

IE409: Time Series Analysis

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Description: This course covers the analysis and prediction of discrete-time random processes with outcomes defined on continua, i.e., time series. The majority of the course will be devoted to modeling, fitting, and forecasting univariate time series. We will also extend our techniques to multivariate time series and, if time allows, study spectral analysis. The methodology we will use is reasonably sophisticated from a mathematical point of view. However, there will also be a strong emphasis on understanding the practical study of time series for which we will use the software package (ITSM) accompanying the textbook.

Prerequisite: IE121 (Applied Engineering Statistics) or equivalent.

Lectures: Mondays and Wednesdays, 4:10pm-5:25pm in Mohler 451.

Office Hours: I have reserved Tuesdays, 3:00pm-5:00pm in Mohler 322 for office hours. I am also available through e-mail (always) and on Google Talk (often). If I do not respond to an e-mail within 24 hours, then please assume that I have not received it and send a follow-up e-mail. If I do not respond on Google Talk, then I am either busy or you are contacting me too late in the day, in which case you can try again the next day (during work hours) or send an e-mail instead. I am also willing to meet at other times, but in such cases please e-mail me in advance to set up a mutually convenient time.

Course Site: Lecture notes will be posted on Course Site prior to each lecture. Homework assignments, solutions, announcements, and other important material will also be posted on Course Site. Important information, comments, corrections, and updates about the course may also be sent by e-mail (via Course Site); thus, please let me know if you do not receive mass e-mails sent through Course Site.

Textbook: The required textbook, from which homework problems will be assigned and along with a hard copy of which you will obtain the required software for the course, is the following.

- Peter J. Brockwell and Richard A. Davis, *Introduction to Time Series and Forecasting*, 2nd ed., Springer Texts in Statistics, Springer Science+Business Media, LLC, New York, NY, USA, 2002.

Course material will also be drawn from the following textbook.

- James D. Hamilton, *Time Series Analysis*, Princeton University Press, Princeton, NJ, USA, 1994.

Reading the textbook is not required, but is recommended. Note that you are not responsible for material in the textbook that is not covered in lecture.

Software: The ITSM software that accompanies the textbook is required. It is your responsibility to have access to this software. Please do not ask me for copies.

L^AT_EX: All work must be submitted as documents produced with L^AT_EX. There are no exceptions to this requirement. Instructions for installing and using L^AT_EX will be the topic of an early lecture. Assistance for learning L^AT_EX will be given in the form of the source for all L^AT_EX documents that I produce (including that for this syllabus) for the course. Moreover, I will provide style files and templates for all homeworks and exams, as well as for the project. It is not required that you use the style files and templates that I provide, but it is highly recommended, especially if you are unfamiliar with L^AT_EX. Please note that the style files may be updated throughout the semester as new material is generated and posted.

Grading: Your grade will be calculated as follows.

Homeworks:	30%
Midterm Exam:	20%
Final Exam:	20%
Project:	25%
Participation:	5%

Homeworks: There will be regular homework assignments throughout the semester, generally assigned and due every other week. Each homework must be submitted electronically. No credit will be given for any late assignment. You are free to consult with other students when working on homework, but the work you turn in must be your own. Please cite any references you use, including fellow students.

Exams: The midterm and final will be cumulative, take-home exams.

Project: A project will be assigned and due in the second half of the semester. Projects are to be completed in groups that I will create at the time the project is assigned. Each group will be required to obtain data for a time series, analyze it, and make forecasts. Each group is required to write a report and present their findings and forecasts to the class, the report and presentation each being weighted equally in the overall project grade. Presentations will be scheduled for the last week(s) of the semester.

Participation: Attendance will not be taken. However, participation will factor into your grade. If you are unable to participate in lecture, then participation entails being a presence online — via e-mail or Course Site — or in office hours. In short, if by the end of the semester I do not remember your having been in the course, then your participation grade will suffer.

Emergencies: Everyone is responsible for all material covered and announcements made in lecture. If you believe you will miss a long period of time in the course due to illness, family emergencies, etc., then please contact me as early as possible. Under no circumstances will I give credit for missed work unless you have discussed your absence with me in advance.

Regrade Requests: If you disagree with a grade you receive on a homework, exam, or project component, then you may submit a regrade request. This request must be in writing and submitted no more than 48 hours after you receive the graded assignment.

Recording Devices: Voice and/or video recording devices may be used only with the approval of everyone in the classroom. Please let me know in advance if you wish to use these types of devices.

Students with Disabilities: If you have a disability for which you are or may be requesting accommodations, please contact me and the Office of Academic Support Services, University Center C212 (610.758.4152) as early as possible in the semester. You must have documentation from Academic Support Services before accommodations can be granted.

Preliminary Schedule:

Week	Dates	Topic(s)	Notes
1	08/29-09/02	Basic Concepts	
2	09/05-09/09	Introduction to Time Series	
3	09/12-09/16	Stationarity Time Series	
4	09/19-09/23	Estimating Mean and Autocorrelation	
5	09/26-09/30	Forecasting Stationary Time Series	
6	10/03-10/07	ARMA Models	
7	10/10-10/14	Midterm Review	
8	10/17-10/21	Forecasting ARMA Processes	Midterm Exam due
9	10/24-10/28	Modeling ARMA Processes	
10	10/31-11/04	ARIMA Models	
11	11/07-11/11	Multivariate Time Series	
12	11/14-11/18	(No lectures)	Project Report due
13	11/21-11/25	State-Space Models, (no lecture 11/23)	
14	11/28-11/02	Spectral Analysis, Final Review	Project Report revisions due
15	12/05-12/09	Project Presentations	
16	12/12-12/16	(No lectures)	Final Exam due