DESCRIPTION OF INDIVIDUAL COURSE UNIT

English version

Course title and code	Prediction in Economics
Level of course (Undergraduate/ Postgraduate)	Degree
Programme in which is integrated	Degree in Economy
Type of course (Compulsory/Elective)	Elective
year of study	1 st semester (Winter semester 2011/2012)
Calendar (Semester)	
Credits (theory and practics)	3+1,5
Number of credits expressed as student workload (ECTS)	4,5* *1 ECTS = 25-30 work hours. See below for more activities and estimated hours of work.
Descriptors	This course consists of two parts: a theoretical part and a practical part.
Objectives of the course (expressed in terms of learning outcomes and competences)	The student will know: On the theoretical part: Basics on the analysis of time series in Economics. Stationary time series models. Non-stationary time series models. ARIMA model based forecasting. Dynamic regression models. State space model and the Kalman algorithms (filtering and forecasting). On the practical part: The statistical package R. A spreadsheet: Microsoft Excel or OpenOffice Calc.
Prerequisites and advises	Knowledge of statistics: descriptive, simple linear regression and basics on inference
Course contents/descriptors/key words	Time series, white noise, stationarity, Wold decomposition theorem, invertibility, ACF, MA(q), AR(p), ARMA(p,q), PACF, non-stationarity, random walk, seasonality, SARIMA, Box-Jenkins ARIMA modelling (identification, estimation and validation), ARIMA prediction, dynamic regression model, transfer function, Koyck model, state space model, Kalman algorithms.
Recommended reading	Theoretical part -Abraham, B. and J. Ledolter (1983). *Statistical Methods for Forecasting*. Wiley, New York. ISBN 0-471-86764-0. -Aznar, A. and J. Trivez (1993). *Métodos de predicción en Economía*. Ariel Economía, Barcelona. -Box, G. E. P. and G. M. Jenkins (1976). *Time series analysis, forecasting and control*. Holden-Day, San Francisco. -Brockwell, P. J. and R. A. Davis (2002). *Introduction to time series and forecasting*. Springer, New York, 2nd edition. -Caridad, J. M. (1998). *Econometría: Modelos econométricos y series temporales*. Reverté, Barcelona. -Chatfield, C. (2000). *Time series forecasting*. Chapman and Hall, London. ISBN 1-58488-063-5. -Chatfield, C. (2003). *The analysis of time series*. Chapman and Hall, London. -de Jong, P. and J. Penzer (2004). The ARMA model in state space form. *Statistics & Probability Letters*, 70, 119-125. -Haldane, A. G. and S. G. Hall (1991). Sterling's relationship with the Dollar and deutschemark: 1976-89. *Economic Journal*, 101(406). -Hamilton, J. D. (1994). *Time series analysis*. Princeton University Press, New York. -Harvey, A. C. (1990). *The econometric analysis of time series*. Philip Alan, New York, 2nd edition. -Harvey, A. C. (1993). *Time series model*. The MIT Press, Cambridge, 2nd edition. -Kailath, T., A. Sayed and B. Hassibi (2000*). Linear estimation*. Pearson, New York. -Makridakis, S., S. C. Wheelwright and R. J. Hyndman (1998). *Forecasting: methods and applications*. John Wiley & Sons, Nueva York, 3rd edition. ISBN 0-471-53233-9. -Otero, J. M. (1993). *Econometría. Series temporales y predicción*. Editorial AC, Madrid. -Pankratz, A. (1991). *Forecasting with dynamic regression models*. John Wiley & Sons, New York. -Peña, D. (1991). *Modelos y métodos. Vol 2 (Modelos lineales y series temporales)*. Alianza Universidad, Madrid. -Priestley, M. B. (1981). *Spectral analysis and time series. Vol. I: Univariate series. Vol II: Multivariate series, prediction and control.* Academic Press, New York. -Pulido, A. and A. López (1999). *Predicción y simulación aplicada a la Economía, Gestión de Empresas*. Pirámide, Madrid. -Rodríguez, J. M. (2002). *Computer-aided introduction to Econometrics*. Springer, Berlin. -Uriel, E. (1985). *Análisis de series temporales: Modelos ARIMA*. Paraninfo, Madrid. -Uriel, E. and A. Peiró (2000). *Introducción al análisis de series temporales*. Editorial AC, Madrid. -Valderrama, M. J. and J. C. Ruiz (1996). *Filtrado de Kalman*: Aplicaciones en Economía e Ingeniería. EUB, Barcelona. -Vandaele, W. (1983). *Applied time series and Box-Jenkins models*. Academic Press, San Diego. -Wei, W. S. (1990). *Time series analysis: univariate and multivariate methods*. Addison-Wesley, California

