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COURSE: Teoria dei Codici (Coding Theory)

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ACADEMIC YEAR: 2017/2018

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TYPE OF EDUCATIONAL ACTIVITY: Free choice

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TEACHER: Angelo Sonnino

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Language:

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ECTS: 6

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No. of hours: 48

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Campus: Potenza  
Dept./School: DiMIE  
Program: LM Mathematics

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Semester: II

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### EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The goal of the course is to provide students with the basics, plus some advanced notions, aimed at both theoretic and applied research in the field of coding theory.

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### PRE-REQUIREMENTS

Undergraduate algebra, linear algebra and analytic geometry at first year level.

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### SYLLABUS

Elements of group theory. Rings and their ideals. Finite fields and their main properties. Polynomials over finite fields. Fundamental concepts in coding theory: redundancy and efficiency, Hamming distance, minimum distance. Vector spaces over finite fields. Linear codes. Generating matrix for a linear code. Dual code. Parity check matrix. Hamming codes and perfect codes. Reed-Muller codes of the first order. Encoding and decoding algorithms. Standard array decoding. Step-by-step decoding. Syndrome decoding. Ideals and cyclic subspaces of vector spaces. Cyclic codes. Generating matrix and parity check matrix for a cyclic code. More encoding and decoding algorithms. BCH codes.

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### TEACHING METHODS

Theoretical lessons and classroom tutorials with the development of some practical examples.

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### EVALUATION METHODS

Discussion of an essay and assessment of the basic notions acquired by the student.

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### TEXTBOOKS

- S. A. Vanstone, P. C. van Oorschot, "An Introduction to Error Correcting Codes with Applications", Kluwer Academic Publishers, 1989, ISBN 0-7923-9017-2.
- R. Hill, "A First Course in Coding Theory", Oxford Applied Mathematics and Computing Science Series, Clarendon Press, Oxford, 1986, ISBN 0-19-853804-9, 0-19-853803-0 (paperback).
- L. Berardi, "Algebra e teoria dei codici correttori", Collana Matematica e Statistica, Franco Angeli, 2006, ISBN 9788820486334.

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### INTERACTION WITH STUDENTS

Lectures and office hours in room No. 3D218 of the DiMIE by appointment and during office hours that will be agreed with the students at the beginning of the course. The lecturer can be contacted at the end of the lessons, by email and on the phone.

Office hours: Tuesdays from 10:30 to 13:00 and all other workdays upon appointment.

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### EXAMINATION SESSIONS (FORECAST)

06/02/2018, 31/05/2018, 27/06/2018, 06/09/2018, 16/10/2018, 07/02/2019.

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SEMINARS BY EXTERNAL EXPERTS      YES     NO

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**Università degli Studi della Basilicata**

**DIPARTIMENTO DI MATEMATICA, INFORMATICA ED ECONOMIA**

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FURTHER INFORMATION

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