

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: $\text{Max} \{(P+F) / 2, F\}$

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.