Stochastic Processes

Academic Year: (2023 / 2024) **Review date: 17/05/2023 13:58:59**

Department assigned to the subject: Statistics Department

Coordinating teacher: NIÑO MORA, JOSE

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Probability
Programming in R

OBJECTIVES

The course aims to develop the following competences:

1) Capacity to formulate basic stochastic process models (Poisson, Markov chains, Brownian motion) in diverse applications;
2) capacity to analyze such models based on an understanding of their fundamental properties;
3) capacity to investigate numerically such models using software.

DESCRIPTION OF CONTENTS: PROGRAMME

1. The Poisson process.
1.1 Introduction and motivation; interarrival and waiting time distributions; conditional distribution of the arrival times.
1.2 Extensions and applications; nonhomogeneous Poisson process; compound Poisson process; conditional Poisson process.

2. Markov chains
2.1 Introduction and motivation; discrete-time Markov chains; Chapman-Kolmogorov equations and classification of states; limit theorems.
2.2 Transitions among classes; applications; reversibility; semi-Markov chains.
2.3 Continuous-time Markov chains; birth and death processes; Kolmogorov equations; limiting probabilities; uniformization.

3. Brownian motion
3.1 Introduction and motivation; hitting times, maximum variable and arc sine laws; variations on Brownian motion.
3.2 Brownian motion with drift; diffusion equations; applications.

LEARNING ACTIVITIES AND METHODOLOGY

Theoretical-practical classes with web-based supporting material. Computational sessions with numerical software. The teaching methodology will have an eminently practical approach, being based on the analysis and solution of stochastic process models arising in diverse application areas.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

The evaluation will be based on two partial exams in the continuous evaluation process, with a total weight of 100% of the final grade.

The evaluation in the extraordinary call will be based on a final exam.

% end-of-term-examination/test:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

BASIC BIBLIOGRAPHY

- Blanco Castan¿eda, L., Arunachalam, V., Dharmaraja, S. Introduction to probability and stochastic processes with applications, Wiley, 2012

- Dobrow, R. P. Introduction to stochastic processes with R, Wiley, 2016

- Durrett, R. Essentials of stochastic processes, Springer, 2012

- S.M. Ross Introduction to probability models, Academic Press, 2007

ADDITIONAL BIBLIOGRAPHY

- Norris, J.R. Markov Chains, Cambridge University Press, 1997

- Ross, S.M. Stochastic Processes, Wiley, 1996