UAB
Universitat Autònoma de Barcelona

Temporal Data Analysis

Code: 104413
ECTS Credits: 6

2025/2026

Degree	Type	Year
Computational Mathematics and Data Analytics	OP	4

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

It is advisable to have knowledge on probability, statistical inference and linear models.

Objectives and Contextualisation

This course aims to introduce students to time series models and their applications. A time series is a set of observations of a random phenomenon evolving over time (or any other ordered magnitude). Time series appear in many fields of application. Therefore, their analysis and the modelling of the underlying random phenomena are of crucial theoretical and applied importance. The ultimate goal is the modelling of the mechanism that generates the data, performing model diagnostics, and predicting future values.

Learning Outcomes

1. CM31 (Competence) Plan studies based on time series with ethical responsibility for real cases.
2. CM32 (Competence) Assess the degree of compliance with the requirements necessary to apply each advanced statistical procedure.
3. CM33 (Competence) Draw relevant conclusions from applied problems by applying advanced statistical methods.
4. KM27 (Knowledge) Recognise the advantages and disadvantages of different statistical methodologies when applied to different disciplines.
5. KM28 (Knowledge) Identify the most appropriate modelling for a chronological series.
6. SM33 (Skill) Use summary graphs of time-varying data.

7. SM34 (Skill) Analyse data using the time series model.
8. SM35 (Skill) Use statistical software to study time series.

Content

1. Introduction. Classical analysis of time series models.
2. Stationary Processes. On the concept of stationarity, examples. Simulation.
3. Linear models. MA(q) and AR(p). Correlograms. Yule-Walker equations. The difference operator. Relationship between MA snd AR models. The autocorrelation and partial autocorrelation functions.
4. ARIMA Models. The ARMA(p,q) model. Parameter estimation: method of moments, MLE, unconditional and conditional least squares. The ARIMA(p,d,q) and SARIMA models. The Box-Jenkins method. Segmentation.
5. Diagnostic checking and Forecasting. AIC and BIC criteria. Analysis of residuals. Confidence intervals for predictions.
6. Models for non-stationary series: ARCH/GARCH, ARMA with covariates.
7. Count Time Series: The INAR models.

Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical sessions	24	0.96	
Theoretical sessions	26	1.04	
Type: Autonomous			
Personal work	62	2.48	
Real data analysis	25	1	

During the theoretical lessons (2 H/week) the fundamental results will be presented, and computer exercises will be developed. During the lab hours (with laptop) students will solve real data problems. The programing language used is R.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final Exam	0,4	3	0.12	CM32, CM33, KM27, KM28
Homework (exercises and computer activities)	0,3	8	0.32	CM31, CM32, CM33, KM27, KM28, SM33, SM34, SM35
Mid-term exam	0,3	2	0.08	CM32, CM33, KM27, KM28

In the continuous assessment modality, the course will be evaluated through assignments (exercise submissions, problem-solving tests and/or practical work) and 2 exams. To obtain the weighted continuous assessment grade (NP), a minimum score of 3 out of 10 is required in each of the components. If this minimum is not reached, the final grade will be NF = min(NP, 4). If the final grade does not reach 5/10, the student has another opportunity to pass the subject through the remedial exam that will be held on the date set by the degree coordinator. In this test you can recover 70% of the grade corresponding to the theory and the problems. The part of internships is not refundable.
Students who have opted for the single assessment modality will have to complete an assessment that will consist of a theory exam, a problem test and the delivery of the first and last practical reports of the course. Assessment of submissions may require an assessment interview with the teacher. The student's grade will be the weighted average of the three previous activities, where the exam will account for 45% of the grade, the test 45% and the assignments 10%. Regarding the remedial exam, the same recovery system as in the continuous assessment modality will be applied.

Bibliography

1. Bisegard, S. (2011). *Time Series Analysis and Forecasting By Example. John Wiley & Sons, Inc., Hoboken, New Jersey.* https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991010344849906709
2. Brockwell, P.J. and Davis, R.A. (2002). Introduction to Time Series and Forecasting. 2nd edit. Springer. https://bibcercador.uab.cat/permalink/34CSUC_UAB/cugbhl/alma991002663039706709
3. Cryer, J.D. and Chan, K.S. (2008). Time Series Analysis with Applications to R. 2nd. edit. Springer. https://bibcercador.uab.cat/permalink/34CSUC_UAB/1gfv7p7/alma991008499229706709
4. Peña, R.D. (2000). A course in time series analysis. https://onlinelibrary-wiley-com.are.uab.cat/doi/book/10.1002/9781118032978
5. Peña, D., Tiao, G.C., and Tsay, R.S. (2001). *A Course in Time Series Analysis. John Wiley & Sons, Inc.* https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991010577691606709
6. Shumway, R.H. and Stoffer, D.S. (2011). Time Series Analysis andits Applications. 3rd. edit. Springer. https://bibcercador.uab.cat/permalink/34CSUC_UAB/avjcib/alma991011050079506709
7. Tsay., R.S. (2010). Analysis of Financial Time Series, 3rd Edition, Wiley. https://bibcercador.uab.cat/permalink/34CSUC_UAB/avjcib/alma991011050079506709

Software

R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

We shall use several R libraries, including forecast, TSA, TSeries, quantmod, fgarch, tscount.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	1	Catalan	first semester	afternoon
(PLAB) Practical laboratories	2	Catalan	first semester	afternoon
(TE) Theory	1	Catalan	first semester	afternoon