



## TIME SERIES

### 25070 - TIME SERIES (2024-25)

#### General

**Code:** 25070

**Lecturer responsible:**

TROTTINI, MARIO

**Credits ECTS:**

**6,00**

Theoretical credits:

1,12

Practical credits:

1,28

Distance-base hours:

3,60

#### Departments involved

- **Dept:** MATHEMATICS  
**Area:** STATISTICS AND OPERATIONS RESEARCH  
**Theoretical credits:** 1,12  
**Practical credits:** 1,28  
 This Dept. is responsible for the course.  
 This Dept. is responsible for the final mark record.

#### Study programmes where this course is taught

- [DOUBLE DEGREE IN PHYSICS AND MATHEMATICS](#)  
 Course type: OPTIONAL (Year: 5)
- [DEGREE IN MATHEMATICS](#)  
 Course type: OPTIONAL (Year: 4)

#### Competencies and objectives

##### Course context for academic year 2024-25

Time series is an optional subject. The objective of the course is to provide an introduction to an important class of univariate time series models: the class of AutoRegressive Integrated Moving Average (ARIMA) models. Within this class, we will cover the problems of model identification, estimation, selection and model diagnosis and prediction. For computation, visualization and analysis of time series data we will use the free software R. This course assumes knowledge of probability theory and statistical theory (at the level taught in the probability and statistical inference courses 25026 and 25035). Background on linear regression methods and familiarity with the statistical software R will be helpful but not required.

## Course content (verified by ANECA in official undergraduate and Master's degrees) for academic year {0}

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### Specific Competences (CE)

- **CE10** : Comunicar, tant per escrit com de manera oral, coneixements, procediments, resultats i idees matemàtiques.
- **CE11** : Ser capaç de resoldre problemes d'àmbit acadèmic, tècnic, financer o social mitjançant mètodes matemàtics.
- **CE12** : Saber treballar en equip, aportant models matemàtics adaptats a les necessitats col·lectives.
- **CE15** : Reconèixer i analitzar nous problemes i plantejar estratègies per a solucionar-los.
- **CE5** : Proposar, analitzar, validar i interpretar models de situacions reals senzilles, utilitzant les eines matemàtiques més adequades a les finalitats que es persegueixen.
- **CE6** : Resoldre problemes de matemàtiques, mitjançant habilitats de càlcul bàsic i altres tècniques, planificant-ne la resolució a partir de les eines de què es disposa i de les restriccions de temps i recursos.
- **CE7** : Utilitzar aplicacions informàtiques d'anàlisi estadística, càlcul numèric i simbòlic, visualització gràfica, optimització o d'altres per a experimentar en matemàtiques i resoldre problemes.
- **CE9** : Utilitzar eines de cerca de recursos bibliogràfics en matemàtiques.

### Specific Generic UA Competences

- **CGUA1** : Comprensió de la llengua estrangera anglès en l'àmbit científic.
- **CGUA2** : Tenir coneixements d'informàtica relatius a l'àmbit d'estudi.
- **CGUA3** : Adquirir o tenir les habilitats bàsiques en TIC (tecnologies de la informació i comunicació) i gestionar adequadament la informació obtinguda.

### Generic Degree Course Competences

- **CG1** : Desenvolupar la capacitat d'anàlisi, síntesi i raonament crític.
- **CG2** : Demostrar capacitat de gestió/direcció eficaç i eficient: esperit emprenedor, iniciativa, creativitat, organització, planificació, control, presa de decisions i negociació.
- **CG3** : Resoldre problemes de manera efectiva.
- **CG4** : Demostrar capacitat de treball en equip.
- **CG5** : Comprometre's amb l'ètica, els valors d'igualtat i la responsabilitat social com a ciutadà i com a professional.
- **CG6** : Aprendre de manera autònoma.
- **CG7** : Demostrar capacitat d'adaptar-se a noves situacions.
- **CG9** : Demostrar habilitat per a transmetre informació, idees, problemes i solucions a un públic tant especialitzat com no especialitzat.

### Exclusive skill taught in this course

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No data

### Learning outcomes (Training objectives)

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No data

## Specific objectives stated by the academic staff for academic year 2024-25

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- Learn how to build, estimate and validate ARIMA time series models for univariate time series data
- Learn how to use ARIMA models for time series forecasting
- Utilize R for computation, visualization and analysis of time series data

## Content and bibliography

### Content for academic year 2024-25

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1. Introduction to time series. Time series and stochastic processes.
2. Descriptive analysis of a time series.
3. Autoregressive processes.
4. Moving Average (MA) and Autoregressive Moving Average (ARMA) processes.
5. Integrated processes.
6. Seasonal ARIMA processes
7. Forecasting with ARIMA models.
8. Identifying possible ARIMA models.
- 9 Estimation and selection of ARIMA models
10. Model diagnosis.
11. Introduction to multivariate models.

