
7. Vandaele, W. (1983). Applied Time Series and Box-Jenkins Models.
8. Kendall, M. (1990). Introduction to Time Series Analysis.
9. Fuller, W.A. (1976). Introduction to Statistical Time Series.
10. Janacek, G. (2001). Practical Time Series.

**Teaching and Learning Methods**

Lecture, self-reading, demonstration, exercises, practice using computer software.

**Modes of Assessment: -** Continuous Assessment 50% and Final Exam 50%