

**Time Series Analysis**  
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PhD School, XXXVI cycle

## Course Description

This course attempts to give an introductory account of time series models and their application to modelling and prediction of data collected sequentially in time. The aim is to provide specific techniques for handling data and at the same time to provide some understanding of the theoretical basis for the techniques. Topics covered will include univariate linear and non linear models (both in mean and variance). Examples in R will be provided and exercises will be carried out during classes. The use of personal laptop during lectures is strongly encouraged. R can be downloaded from the cran R project page (<https://cran.r-project.org>). The RStudio environment (<https://rstudio.com/>) is suggested to run R.

## Objectives

The objectives of this course are:

- to introduce the students to the main developments in time series analysis;
- to learn theoretical, applied and computational methods for time series analysis and forecasting;
- to gain experience in model building;

## Schedule

- Introduction. Linear time series models.
- Linear time series models: model specification.
- Linear time series models: parameter estimation and forecasting.
- Transfer function models.
- Nonlinear models: an introduction.
- Nonlinear models: Markov-Switching Models and Threshold Autoregression Models.
- Nonlinear models: ARCH-type models.

## Recommended texts

- Brockwell P.J., Davis R.A. (1996), Introduction to Time Series and Forecasting, Springer
- Fan J., Yao Q. (2003), Nonlinear time series, Springer-Verlag, New York.
- Shumway R.H., Stoffer (2010) Time series analysis and its applications. Springer. A gentle introduction to time series analysis is now available (for free) here: <http://www.stat.pitt.edu/stoffer/tsa4/tsaEZ.pdf>
- Tsay R.S., (2005) Analysis of Financial Time Series, Wiley-Interscience.
- Wei, W.W.S. (2006), Time Series Analysis - 2nd Ed. , Pearson.