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34950 - CALG - Commutative Algebra

Coordinating unit: 200 - FME - School of Mathematics and Statistics

Teaching unit: 725 - MA I - Department of Applied Mathematics I

Academic year: 2014

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: JOSEP ALVAREZ MONTANER

Others:

JOSEP ALVAREZ MONTANER - A

Prior skills

Linear algebra, calculus, topology, analysis.

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 INFORMATI0N 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 rings, ideal, primary decomposition, noetherian rings, integral extensions, completions and dimension theory.

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: 12h 45m
Theory classes: 3h
Self study : 9h 45m

Description:
It covers rings, ideals, radicals, extensions, and contractions.

Modules

Learning time: 12h 45m
Theory classes: 3h
Self study : 9h 45m

Description:
General properties of modules. Tensor product.

Rings and modules of fractions

Learning time: 18h
Theory classes: 6h
Self study : 12h

Description:
Introduction to rings and modules of fractions

Primary decompostion

Learning time: 18h
Theory classes: 6h
Self study : 12h

Description:
Classical primary theory. First theorems.

Integral dependence

Learning time: 18h
Theory classes: 6h
Self study : 12h

Description:
Definition of integral dependence. Theorems of going-up and going-down.

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Chain conditions	Learning time: 18h Theory classes: 6h Self study : 12h

Description:
Chain conditions on sets, modules, rings.

Noetherian rings	Learning time: 18h Theory classes: 6h Self study : 12h

Description:
They play a central role in Commutative Algebra and Algebraic Geometry.

Artin rings	Learning time: 18h Theory classes: 6h Self study : 12h

Description:
A good examples of noetherian rings. In some sense the simpliest.

Discrete valuation rings	Learning time: 18h Theory classes: 6h Self study : 12h

Description:
The next case. Noetherian rings of dimension one.

Completions	Learning time: 18h Theory classes: 6h Self study : 12h

Description:
To deal with topologies, completions, filtrations and graded rings.

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Dinmension theory	Learning time: 18h Theory classes: 6h Self study : 12h

Description:
A biref introduction to Hilbert functions and dimension theory.

Qualification system

Continuous assessment, a final exam (if necessary)

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.