



COURSE: 2019-2020

ACADEMIC YEAR: Numerical Analysis Part A

TYPE OF EDUCATIONAL ACTIVITY: (Basic, Characterizing, Affine, Free choice, Other) Characterizing

TEACHER: Maria Carmela De Bonis

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mobile (optional):

Language: Italian

ECTS: (lessons and tutorials/practice) 6	n. of hours: (lessons and tutorials/practice) 56	Campus: Potenza Dept.: DiMIE Program: Mathematics	Semester: First
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EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

Knowledge of the main numerical methods applied to the solution of linear systems and to the approximation of the zeros of nonlinear equations.

To be able to choose between antagonists methods for solving a specific problem (eg, comparing the order of convergence, stability of algorithms, computational cost, etc).

To achieve a good level in programming algorithms, for example, in Matlab, in order to apply the studied numerical methods.

To be able to read the numerical results provided by the machine.

PRE-REQUIREMENTS

The knowledge of the arguments from Calculus and Linear Algebra, basics of computer science

SYLLABUS

Internal format of data:

Single and double precision. Absolute and relative error. Machine precision. Conditioning of a problem and algorithm stability. Numerical Cancellation.

Numerical Methods for linear systems: Condition number. Back and forward substitution. Gauss elimination, LU factorization with applications. Pivoting. Cholesky factorization. Iterative methods: Jacobi and Gauss-Seidel methods with convergence study. Overrelaxing. Sparse matrices.

Numerical methods for the solution of nonlinear equations: Bisection method. Newton method

TEACHING METHODS

Theoretical lessons, Laboratory tutorials.

EVALUATION METHODS

The aim of the examination is to test the level of achievement of the previously mentioned educational goals. The exam is divided into 2 parts:

- a practical test with the computer (resolution of three numerical exercises) on all the topics covered in the course; the test is intended to assess understanding of the topics and the ability to choose between the different methods studied in the numerical solution of a specific problem and the selection character (the student who does not show sufficient knowledge of the subjects is not admitted to the oral test); to pass the test you must acquire at least 18 points out of 30. The estimated time for the test is 2.5 hour.
- an oral test which will evaluate the ability to link and compare different aspects covered during the course; to pass the test you must acquire at least 18 points out of 30.

Students who take the course may subdivide written test in two separate tests to be performed at each end of the



lessons in each module. In that case, the written test is passed if the student acquires at least 18 points out of 30 in both tests.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Lecture notes and teaching material for exercises provided by the teacher, available in the course web page.

TEXTBOOKS

- G. Monegato, Fondamenti di Calcolo Numerico, CLUT (Torino)
- A. Quarteroni, R. Sacco, F. Saleri, Matematica Numerica, Springer

INTERACTION WITH STUDENTS

The teacher offers its students teaching materials in the course web page.

Office hours: Monday from 16.00 to 18.00 and Tuesday from 10.30 to 12.30 at the office of the teacher.

In addition to weekly reception, the teacher is available to take appointments in schedules and/or different days to answer students' questions through his e-mail.

EXAMINATION SESSIONS (FORECAST)¹

15/06/2020, 6/07/2020, 20/07/2020, 21/09/2020, 19/10/2020, 14/12/2020

SEMINARS BY EXTERNAL EXPERTS YES NO

¹ Subject to possible changes: check the web site of the Teacher or the Department/School for updates.