### Related links

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No data

### Introduction to time series and forecasting

**Author(s):** Brockwell, Peter J. ; Davis, Richard A.

**Issue:** Cham : Springer International Publishing, 2016;

**ISBN:** 978-3-319-29852-8

**Category:** Complementario

### Análisis de series temporales

**Author(s):** Peña, Daniel

**Issue:** Madrid : Alianza Editorial, 2010;

**ISBN:** 978-84-206-6945-8

**Category:** Básico

### Time series analysis and its applications : with R examples

**Author(s):** Shumway, Robert H.

**Issue:** Cham : Springer, 2017;

**ISBN:** 9783319524528 (libro e.)

**Category:** Básico

### A course in time series analysis

**Author(s):** Peña, Daniel (editor)

**Issue:** New York : John Wiley, [2001];

**ISBN:** 0-471-36164-X

**Category:** Básico

## Assessment

### Assessment procedures and criteria 2024-25

#### Continuous assessment: 100% of the final grade.

The final grade will be a weighted average of:

- **Written test (70%).**
- **Project presentation (30%):** Each student, either individually or in small groups, will model and analyze a univariate time series data set and present the results of the analysis.

Both the written test and the project presentation will be scored from 0 to 10. The written test is recoverable. In particular, students with written test score <5 can take, if they wish, the final exam (C3, C4 or C1). In such case, the final grade will be:

$$\text{Final grade} = 0.30 \times (\text{Project presentation grade}) + 0.70 \times (\text{final exam grade})$$

Description	Criteria	Type	Weighting system
Open-response written test (Recoverable)	Open-response written test.	ACTIVITIES OF EVALUATION DURING THE SEMESTER	70
Project presentation (Not recoverable)	Each student, either individually or in small groups, will model and analyze a univariate time series data set and present the results of the analysis.	ACTIVITIES OF EVALUATION DURING THE SEMESTER	30

### Official exam dates for academic year 2024-25

Exam session	Date	Time	Group - Classroom(s) allocated	Comments
(C3) Periodo ordinario para asignaturas de segundo semestre y anuales	28/05/2025			DEGREE IN MATHEMATICS
(C4) Pruebas extraordinarias para asignaturas de grado y máster	02/07/2025			DEGREE IN MATHEMATICS

## Academic staff

Fotografia  
no disponibile

Fotografia  
no disponibile

**TROTTINI, MARIO**  
Lecturer responsible

THEORY CLASS: Groups: 1

PROBLEM PRACTICALS / WORKSHOP: Groups: P1

COMPUTER PRACTICALS: Groups: O1

GROUP TUTORIALS: Groups: T1

## Groups

### THEORY CLASS

Group	Semester	Morning or afternoon session	Language	No. of enrolled students	
Gr. 1 (THEORY CLASS) : 1	2S	Morning	English	30	▪ Allowed DEGREE IN MATHEMATICS
Gr. 50 (THEORY CLASS) : 50	2S	Afternoon	Spanish	0	▪ Allowed DOUBLE DEGREE IN PHYSICS AND MATHEMATICS

### PROBLEM PRACTICALS / WORKSHOP

Group	Semester	Morning or afternoon session	Language	No. of enrolled students	
Gr. P1 (PROBLEM PRACTICALS / WORKSHOP) : P1	2S	Morning	English	30	▪ Allowed DEGREE IN MATHEMATICS
Gr. P50 (PROBLEM PRACTICALS / WORKSHOP) : P50	2S	Afternoon	Spanish	0	▪ Allowed DOUBLE DEGREE IN PHYSICS AND MATHEMATICS

### COMPUTER PRACTICALS

Group	Semester	Morning or afternoon session	Language	No. of enrolled students	
Gr. O1 (COMPUTER PRACTICALS) : O1	2S	Morning	English	30	▪ Allowed DEGREE IN MATHEMATICS
Gr. O50.1 (COMPUTER PRACTICALS) : O50.1	2S	Afternoon	Spanish	0	▪ Allowed DOUBLE DEGREE IN PHYSICS AND MATHEMATICS
Gr. O50.2 (COMPUTER PRACTICALS) : O50.2	2S	Afternoon	Spanish	0	▪ Allowed DOUBLE DEGREE IN PHYSICS AND MATHEMATICS

