Università degli Studi della Basilicata

DIPARTIMENTO DI MATEMATICA, INFORMATICA ED ECONOMIA

ACCADEMIC YEAR:	2019/2020
COURSE:	Scientific Computing for Economics and Finance
TYPE OF EDUCATIONAL ACTIVITY: (Basic, Characterizing, Affine, Free choice, Other)	Affine
TEACHER:	Incoronata Notarangelo
e-mail:	incoronata.notarangelo@unibas.it
web site:	https://sites.google.com/site/inconota/
phone:	+39 0971205836
mobile (optional):	
Language:	Italian

ECTS: (lessons and tutorials/practice) 8	n. of hours: (lessons and tutorials/practice) 64	Campus: Potenza Dept./School: DiMIE Program:	Semester: Primo

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES:

*** Knowledge and understanding.** Knowledge of some scientific computing tools often used in Economics: basic programming in Matlab, numerical methods for linear systems, approximation of eigenvalues and eigenvectors, finite difference equations, linear programming, least square approximation.

*** Applying knowledge and understanding.** Using such mathematical tools and applying them for solving problems in Economics and Finance, studying the existence of solutions and their contitioning, and giving "a priori" error estimates.

*** Making judgements.** Choosing suitable numerical methods for solving problems in Economics and Finance.

*** Communication skills.** Using a proper mathematical language to express the knowledge in oral and written form. Justify the choice of the method for solving theoretical and application problems.

*** Learning skills.** Learning the contents of the course and relating them to other topics in the Program of Studies. Using the suggested books for exercises, insights and comparisons.

PRE-REQUIREMENTS:

SYLLABUS:

Matlab and machine arithmetic (12 h). Basic algorithm and translation in Matlab. Machine epsilon, absolute and relative errors, exact significant digits. Stability of algorithms and conditioning of problenms analysis.

Numerical methods for linear systems (12 h). Conditioning study. Forward and backward substitution for triangular systems. Gauss elimination method. Partial pivoting. LU factorization and inverse matrix. Analysis of Input-Output systems.

Approximation of the eigenvalues and the eigenvectors of a matrix (12 h). Eigenvalues and eigenvectors of a matrix: localization theorems and conditioning. The power iteration method: normalization with respect to the infinity norm and the 2 norm. The inverse power method for the computation of the smallest eigenvalue. The inverse power method for improving the approximation of an eigenvalue and for computing one of the corresponding eigenvectors. The QR method.

Numerical methods for finite difference equations (12 h). First order linear difference equations with constant coefficients. Higher order linear difference equations and simultaneous difference equations with constant coefficients. Equilibrium and stability analysis. Application to population dynamics: Malthus, Verhulst and Leslie models. Application to dynamical models in Economics, market equilibrium and equilibrium analysis.

Linear programming (12 h). Symplex method. Duality. Optimization problems: resource allocation, profit maximization, cost minimization.

Approximation of data (4 h). Least square method.

TEACHING METHODS:

The course consists in 64 hours of lessons and tutorials/practice (with theoretical exercises and pretical training in numerical laboratory)

Moreover, some hours will be devoted to an optional intermediate written test, its correction and exam simulations.

The lectures will deal with theoretical aspects of the subject, exercises resolution and some applications to economic analysis. The lecturer will provide slides and exercises at the web page of the course.

EVALUATION METHODS:

Written 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 pratical-written test using Matlab, containing theoretical and application exercises on all the topics covered in the course; the test is indended to evaluate the knowledge and unterstanding of the topics and is selective (the student who does not show sufficient knowledge of the subjects is not admitted to the oral examination). The estimated time for the test is 2 hours. During the test the use of graphic calculator, books, notes, notebook, tablet or smartphone is forbidden.

* an oral examination (to be taken during the same exam session of the written test) which will evaluate the ability to link and compare different topics of the course and will consist in the discussion of the written test, some theoretical questions and eventually short exercises. After this examination, the student will receive a final grade: in order to pass the exam this should be at least 18 out of 30; otherwise, one should repeat both the written test and the oral examination.

Students who attend the lectures may take optional intermediate written tests containig theoretical and pratical exercises on specific part of the program.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL:

Slides and teaching material for exercises provided by the lecturer, avalaible in https://sites.google.com/site/inconota/ACSEF

Textbooks:

- Alpha C. Chiang, Introduzione all'economia matematica, Bollati Boringhieri, 2002.
- V. Comincioli, Analisi numerica. Metodi, modelli, applicazioni, McGraw-Hill, 2003.
- C. Pocci - G. Rotundo - R. De Kok, Matlab per le applicazioni economiche e finanziarie, Apogeo, 2016.
- E. Salinelli - F. Tomarelli, Modelli dinamici discreti, Springer, 2013.

INTERACTION WITH STUDENTS:

At the beginning of the course goals, program and evaluation method will be described.
At the end of the discussions of each topic the lecturer provides the related teaching material in the web page of the course.
Office hours: Monday from 14.30 to 16.30, office n. 63/3D214 at the second floor of DiMIE.
In addition to the weakly office hours, the lecturer is avalaible to fix appointments at different hours and/or days of the week and to answer students' questions via e-mail.

EXAMINATION SESSIONS (FORECAST)[1]

03/02/2020, 17/02/2020, 11/05/2020, 10/07/2020, 04/09/2020, 16/11/2020

16/03/2020 (reserved to students enrolled in supplementary years)

SEMINARS BY EXTERNAL EXPERTS YES ☑ NO ☐

FURTHER INFORMATION:

Datailed and updated information can be found in https://sites.google.com/site/inconota/teaching/ACSEF

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