	Practical part -Aula Fácil. *Curso de Excel*. http://www.aulafacil.com/CursoExcelLargo/temario.htm -Brockwell, P.J. and R.A. Davis (1996). *Introduction to time series forecasting*. Springer, New York. -Caridad, J.M. (1998). *Econometría: Modelos econométricos y series temporales*. Reverté, Barcelona. -García de Jalón de la Fuente and others (1995). *Aprenda Microsoft Excel 7.0 como si estuviera en Primero*. ETS Ingenieros Industriales, Universidad de Navarra. http://www1.ceit.es/asignaturas/Informat1/ayudainf/aprendainf/Excel95/excel7.pdf -Peña, D. (1991). *Modelos y métodos. Vol. 2 (Modelos lineales y series temporales)*. Alianza Universidad, Madrid. -Rodríguez, Juan M. (2002) *Computer-aided introduction to Econometrics.* Springer, Berlin.
Teaching methods	The content of the course is developed by the professor by means of presentations for each lesson, being provided to the students the slides and any other material considered in class previously. However, some of the related contents, or subjects, of the course could be elaborated by the students and be presented by them, under the supervision of the professor, who provides bibliography and directions to them on request. As the approach to the contents in this course is mainly practical, the mathematical and statistical theory presented in the course is addressed by its applicability to time series. Indeed exercises solved in the blackboard will aid the student to understand the key ideas underlying both theory and practice with data. Furthermore, taking into account that computational efficiency is critical in prediction problems, the teaching in this course must be partly carried out in a computer lab, in order to ease the use of the available software tools at the UGR network. However, the teaching activities in the computed lab are not only focused to provide software skills to students, but also to illustrate the resolution of practical cases with the computer aid. To this end, details and explanations about the interpretation of statistical outcomes will be analysed with both practical and simulated examples in the computed lab.
Activities and estimated workload (hours)	Activities — class h Lessons — 30 Practical exercises — 12 Examinations — 3 Total — 45
Assessment methods	The final grade is composed by different factors – not only by a final exam: a) The theoretical exam is to be taken either at the end of the semester or during the semester in terms of three partial exams (approx. 75% weight). b) The practical exam is to be done at the end of the semester in the form of a practical assignment with R and Calc/Excel (approx. 25 % weight). c) Voluntary assignments using either R or Calc/Excel will improve the final grade.
Language of instruction	Spanish
Links to more information	http://www.ugr.es/~focana/peef.htm It provides further information about this subject and the classes. https://swad.ugr.es/?CrsCod=1032 It manages the information (homeworks, student profiles, documents, lecture notes, slides, self-tests, etc.) between the students and the professor. This is a special website in the learning platform SWAD (http://swad.ugr.es)
Name of lecturer(s) and address for tutoring	Francisco Antonio Ocaña Department of Statistics and Operations Research University of Granada, Spain http://www.ugr.es/~focana

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Week	Class Hours	Activities	Contents
1	3	Lesson 1 Practical exercises	*Introduction to times series* Intuitive definition. Time series models in Economics. Historical development and current approach to time series analysis.
2	3	Lessons 1 and 2 Practical exercises	*Introduction to times series (Continuation)* Probabilistic definition of time series. Autocorrelation function (ACF). Stationarity. Invertibility.
3	3	Lesson 2 Practical exercises	*Stationary times series* AR(p) models. Partial autocorrelation function (PACF). *Calc or Excel* * Implementation of some characteristics of AR models. * Practicing with AR(1) and AR(2).
4	3	Lesson 2 Practical exercises	*Stationary times series (Continuation)* Moving average models: MA(q). ARMA models. *Calc or Excel* * Implementation of some characteristics of MA and ARMA models. * Derivation of the MA(∞) and AR(∞) forms for a given ARMA model. * Practicing with MA(1), MA(2) and ARMA(1,1).
5	3	Lesson 3 Practical exercises	*Non-stationarity times series (continuation)* Non-stationarity and seasonality in Economics. Random walk. Holt-Winters models. Series transformations. ARIMA model. SARIMA model. *R* * Introduction to R. * Handling data series: creating data files (import files, etc.).
6	3	Lesson 3 Practical exercises	*ARIMA modelling* Box-Jenkins ARIIMA modelling (identification, estimation and validation). *R* * Basic analysis of a data series (summary statistics, time series plot, analysis of the estimated ACF and PACF, etc.). * Time series transforms (differencing, log-transform, seasonal differencing).
7	3	Lesson 3	*ARIMA forecasting* The problem of time series forecasting. ARIMA model based forecasting. Mean squared forecasting error. Forecasting intervals. Forecasting update. *Calc or Excel* * Simulation of an ARIMA series. * Implementation of the forecasting equation for an ARIMA model.
8	3	Lesson 3 Practical exercises	*Calc or Excel* * Implementation of the mean squared error for an ARIMA model. * Implementation of the forecasting confidence intervals for an ARIMA model. * Analysis of the absolute and relative forecasting errors.
9	3	Lesson 3 Practical exercises Partial examination	*R* * ARIMA model estimation. * Validation of estimated ARIMA models (statistical inference on model parameters and analysis of estimated residuals). * Forecasting.

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10	3	Lessons 4 Practical exercises	*Dynamic Regression models* Dynamic vs. classical regression in Economics. Definition of dynamic regression models. *Calc or Excel* Simulation of a dynamic regression model.
11	3	Lesson 4 Practical exercises	*Dynamic regression models (Continuation)* Transfer function. Gain. Mean lag time. Cross correlation function. On the dynamic regression modelling. *Calc or Excel* * Analysis of the transfer function in a dynamic regression model. Implementation of the impulse and step response functions, its gain and its mean time lag.
12	3	Lesson 4 Practical exercises Partial examination	*Dynamic regression models (Continuation)* Forecasting in dynamic regression models. Cointegration analysis. Intervention analysis. *Calc or Excel* * Implementation of the forecasting equations for a dynamic regression models.
13	3	Lesson 5 Practical exercises	*State space model and the Kalman filter* Definition of state space model. The state-space formulation of some problems in Economics. *R* * Simulation of a state-space model.
14	3	Lesson 5 Practical exercises	*State space model and the Kalman filter (continuation)* The problem of forecasting and filtering. Kalman algorithms. *R* * Implementation of the Kalman algorithms (forecasting and smoothing).
15	3	Partial examination Examination	The practical exam is to be done at the end of the semester plus three partial examinations during semester.