# Course guide
# 200232 - CITG - Combinatorics and Graph Theory

**Last modified:** 01/06/2023

**Unit in charge:** School of Mathematics and Statistics
**Teaching unit:** 749 - MAT - Department of Mathematics.

**Degree:** BACHELOR'S DEGREE IN MATHEMATICS (Syllabus 2009). (Optional subject).

**Academic year:** 2023 **ECTS Credits:** 6.0 **Languages:** English

## LECTURER

**Coordinating lecturer:** MARCOS NOY SERRANO

**Others:** Primer quadrimestre:
MARCOS NOY SERRANO - M-A
CLÉMENT REQUILÉ - M-A
LLUIS VENA CROS - M-A

## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

**Specific:**
3. CE-2. Solve problems in Mathematics, through basic calculation skills, taking in account tools availability and the constraints of time and resources.
4. CE-4. Have the ability to use computational tools as an aid to mathematical processes.
5. Ability to solve problems from academic, technical, financial and social fields through mathematical methods.

**Generical:**
1. CB-4. Have the ability to communicate their conclusions, and the knowledge and rationale underpinning these to specialist and non-specialist audiences clearly and unambiguously.
2. To have developed those learning skills necessary to undertake further interdisciplinary studies with a high degree of autonomy in scientific disciplines in which Mathematics have a significant role.
6. CG-1. Show knowledge and proficiency in the use of mathematical language.
7. CG-2. Construct rigorous proofs of some classical theorems in a variety of fields of Mathematics.
8. CG-3. Have the ability to define new mathematical objects in terms of others already know and ability to use these objects in different contexts.
9. CG-4. Translate into mathematical terms problems stated in non-mathematical language, and take advantage of this translation to solve them.
10. CG-6 Detect deficiencies in their own knowledge and pass them through critical reflection and choice of the best action to extend this knowledge.

**Transversal:**
11. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.
12. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

## TEACHING METHODOLOGY

(Section not available)

## LEARNING OBJECTIVES OF THE SUBJECT

(Section not available)

## STUDY LOAD

| Type | Hours | Percentage |
|---|---|---|
| Hours small group | 30,0 | 20.00 |
| Hours large group | 30,0 | 20.00 |
| Self study | 90,0 | 60.00 |

**Total learning time:** 150 h

## CONTENTS

### 1. The symbolic method

**Full-or-part-time:** 25h
Theory classes: 5h
Laboratory classes: 5h
Self study : 15h

### 2. Enumeration with symmetries

**Full-or-part-time:** 15h
Theory classes: 3h
Laboratory classes: 3h
Self study : 9h

### 3. Finite geometry

**Full-or-part-time:** 30h
Theory classes: 6h
Laboratory classes: 6h
Self study : 18h

### 4. Graph connectivity

**Full-or-part-time:** 20h
Theory classes: 4h
Laboratory classes: 4h
Self study : 12h

### 5. Matching

**Full-or-part-time:** 20h
Theory classes: 4h
Laboratory classes: 4h
Self study : 12h

### 6. Graph coloring

**Full-or-part-time:** 20h
Theory classes: 4h
Laboratory classes: 4h
Self study : 12h

### 7. Extremal graph theory

**Full-or-part-time:** 20h
Theory classes: 4h
Laboratory classes: 4h
Self study : 12h

## GRADING SYSTEM

- Midterm exam (contents 1, 2 and 3) (P)
- Final exam (either contents 4, 5, 6 and 7, or all the contents) (F)
- Final score: Max {(P+F) / 2, F}

## BIBLIOGRAPHY

**Basic:**
- West, Douglas Brent. Introduction to graph theory. 2nd ed. Upper Saddle River, NJ: Prentice Hall, cop. 2001. ISBN 0130144002.
- Diestel, Reinhard. Graph theory. 3rd ed. Berlin [etc.]: Springer, 2005. ISBN 3540261826.
- Flajolet, Philippe; Sedgewick, Robert. Analytic combinatorics [on line]. Cambridge: Cambridge University Press, 2009 [Consultation: 27/06/2023]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=412737. ISBN 9780521898065.
- Cameron, Peter J. (Peter Jephson). Combinatorics : topics, techniques, algorithms. Cambridge: Cambridge University Press, 1994. ISBN 0521457610.

**Complementary:**
- Bollobás, Béla. Extremal graph theory. Mineola, N.Y: Dover Publications, cop. 2004. ISBN 0486435962.
- Bondy, J. A. ; Murty U.S.R. Graph theory. New York: Springer, 2008. ISBN 9781846289699.
- Lint, Jacobus Hendricus van; Wilson R.M. A Course in combinatorics. 2nd ed. Cambridge: Cambridge University Press, 2001. ISBN 0521803403.
- Lovász, László. Combinatorial problems and exercises. 2nd ed. Providence: AMS Chelsea Publishing, 2007. ISBN 9780821842621.
- Wilson, Robin J. Introduction to graph theory. 5th ed. Harlow: Prentice-Hall, 2010. ISBN 9780273728894.