Course content for MT5434, Time Series Analysis

Prerequisites:
UG in Statistics

Aims:
Time series are observations collected through time and there are correlations among successive observations. Time series data are collected in many fields: finance, economics, medicine, meteorology, agriculture etc. This course aims to introduce some of the descriptive methods and theoretical techniques that are used to analyse time series.

Learning outcomes:
On completion of the course the students should be able to:
-   understand basic concepts and notions of time series analysis;
-   understand the standard theory around several prototype classes of time series models;
-   apply appropriate methods of times series analysis and forecasting to a given set of data using an appropriate statistical computing package;
-   appreciate inferential and associated algorithmic aspects of time-series modelling;
-   simulate time series based on several prototype classes and using an appropriate statistical computing package;

Course content:
Introduction and simple descriptive techniques: Some simple time series models; notions of trend and seasonality; linear filters; convolutions; local regression; estimation and elimination of trend and seasonal components; introduction to relevant functions of a suitable software package.
Stationarity: Notions of weak and strict stationarity; autocovariance and autocorrelation functions; linear processes; modes of stochastic convergence
ARMA modelling: AR(p), MA(p), and ARMA(p,q) models; characteristic polynomials; conditions for stationarity; causality; model identification and invertibility;
Inference: parameter estimation; confidence intervals and tests of hypotheses; forecasting; prediction intervals; Bartlett's formula; Durbin-Levinson algorithm
Non-stationary time series: ARIMA models; random walk; identification and forecasting.
Further topics: state-space representation