COURSE DETAILS

" COMPUTATIONAL METHODS FOR APPLIED SCIENCES "

SSD MAT/08

DEGREE PROGRAMME: SCIENZE E TECNOLOGIE AGRARIE

ACADEMIC YEAR 2021-2022

GENERAL INFORMATION – TEACHER REFERENCES

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GENERAL INFORMATION ABOUT THE COURSE

YEAR OF THE DEGREE PROGRAMME (I, II, III): II
SEMESTER (I, II): I
CFU:8

REQUIRED PRELIMINARY COURSES (IF MENTIONED IN THE COURSE STRUCTURE "ORDINAMENTO")

No

PREREQUISITES (IF APPLICABLE)

Elements of statistics
Elements of Mathematics (study of function, monotony, derivatives)

LEARNING GOALS

The aim of the course is to provide students with the basic knowledge of computational methods for solving applied problems. In particular, the student, after being introduced to a scientific computing and programming language, will study statistical inference, regression models and mathematical modeling of system dynamics.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student must be able to evaluate where and how to apply the knowledge acquired in the course.
The student will have to be able to present in a essay the used tools and the results obtained through the elaborations. The student will have to be able to know how to discern the different computational techniques.

Applying knowledge and understanding

The student will have to demonstrate the ability to manage and analyze a set of data to extract information also through a programming language.
In particular, the student will need to plan an experiment, collect data and perform statistical analyzes and build a mathematical model for the description of the biological phenomenon. The student will use different mathematical tools for the analysis, manipulation and data processing.

COURSE CONTENT/SYLLABUS

1. Course presentation
2. Programming language: use of scientific calculation tools (eg: Excel, R, Python, Matlab, SIMILE)
3. Introduction to applied mathematical modeling: System definition, the different types of mathematical models. Systems dynamic, the modeling process, mathematical representation of biological systems and introduction to differential equations. Use of systems dynamic software.
4. Statistics: statistical units and variables, measurement scales, position index and variability
5. Statistical Inference: Sampling Techniques: Point Estimation, Interval Estimation, Hypothesis Testing
6. Introduction to the experimental design
7. The linear regression model: the method of Ordinary Least Squares and properties of the estimators.
6. Seminars on applied case studies held by professors of the Department

READINGS/BIBLIOGRAPHY

On line material on the web page https://www.docenti.unina.it/francesco.giannino
P. Newbold, W. L. Carlson, B. Thorne, Statistica 9/Ed. (con MyLab) 2021
Pensare per sistemi. di Donella H. Meadows (Autore), S. Armenia (a cura di), Next 2019
Valeriano Comincioli, Problemi e modelli matematici nelle scienze applicate. 2010, Apogeo Education

TEACHING METHODS

The teacher will use:
a) lectures for about 30% of the total hours,
b) exercises for about 60% of the total hours
d) seminars of specific topics for 10% of the total hours

The teacher will use multimedia supports (power point presentations), specialized Mathematics software: Wolfram alpha, statistics tool (R, Python), system dynamics tool (SIMILE), advanced OneNote functions

EXAMINATION/EVALUATION CRITERIA

a) Exam type:

Exam type	
written and oral	x
only written	
only oral	
project discussion	x
other	

In case of a written exam, questions refer to: (*)	**Multiple choice answers**	x
	Open answers	x
	Numerical exercises	x

(*) multiple options are possible