Stochastic Processes

Academic Year: (2024 / 2025) **Review date: 01-04-2024**

Department assigned to the subject: Statistics Department

Coordinating teacher: JIMENEZ RECAREDO, RAUL JOSE

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Elementary Statistical Theory I
Elementary Statistical Theory II

OBJECTIVES

1. Knowing the theoretical foundations and the basic properties of stochastic processes.
2. Solve problems based on the studied stochastic models.
3. Simulating techniques for Markov Chains.

1. Capacity for analysis and synthesis.
2. Problem solving.
3. Critical Thinking.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction
1.1 Basic concepts and classification of random processes.
1.2 Finite-dimensional distributions. Transition probabilities. Conditional expectation.

2 ¿ Discrete time processes
2.1 Examples of discrete-time processes. The simple random walk and the player's ruin. Martingales in discrete time.
2.2 Markov chains in discrete time. State classification. Stop times. limit theorems. Limit and stationary distributions.

3 - Continuous time processes
3.2 Examples of continuous-time processes with discrete state spaces. Renewal Processes. Queues and processes of birth and death. Poisson's process. Non-homogeneous Poisson process. Superposition of Poisson Processes.
3.3 Examples of processes with continuous state space. Processes with independent increments. The Brownian motion.

LEARNING ACTIVITIES AND METHODOLOGY

Theory (4 ECTS). Lectures.
Practice (2 ECTS). Problem solving lessons.

ASSESSMENT SYSTEM

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

Continuous evaluation (midterms, exercises and resolution of homework) 100%.
Students who have not taken the continuous assessment or who have failed it may take a final exam worth 60% of the subject.

BASIC BIBLIOGRAPHY

- R. Durrett Essentials of stochastic processes, Springer, 2012 (2nd ed.)

- S.M. Ross Stochastic Processes, John Wiley & Sons, inc., 1996 (2nd. ed.)

BASIC ELECTRONIC RESOURCES

- R. Durrett . Essentials of Stochastic Processes: http://www.math.duke.edu/~rtd/EOSP/EOSP2E.pdf