

**ACADEMIC YEAR: 2019-2020**

COURSE: Soil Pollution and Bioremediation

TYPE OF EDUCATIONAL ACTIVITY: Basic

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Language: Italian

ECTS: (lessons / tutorials/practice): 6	n. of hours: 40 hours of lessons 16 hours of practice	Campus: Potenza School: SAFE Program: LM Forest and Environmental Sciences	Semester: I
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#### EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

Soil pollution is one of the main problems today, due to the destruction of habitat, biodiversity and ecological balance, and because it is one of the main factors endangering human health and life. During the course, students will learn theoretical and practical skills on the different forms of soil pollution and on the mechanisms that contribute to its spread, as they exist. For each form of soil contamination, all the techniques aimed to eliminate this problem or mitigate their harmful effects will be examined.

- **Knowledge and understanding:** knowledge and ability to understand the general principles governing, both qualitatively and quantitatively, the phenomenon of soil pollution and the reactivity of the toxic and harmful compounds present in the soil, the physical and chemical equilibria of various types of pollutants, the Electronic structure of heavy metals and their periodic properties, persistence of xenobiotics in soils, as well as intermolecular and interparticle interactions in polluted soils. Knowledge and ability to understand key relationships between the structure and properties of the most important soil pollutants. Knowledge and ability to understand the remediation mechanisms of polluted soils.
- **Applying knowledge and understanding:** Ability to read and write the formulas of the most common toxic compounds in the soil. Ability to apply the acquired knowledge to the resolution of simple chemical problems. Ability to identify the main physical and chemical properties of soil pollutants in gaseous, liquid, solid phases and solutions. Ability to treat appropriately, both qualitatively and quantitatively, the general properties of groundwater pollutants in aqueous solution. Ability to recognize the main models of the heavy metal electronic structure and to identify the properties of other xenobiotics and their trends in the soil. Ability to properly address issues relating to the effect of pollutants on organisms, bioaccumulation in organisms and biomagnification in the trophic chains, and soil biomonitoring for the purpose of interpreting the relationship between soils' characteristics and the dynamics of pollutants. Ability to recognize and describe the essential factors that control the kinetics of the chemical reactions of the main pollutants in the soil. Ability to recognize and interpret the main structure/property relationships of the classes of inorganic and organic compounds studied.
- **Making judgements:** ability to evaluate and apply the most appropriate procedure for solving simple chemical problem problems. Ability to build the main relationships between macroscopic and microscopic properties of soil pollutants. Ability to discriminate between the different characteristics of polluted soils and to apply the correct remediation methods. Ability to predict the main physical properties and the most marked differences in the reactivity of the classes of inorganic and organic compounds studied.
- **Communication skills:** ability to organize in a logical way and to communicate, using an appropriate and correct language and mathematical and graphical tools as well, the acquired knowledge.
- **Learning skills:** ability to collect and organize in a functional way the information coming from class

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lectures, suggested books, and literature data.

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#### PREREQUIREMENTS

- Inorganic chemistry
  - Forest ecology and general silviculture
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#### SYLLABUS

##### *Lessons*

##### 1. SOIL POLLUTION

- 1.1 The concept of environment
- 1.2 Definition of Soil Pollution
- 1.3 Contaminated sites and types
- 1.4 Types of intervention
- 1.5 Treatment techniques

##### 2. THE BIOREMEDIATION

- 2.1 The bioremediation
- 2.2 Plants and micro-organisms: their use in remediation of contaminated sites
- 2.3 Cell energetic processes in plants and microorganisms
- 2.4 Organisms of environmental importance

##### 3. APPLIED BIOREMEDIATION

- 3.1 Methods of bioremediation for heavy metals and other xenobiotics
- 3.2 Bioremediation applied to the soil and water contaminated by hydrocarbons
- 3.3 Other examples of bioremediation

##### *Practice*

Case-studies on forest and soil systems. Laboratory training regarding biochemical and physiological plant and soil measurements.

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#### TEACHING METHODS

40 hours of lessons (frontal lessons and case-studies) and 16 hours of practice (laboratory and educational visits). During practices, students will be asked to analyze specific case-studies and to work in the laboratory.

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#### EVALUATION METHODS

The learning will be verified on the basis of checks during the course, of group work on specific case-studies (in groups of maximum 4-5 students), on the frequency of laboratories and educational visits and, finally, on an oral exam on all the topics of the course. If the overall grade does not suffice (<18), the exam will not be passed.

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#### TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Carli Anna M., Pane Luigi, Mariottini G. Luigi. Elementi di ecologia applicata. Inquinamento del suolo. ECIG Editore. Pp. 133. ISBN: 8875458855

Sequi Paolo, Ciavatta Claudio, Miano Teodoro. Fondamenti di Chimica del Suolo. Pàtron Editore. Pp. 296. ISBN: 9788855533621

Reviews and articles provided during the course.

Lesson notes.

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Part of the teaching material will be made available online at: <http://docenti.unibas.it/site/home/docente/materiali-e-risorse.html?m=003255>

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#### INTERACTIONS WITH STUDENTS

- in the office at planned days/hours (usually on Tuesday, Wednesday and Thursday)
- email, skype (every time)

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#### EXAMINATION SESSIONS (Forecast)

Calendar online:

<http://docenti.unibas.it/site/home/docente.html?m=003255>

#### EVALUATION BOARD

Prof. Adriano Sofo (president)  
Prof. Sabino A. Bufo (member)  
Dr. Laura Scrano (member)  
Prof. Bartolomeo Dichio (additional member)  
Dr. Maria Nuzzaci (additional member)  
Prof. Vitale Nuzzo (additional member)  
Dr. Alba Nicoletta Mininni (additional member)

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SEMINARS BY EXTERNAL EXPERTS: YES

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