## GROUP TUTORIALS
















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<b>Group</b>	<b>Semester</b>	<b>Morning or afternoon session</b>	<b>Language</b>	<b>No. of enrolled students</b>	
Gr. T1 (GROUP TUTORIALS) : T1	2S	Morning	English	30	▪ Allowed DEGREE IN MATHEMATICS
Gr. T50 (GROUP TUTORIALS) : T50	2S	Afternoon	Spanish	0	▪ Allowed DOUBLE DEGREE IN PHYSICS AND MATHEMATICS








## Timetables

### THEORY CLASS











Group	Start date	End date	Day	Start time	End time	Lecture room
1	27/01/2025	27/01/2025	LUN	09:00	11:00	<a href="#">A1/1-44P</a> 
1	29/01/2025	29/01/2025	MIE	09:00	11:00	<a href="#">A1/1-44P</a> 
1	03/02/2025	03/02/2025	LUN	09:00	11:00	<a href="#">A1/1-44P</a> 
1	17/02/2025	17/02/2025	LUN	09:00	11:00	<a href="#">A1/1-44P</a> 
1	19/02/2025	19/02/2025	MIE	09:00	11:00	<a href="#">A1/1-44P</a> 
1	26/02/2025	26/02/2025	MIE	09:00	11:00	<a href="#">A1/1-44P</a> 
1	03/03/2025	03/03/2025	LUN	09:00	11:00	<a href="#">A1/1-44P</a> 
1	12/03/2025	12/03/2025	MIE	09:00	11:00	<a href="#">A1/1-44P</a> 
1	17/03/2025	17/03/2025	LUN	09:00	10:00	<a href="#">A1/1-44P</a> 
1	26/03/2025	26/03/2025	MIE	10:00	11:00	<a href="#">A1/1-44P</a> 
1	31/03/2025	31/03/2025	LUN	09:00	11:00	<a href="#">A1/1-44P</a> 
1	07/04/2025	07/04/2025	LUN	09:00	11:00	<a href="#">A1/1-44P</a> 
1	09/04/2025	09/04/2025	MIE	09:00	11:00	<a href="#">A1/1-44P</a> 
1	16/04/2025	16/04/2025	MIE	09:00	11:00	<a href="#">A1/1-44P</a> 
1	30/04/2025	30/04/2025	MIE	09:00	11:00	<a href="#">A1/1-44P</a> 

### PROBLEM PRACTICALS / WORKSHOP


Group	Start date	End date	Day	Start time	End time	Lecture room
P1	05/02/2025	05/02/2025	MIE	09:00	11:00	<a href="#">A1/1-44P</a> 
P1	10/02/2025	10/02/2025	LUN	09:00	11:00	<a href="#">A1/1-44P</a> 

Group	Start date	End date	Day	Start time	End time	Lecture room
P1	12/02/2025	12/02/2025	MIE	09:00	11:00	A1/1-44P 
P1	17/03/2025	17/03/2025	LUN	10:00	11:00	A1/1-44P 
P1	24/03/2025	24/03/2025	LUN	09:00	11:00	A1/1-44P 

## COMPUTER PRACTICALS

Group	Start date	End date	Day	Start time	End time	Lecture room
O1	24/02/2025	24/02/2025	LUN	09:00	11:00	C1/INF6 
O1	10/03/2025	10/03/2025	LUN	09:00	11:00	C1/INF6 
O1	02/04/2025	02/04/2025	MIE	09:00	11:00	C1/INF6 
O1	14/04/2025	14/04/2025	LUN	09:00	11:00	C1/INF6 
O1	05/05/2025	05/05/2025	LUN	09:00	11:00	C1/INF6 
O1	07/05/2025	07/05/2025	MIE	09:00	11:00	C1/INF8 
O1	12/05/2025	12/05/2025	LUN	09:00	11:00	C1/INF6 
O1	14/05/2025	14/05/2025	MIE	09:00	11:00	C1/INF7 
O1	19/05/2025	19/05/2025	LUN	09:00	11:00	C1/INF6 
O1	21/05/2025	21/05/2025	MIE	09:00	11:00	C1/INF6 

## GROUP TUTORIALS

Group	Start date	End date	Day	Start time	End time	Lecture room
T1	05/03/2025	05/03/2025	MIE	09:00	11:00	A1/1-44P 
T1	26/03/2025	26/03/2025	MIE	09:00	10:00	A1/1-44P 