



COURSE: Numerical Analysis			
ACADEMIC YEAR: 2016/2017			
TYPE OF EDUCATIONAL ACTIVITY: Characteristic			
TEACHER: Concetta Laurita			
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phone: 00390971205846		mobile (optional):	
Language: Italian			
ECTS: 6	n. of total hours: 54 n. of hours of lessons: 32 n. of hours of practice: 22	Campus: Potenza School of Engineering Program: Mechanical Engineering	Semester: First

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

To know the main numerical methods applied in different contexts.

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

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 when a numerical procedure is implemented.

PRE-REQUIREMENTS

The knowledge of the arguments from Calculus and Linear Algebra, basic of computer science and Matlab programming fundamentals.

SYLLABUS

Errors and computer arithmetic

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, pivoting. LU factorization. Cholesky factorization.

Numerical methods for the solution of nonlinear equations

Bisection method. Newton method.

Approximation of functions

Algebraic polynomial approximation by Lagrange interpolation. Interpolation by piecewise polynomial functions. Spline functions.

Numerical integration

Quadrature formulas. Stability, convergence, degree of accuracy, error estimation. Newton-Cotes quadrature rules. The trigonometric quadrature formula.

Numerical differentiation

Finite difference methods.

Numerical methods for the solution of ODE

The Initial Value Problem. Onestep and multistep methods. Runge-Kutta methods. Predictor-corrector methods.

Practical implementation of the studied algorithms in Matlab

TEACHING METHODS

Theoretical lessons, Laboratory tutorials.

EVALUATION METHODS

Practical test and oral examination.

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 the understanding of the topics and the ability to choose between the different methods studied in the numerical solution of a specific problem. The student who does not show sufficient knowledge of the subjects is not admitted to the oral test; to pass the test one 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 one must acquire at least 18 points out of 30.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Lecture notes and teaching material for exercises provided by the teacher, available on a shared folder with the students enrolled in the course.

TEXTBOOKS

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

INTERACTION WITH STUDENTS

At the beginning of the course, after describing the objectives, program and evaluation methods, the teacher collects the list of students who intend to enroll in the course, together with name, serial number and email. The teacher at the beginning of the discussion on each item makes available the lecture notes in a folder shared with the students enrolled in the course.

Office hours: Monday and Wednesday from 15.30 to 17.30.

In addition to weekly reception, the teacher is available at all times for a contact with the students through their e-mail.

EXAMINATION SESSIONS (FORECAST)¹

22/02/2017, 22/03/2017, 24/04/2017, 24/05/2017, 21/06/2017 21/07/2017, 27/09/2017, 25/10/2017, 20/12/2017

EVALUATION BOARD

Concetta Laurita (Presidente)
Antonio Cossidente
Maria Carmela De Bonis
Donatella Occorsio
Maria Grazia Russo

SEMINARS BY EXTERNAL EXPERTS YES NO

FURTHER INFORMATION

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