

Approved: 10th Senate Meeting

Course Name: **Statistical Data Analysis**

Course Number: MA 605

Credit: 2-1-0-3

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

Prerequisites: MA 202 for undergraduate.

Elective or Compulsory: Elective

Semester: Odd/Even

Course objective: This course reviews and expands upon core topics in probability and statistical estimation and inference through practice of data analysis. Other topics will include univariate stationary and non-stationary models; frequency domain methods like wavelet analysis; and models in network analysis. Upon completion of this course, students should be able to think critically about the data and apply standard statistical inference procedures to draw conclusions from such analysis. This course will be computationally 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.

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, χ^2 -test, p-values; stationary time series process (ARMA Processes). **12hrs**

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 hrs**

Clustering data techniques:

Principal component analysis; different techniques of data clustering.

6hr

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