

34950 - CALG - Commutative Algebra

Coordinating unit:	200 - FME - School of Mathematics and Statistics
Teaching unit:	749 - MAT - Department of Mathematics
Academic year:	2017
Degree:	MASTER'S DEGREE IN ADVANCED MATHEMATICS AND MATHEMATICAL ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits:	7,5
Teaching languages:	English

Teaching staff

Coordinator:	FRANCESC D'ASSIS PLANAS VILANOVA
Others:	Primer quadrimestre: FRANCESC D'ASSIS PLANAS VILANOVA - A

Prior skills

Linear algebra, algebraic structures, topology.

Requirements

The two first years of a degree in mathematics.

Degree competences to which the subject contributes

Specific:

1. RESEARCH. Read and understand advanced mathematical papers. Use mathematical research techniques to produce and transmit new results.
2. CALCULUS. Obtain (exact or approximate) solutions for these models with the available resources, including computational means.
3. CRITICAL ASSESSMENT. Discuss the validity, scope and relevance of these solutions; present results and defend conclusions.

Transversal:

4. 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.
5. 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.
6. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
7. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
8. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.

Teaching methodology

Teaching Classes, resolution of problems

Learning objectives of the subject

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Basic course in Commutative Algebra.
An introduction to the theory of rings, ideals and modules.
Some basics on local algebra.

Study load

Total learning time: 187h 30m	Hours large group:	60h	32.00%
	Self study:	127h 30m	68.00%

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Content

Rings and ideals	Learning time: 28h 20m Theory classes: 15h Self study : 13h 20m
Description: Basics on ring theory and ideals. Rings of fractions. Primary decomposition. Chain conditions. Noetherian and Artinian rings.	
Modules	Learning time: 24h Theory classes: 12h Self study : 12h
Description: General properties of modules. Modules of fractions. Chain conditions. Homomorphisms and tensor product.	
Algebraic varieties	Learning time: 24h Theory classes: 12h Self study : 12h
Description: The spectrum of a ring. Zariski topology.	
Introduction to homological algebra	Learning time: 24h Theory classes: 12h Self study : 12h
Description: Categories and functors. Complexes of modules. Derived functors.	
Local algebra	Learning time: 18h 40m Theory classes: 9h Self study : 9h 40m
Description: Regular sequences. Depth. Homological characterizations. Regular rings, Gorenstein rings, Cohen-Macaulay rings	

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Qualification system

The qualification will be based on:

Active participation of the student during the course,

Resolution of assigned exercises

Exposition of a directed work in which the student develops some material related to the course.

If necessary, a final exam

Bibliography

Basic:

Atiyah, Michael Francis; MacDonald, I. G. Introduction to commutative algebra. Reading: Addison-Wesley, 1969. ISBN 0201407515.

Reid, Miles. Undergraduate commutative algebra. Cambridge: Cambridge University Press, 1995. ISBN 0521452554.

Eisenbud, David. Commutative algebra : with a view toward algebraic geometry. Corrected 2nd. printing. New York: Springer-Verlag, 1996. ISBN 0387942696.

Kunz, Ernst. Introduction to commutative algebra and algebraic geometry. Boston: Birkhäuser, ISBN 3764330651.

Matsumura, Hideyuki. Commutative ring theory. Cambridge: Cambridge University Press, ISBN 0521259169.

Rotman, J.J. An introduction to homological algebra. Academic Press, 1979.

Bruns, Winfried; Herzog, Jürgen. Cohen-Macaulay rings. Cambridge University Press, 1993.