

DOGUS UNIVERSITY**CSE 683 Time Series Analysis and Forecasting - Course Instruction Manual**

Institute	Institute of Science and Technology
Department	Computer Engineering
Credits / Hour	3 (3+0+0)
Course Type	Elective
Prerequisites	-
Lecturer	Prof. Dr. Selim AKYOKUŞ (Room: G 912, Tel: (Ext) 1213) Electronic mail: sakyokus@dogus.edu.tr
The text book	<ul style="list-style-type: none">• Rob J Hyndman and George Athanasopoulos (2013), Forecasting: principles and practice, www.otexts.org.
Recommended Texts	<ul style="list-style-type: none">• Soren Bisgaard and Murat Kulahci (2011), Time Series Analysis and Forecasting by Example, Wiley Series in Probability and Statistics.• R. H. Shumway and D. S. Stoffer (2006), Time Series Analysis and Its Applications (With R Examples), 2nd Edition. Springer, New York.• Brockwell, Peter J & Davis, Richard (2002), Introduction to Time Series and Forecasting. 2nd Edition. Springer Series in Statistics.• Box, G.E.P., Jenkins, G.M. and Reinsel, G.C. (2008). Time Series Analysis: Forecasting and Control, 4th Edition, Prentice Hall, New Jersey.
Course Description	The objective of this course is to teach theory, concepts, methods and practical applications of time series analysis and forecasting methods. This course will cover examples and exploratory analysis of time series data, auto-correlated data analysis, forecasting strategies and evaluation, regression, stationary models, non-stationary models, spectral analysis and filtering, multivariate models, state space models and recent development in the field. We will use R programming language, related software libraries and tools for applications and implementation of methods.
Purpose	A time series is a sequence of data values, collected typically at successive points in time spaced at uniform time intervals. Time series analysis involves methods for analyzing time series data in order to extract meaningful statistics, patterns and other characteristics of the data. Time series forecasting predicts future values by using a model developed with previously observed values. Time series analysis and forecasting methods are used in many fields such as statistics, signal processing, pattern recognition, econometrics, mathematical finance, weather forecasting, earthquake prediction, control engineering, astronomy and communications engineering, medical and social sciences. The course aims to teach theory, concepts, methods, applications of time series analysis and forecasting used in many areas of applied science and engineering which involves temporal measurements. Time series analysis and forecasting has widespread use in many fields and has a growing interest in recent years because of the latest advances in data and predictive analytics.
Learning Outcomes	The students passing the course will be able to <ul style="list-style-type: none">- get a technical understanding and appreciation of time series analysis and forecasting methods,- have in-depth knowledge of time series and forecasting theory, concepts and techniques- Perform complete statistical analyses to real data and interpret the results- describe and utilize a range of methods for time series analysis and forecasting,- apply forecasting and state space models by using several models,- use the programming language R to apply appropriate models to real data,- gain hands-on experience by conducting a term project on designing and developing time series and forecasting application,- be able to effectively present and communicate the knowledge they have acquired in the course.
Content of the Course	This course involves examples and exploratory analysis of time series data, auto-correlated data analysis, forecasting strategies and evaluation, regression, stationary models, non-stationary models, spectral analysis and filtering, multivariate models, state space models and recent development in the field.

Learning Methods	A variety of teaching and learning methods are used including formal lectures and paper presentations, the use of several tools and software to gain practical experience of web search and mining systems. Additionally, students will prepare homework and projects on several related problems.	
Assessment	Presentations	10%
	HWs	10%
	Project	15%
	Midterm	25%
	Final examination	40%

Course Plan

Week	Topics
1	Introduction, examples and exploratory analysis of time series data
2	R language
3	The forecaster's toolbox
4	Autocorrelation and seasonality
5	White noise and time series decomposition
6	Exponential smoothing methods
7	ETS models
8	Transformations and adjustments
9	Stationarity and differencing
10	Non-seasonal ARIMA models
11	Seasonal ARIMA models
12	Dynamic regression
13	Advanced methods
14	Review