

Discrete Mathematics

Academic Year: (2020 / 2021)

Review date: 30-07-2020

Department assigned to the subject:

Coordinating teacher: IBORT LATRE, LUIS ALBERTO

Type: Electives ECTS Credits : 6.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Real and Complex Analysis

OBJECTIVES

1. To know the techniques in discrete mathematics, and their applications.
2. To understand and to use the advanced techniques in combinatorics and enumerative combinatorics.
3. To know the techniques of generating functions.
4. To know the basic facts of Markov chains, applied to the graphs.
5. To extend the more important concepts of differential and integral calculus to the discrete case.
6. To relate the concepts of transient and recurrence with Green's function and extremal length.
7. To understand the relations between graph theory and geometry.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Advanced techniques in combinatorics.
 - 1.1. Selection problems.
 - 1.2. Pairing problems.
 - 1.3. Recurrence.
2. Generating functions.
 - 2.1. Power series : examples.
 - 2.2. Analytic properties of power series and analytic behaviour of coefficients.
3. Potential theory on graphs.
 - 3.1. Graphs and networks, Markov chains and harmonics functions on graphs.
 - 3.2. Green's function, transient and recurrence networks.
 - 3.3. Dirichlet and Rayleigh principles, extremal length.
 - 3.4. Rough isometries: the relation between graph theory and geometry.

LEARNING ACTIVITIES AND METHODOLOGY

The docent methodology will include:

1. Master classes, where the knowledge that the students must acquire will be presented. To make easier the development of the class, the students will have written notes and also will have the basic texts of reference that will facilitate their subsequent work.

2. Resolution of exercises by the students, in which proposed problems are discussed and developed (by the professor and by the students). These classes allow to the students to acquire the necessary skills.

Additionally, 1.4 ECTS will be used for tutorial learning activities. These tutorial activities will be supervised and they will have theoretical and practical content.

3.2 ECTS will be used for the personal study of the students, which will have access to computer rooms.

ASSESSMENT SYSTEM

The evaluation will be based in the following criteria:

Partial evaluation (50%). Final (50%).

In the ordinary and extraordinary examination.

% end-of-term-examination:	50
% of continuous assessment (assignments, laboratory, practicals...):	50

BASIC BIBLIOGRAPHY

- DOYLE, P. G., SNELL, J. L. Random walks and electric networks, Mathematical Association of America, 1984
- LANDO, S. K. Lectures on generating functions, American Mathematical Society, 2003
- MICKENS, R. E. Difference equations, Van Nostrand Reinhold, 1990
- RODRIGUEZ, J. M., SIGARRETA, J. M., TOURIS, E. Teoría geométrica de funciones: el punto de encuentro entre la variable compleja y la geometría, Ediciones IVIC (Instituto Venezolano de Investigaciones Científicas), 2010

ADDITIONAL BIBLIOGRAPHY

- ELAYDI, S. N. An introduction to difference equations, Springer, 1996
- SOARDI, P. M. Potential theory on infinite networks, Springer, 1994

BASIC ELECTRONIC RESOURCES

- FERNANDEZ GALLARDO, P., FERNANDEZ PEREZ, J. L. . Matemática discreta:
http://www.uam.es/personal_pdi/ciencias/gallardo/index.htm