

# MA550 Statistical Data Analysis

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Credit: 2-1-0-3

Approval: Approved in 2nd Senate

Students intended for: MS/ Ph.D., Undergraduate (3rd and 4th year)

Prerequisites: MA 202 for undergraduate.

Elective or Core: Elective

Semester: Odd/Even

## Course objective:

The course reviews and expands upon core topics in probability and statistics through the study and practice of data analysis. Topics covered include univariate stationary and non-stationary models, vector auto regressions, frequency domain methods, models for estimation and inference in time series. Upon completion of the course, students should be able to think critically about data and apply standard statistical inference procedures to draw conclusions from such analyses. The course is computationally, not mathematically, intensive and will use the R language and environment for statistical computing and graphics. Students are expected to work on a project on real life data.

## Course content:

- **Exploratory analysis of time series:** Introduction, examples, simple descriptive techniques, trend, seasonality, stochastic and deterministic approaches; numerical and experimental data sets; challenges in data analysis and data graphical representation, interpretation; statistical tests, significance and power of a test, choice of the critical region, constructing test statistics: the Fisher discriminant, mean and variance test, testing goodness-of-fit, chi<sup>2</sup>-test, p-values; stationary time series process (ARMA Processes). [12 hours]
- **Analysis of stochastic series:** Model identification and non-stationary time series models; forecasting with classical regression models; Forecasting with autocorrelations; Forecasting with lagged dependent variable; Forecast error statistics and evaluation; singularity detection, spectral density function, the periodogram, spectral analysis, correlogram, wavelet cross-correlation, multi-resolution analysis, examples and applications. [12 hours]
- **Clustering data techniques:** Principal component analysis; different techniques of data clustering. [6 hours]

## Text books

Peck and Devore, Statistics: The Exploration and Analysis of Data, 7th edition, Thomson-Brooks/Cole (2012).

Montgomery, D., Jennings, C.L. and Kulahci, M. (2008) *Introduction to Time Series Analysis and Forecasting*, Hoboken, N.J. : Wiley-Interscience.

Chatfield, C., *The Analysis of Time Series*, Sixth Edition Chapman & Hall/CRC, 2004

## Reference Books:

Petre Stoica and Randolph L. Moses, *Introduction to Spectral Analysis*, Prentice Hall, 1997.

Robert H. Shumway and David S. Stoffer, *Time Series Analysis and Its Applications with R Examples*, Third edition, Springer Texts in Statistics, 2006.

Raghuveer M. Rao and Ajit S. Bopardikar, *Wavelet Transform*, Pearson Education, 1998

Other Faculty Members interested in teaching this course: Not Known

Proposed by: Dr. Sarita Azad