

TEACHING GUIDE 2019/20

Centre	310 - Faculty of Science and Technology	Cycle	Indiferente
Plan	GMATEM31 - Bachelor's Degree in Mathematics	Year	Second year

SUBJECT	
26011 - Discrete Mathematics	ECTS Credits: 6

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

The objective of this course is to learn the basic elements of mathematics and how to use the mathematical language as well as the techniques for proving and solving problems. This course goes deeply into combinatorial aspects started in the first year course Matemáticas Básicas and is a basis for the second year course Cálculo de Probabilidades. Some of the concepts introduced, such as recurrences and graphs, are used later in the third and fourth year courses Métodos Numéricos II and Programación Matemática.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

COMPETENCES

To be familiarized with the main types of mathematical proof and with the techniques of solving problems (observation-conjecture-proof).

To know and use properly the basic elements of the set theory.

To know how to solve combinatorial problems using basic techniques, generating functions and recurrence relations.

To be familiarized with combinatorial identities and the main families of numbers with combinatorial meaning.

To know the concepts, techniques and basic results of the graph theory and to be familiarized with some of its multiple applications.

LEARNING RESULTS

To know the main combinatorial techniques, the main families of numbers with combinatorial meaning, and the graphs with their multiple applications.

- THEORETICAL/PRACTICAL CONTENT**
1. BASIC COMBINATORICS: Basic resources in the combinatorial reasoning. The principle of inclusion and exclusion. The pigeonhole principle.
 2. COMBINATORIAL IDENTITIES: Binomial and multinomial coefficients. Binomial and multinomial formulae. Related identities.
 3. GENERATING FUNCTIONS AND RECURRENCE RELATIONS: Generating function of a sequence of numbers. Applications to combinatorial problems. Recurrence relations and combinatorial problems. Recurrence relations and generating functions. Obtaining the general term.
 4. MAIN FAMILIES OF NUMBERS: Numbers of Fibonacci. Numbers of Catalan. Numbers of Bell. Numbers of Stirling.
 5. GRAPHS: Basic concepts. Paths. Trees. Planar graphs. Coloring.

METHODS

In the M classes the theoretical contents will be developed.

In the S classes the students will work and present problems and tasks.

In the GA classes exercises will be solved.

TYPES OF TEACHING									
Type of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Classroom hours	36	6	18						
Hours of study outside the classroom	54	9	27						

Legend: M: Lecture S: Seminario GA: Pract.Class.Work GL: Pract.Lab work GO: Pract.computer wo GCL: Clinical Practice TA: Workshop TI: Ind. workshop GCA: Field workshop

- ASSESSMENT SYSTEMS**
- Continuous assessment system
 - Final assessment system

- TOOLS USED & GRADING PERCENTAGES**
- Extended written exam 70%
 - Practical work (exercises, case studies & problems set) 10%
 - Team work (problem solving, project design) 15%
 - Exposition of work, readings, etc. 5%

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

GUIDELINES

Final exam (70%), solving exercises (10%), and preparing and presenting tasks (20%).

The minimum grade required to pass is 5 points (over 10) provided that at least 4 points (over 10) are gotten in the final exam (compulsory).

WITHDRAWAL OF CONTINUOUS ASSESSMENT SYSTEM

The student must give written notice of withdrawal of continuous assessment system in a period of 9 weeks.

DECLINING TO SIT

A student who does not take the final exam will obtain <<no presentado>>.

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

GUIDELINES

The grade obtained in the exercises and tasks will be kept, when advantageous to the student. Grades will never be kept from one year to another. The minimum grade required to pass is 5 points (over 10) provided that at least 4 points (over 10) are gotten in the final exam (compulsory).

DECLINING TO SIT

A student who does not take the final exam will obtain <<no presentado>>.

COMPULSORY MATERIALS

The recommended materials will be available at the virtual platform.

BIBLIOGRAPHY

Basic bibliography

- D.I.A. COHEN, Basic Techniques of Combinatorial Theory, Wiley, New York, 1978.
- J.M. HARRIS, J.L. HIRST, M.J. MOSSINGHOFF, Combinatorics and Graph Theory, Springer, New York, 2008.
- N. HARTSFIELD, G. RINGEL, Pearls in Graph Theory, Dover, New York, 1994.
- R.L. GRAHAM, D.E. KNUTH, O. PATASHNIK, Concrete Mathematics, Addison-Wesley, Reading, Mass., 1994.

In-depth bibliography

- V.K. BALAKRISHNAN, Combinatorics, Schaum's Outline Series, McGraw-Hill, 1995.
- R.C. BOSE, B. MANVEL. Introduction to Combinatorial Theory, Wiley, New York, 1984.
- F. GARCIA MERAYO, Matemática Discreta, Paraninfo, Madrid, 2001.
- J. HEBER NIETO SAID, Teoría Combinatoria. La Universidad del Zulia, 1996. <http://www.jhnieto.org/tc.pdf>
- D.A. MARCUS, Combinatorics: A Problem Oriented Approach, The Mathematical Association of America, 1998.
- R. J. TRUDEAU, Introduction to Graph Theory, Dover Publications, Inc, Nueva York, 1993.
- N. Ya. VILENKIN, Combinatorics, Academic Press, New York, 1971.
- H.S. WILF, Generatingfunctionology, Academic Press, Boston, 1990. <http://www.math.upenn.edu/~wilf/gfology2.pdf>

Journals

- The Electronic Journal of Combinatorics <http://www.combinatorics.org/>
- The Fibonacci Quarterly <http://www.fq.math.ca/>

Useful websites

- Combinatorics <http://mathworld.wolfram.com/topics/Combinatorics.html>
- Pascal triangle http://en.wikipedia.org/wiki/Pascal%27s_triangle
- Pigeon principle http://www.cut-the-knot.org/do_you_know/pigeon.shtml
- Fibonacci numbers <http://www.maths.surrey.ac.uk/hosted-sites/R.Knott/Fibonacci/>
- Catalan numbers <http://mathforum.org/advanced/robertd/catalan.html>
- Stirling Number of the First Kind <http://mathworld.wolfram.com/StirlingNumberoftheFirstKind.html>
- Stirling Number of the Second Kind <http://mathworld.wolfram.com/StirlingNumberoftheSecondKind.html>
- The Encyclopedia of Integer Sequences <http://oeis.org/>
- Graphs http://en.wikipedia.org/wiki/Graph_theory

REMARKS