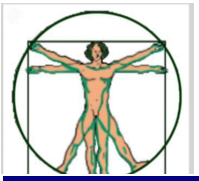

University of Puerto Rico. Mayagüez Campus
College of Engineering.
Industrial Engineering Department

Course Syllabus

General Information

Course Number: InIn 6036
Course Title: **Introduction to Time Series Analysis**
Credit-Hours: Three

Course Description

This course discusses the main principles of stochastic time series models. The solutions of differential and difference equations are discussed as the fundamental to understand the stochastic equations. Special attention is devoted to the identification of time series models based on nonlinear optimization techniques with the support of auto- partial and cross-correlation functions as well as the periodogram. Univariate and multivariate time series in time domain will be discussed. Model diagnostic will be implemented to validate the model and forecasting techniques will be derived. Multivariate time series changing in time and space domain will be modeled. Students will be organized in groups to develop a technical paper and submit it to a professional conference to be published in proceedings. The paper must be submitted before the end of the course.

Prerequisites

Authorization of the Director of the Department

Textbook and References

- Brockwell, P.J. and Davis, R.A., 2003, Introduction to Time Series and Forecasting, 2nd Edition, Springer-Verlag, New York.
- Hagan, M.T., Demuth,H.B., Beale, M.H., O. De Jesus. 2014. Neural Networks Design, 2nd Edition, Hagan and Demuth, San Bernardino, CA.
- Wei, W. W.S., 2005, Times Series Analysis, Univariate and Multivariate Methods, 2nd Edition, addison- wesley Publishing Co.
- G.E.P. Box, G. Reinsel, and G.M. Jenkins,1994. Times Series Analysis, Forecasting and Control, 3rd Edition, Holden-Day, CA.
- Pandit, S.M., and Wu, S.M., 2001, Times Series and System Analysis with Applications, Krieger Publishing Company; Reissue edition.
- Montgomery, D.C., Johnson, L.A., and Gardiner, J.S., 1990, Forecasting & Time Series Analysis, 2nd Edition, McGraw-Hill, New York.

Purpose

This course is mainly designed for Industrial Engineering graduate students that want to develop forecasting background in the field of Management Science. This course provides an excellent analytical and computational support for graduate students that come from other disciplines such as chemical, Civil, Mechanical, Electrical and Computer Engineering. The main purpose of this course is to develop student capabilities to identify time series models to represent the temporal and spatial variability of a given process.

Course Goals

- The students should understand the statistical basis of time series analysis.
- The student must conduct model building and parameter estimation for the univariate ARIMA model and the vector autoregressive model.
- The student must be able to model multivarite time series models using artificial neural networks.

Requirements

All students are expected to come to class on time, and prepared; do all assigned readings and related homework; actively participate in class discussions; and satisfy all assessment criteria to receive credit for the course

Course Syllabus

Department and Campus Policies

Class attendance: Class attendance is compulsory. The University of Puerto Rico, Mayagüez Campus, reserves the right to deal at any time with individual cases of non-attendance. Professors are expected to record the absences of their students. Frequent absences affect the final grade, and may even result in total loss of credits. Arranging to make up work missed because of legitimate class absence is the responsibility of the student. (Bulletin of Information Undergraduate Studies)

Absence from examinations: Students are required to attend all examinations. If a student is absent from an examination for a justifiable reason acceptable to the professor, he or she will be given a special examination. Otherwise, he or she will receive a grade of zero of "F" in the examination missed. (Bulletin of Information Undergraduate Studies)

Final examinations: Final written examinations must be given in all courses unless, in the judgment of the Dean, the nature of the subject makes it impracticable. Final examinations scheduled by arrangements must be given during the examination period prescribed in the Academic Calendar, including Saturdays. (see Bulletin of Information Undergraduate Studies).

Partial withdrawals: A student may withdraw from individual courses at any time during the term, but before the deadline established in the University Academic Calendar. (see Bulletin of Information Undergraduate Studies).

Complete withdrawals: A student may completely withdraw from the University of Puerto Rico, Mayagüez Campus, at any time up to the last day of classes. (see Bulletin of Information Undergraduate Studies).

Disabilities: After been identified with the professor and the institution, the students with disabilities will receive reasonable accommodations in their courses and evaluations. For more information, please contact *Student Services with Disabilities* at the Student Dean's Office at (Q-019), 787-265-3862 ó 787-832-4040 x-3250 ó 3258.

Ethics: Any academic fraud is subject to the disciplinary sanctions described in article 14 and 16 of the revised General Student Bylaws of the University of Puerto Rico contained in Certification 018-1997-98 of the Board of Trustees. The professor will follow the norms established in articles 1-5 of the Bylaws.

General Topics

Lecture	Topic	Reading
1-3	Fundamental Concepts	T1: Ch. 1
4-9	Stationary Tmes Series, Linear Processes, Introduction to ARMA Processes, Autocorrelation Function, Forecasting, Wold Decomposition. Differential and difference equations	T1: Ch. 2 Notes
10-15	ARMA Models. Autocorrelation and Partial Autocorrelation Function for ARMA processes.	T1: Ch. 3
16-21	Modelling and Forecasting with ARMA Processes. Prelimary stimation. Maximum Likelihood Estimation. Diagnostic Chbeking. Forecasting.	T1: Ch. 5
22-27	Nonstationary and Seasonal Time Series Models. ARIMA Models. Identification Techniques. Unit Roots. Forecasting ARIMA Models. Seasonal ARIMA Models. Regression with ARMA errors.	T1: Ch. 6
28-33	Modeling mutivariate time series using the Kalman Filter. Modeling multivariate time series using the transfer function	T1 Ch 8 T1: Ch 10
34-40	Modeling spatial and temporal time series using Artificial Neural Networks.	T2: 37-40

T1: Peter J. Brockwell and Richard A. Davis,1996
T2: Hagan, M.T., Demuth,H.B., Beale, M.H., O. De Jesus. 2014.

Nazario D. Ramirez/rev. September 2016