SCUOLA DI SCIENZE AGRARIE, FORESTALI, ALIMENTARI ED AMBIENTALI

COURSE: **Agricultural chemistry and principles of forestry biochemistry**			
ACADEMIC YEAR: 2018/2019			
TYPE OF EDUCATIONAL ACTIVITY:			
TEACHER: Prof. ANTONIO SCOPA			
e-mail: antonio.scopa@unibas.it		web:	
phone: +39 (0) 971 205240		mobile (optional):	
Language: Italian			
ECTS: 9 (8 of lessons and 1 of laboratory/practice)	n. of hours: (64 of lessons and 16 of labs/practice)	Campus: Potenza School: SAFE	Semester: II

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The goal in this teaching is to enable students to acquire the basic knowledge and operational capabilities for understanding the main chemical and physical processes that are the basis of soil formation and chemical and biological soil fertility in addition to those the complex soil-plant-atmosphere system.

The result to be achieved will be the one to introduce the students the tools to make him understand the role that the soil plays in the sustainability of agricultural, forestry and natural environments. The course also aims to introduce the student to the understanding and use of the main soil classification.

- Knowledge and understanding: knowledge and ability to understand the general principles governing qualitative and quantitative aspects of soil matter and reactivity of inorganic compounds in various phases, physical and chemical parameters; reading keys and interpretations for the identification and classification of soils. knowledge and ability to understand relationships between structure and properties of functional groups of organic soil matrix and the correlate processes; knowledge and ability to understand the functions and importance of biological processes occurring in soil and plant.
- Applying knowledge and understanding: ability to interpret phenomena and transformations in the soil; Ability to identify the main physical and chemical properties of the gaseous, liquid, solid soil phases; ability to handle appropriately, qualitatively and quantitatively, the general properties of ionic equilibria in the soil solution; ability to appropriately handle information of formation of novel minerals; ability to recognize and describe the factors that controlling the kinetics of biochemical reactions; ability to recognize and interpret the main structure/property relationships of the classes of soil organic compounds.
- Ability to choose and judge (autonomy of judgment): ability to build pathways to identify the main relationships between macroscopic and microscopic soil properties; ability to predict the major degradative pathways and differences in the transformation of organic compounds present in the telluric matrix.
- Communication skills: ability to communicate, organize the information using a correct language and mathematical and graphical means.
- • Ability to learn: ability to collect and organize the information received during the lesson or in recommended texts.

PRE-REQUIREMENTS

Students wishing to access this teaching is advised to have a good grounding in the foundations of mathematics, physics, general and organic chemistry as well as elements of plant biology.

SYLLABUS (**units in bold**)

Introduction to Basic Course and Training (2 h L)

Pedogenesis (6 h L)

Genesis of the soil. Soil phases. Processes and factors of pedogenesis: Jenny equation. Rock weathering processes: physical disintegration and chemical decomposition. Rocks: Types and Characteristics. Crystalline and amorphous minerals. Pedogenetic processes.

Soil Classification (5 h L)

Structure and properties of solid phase (7 h L)

Silicates and Aluminosilicates. Tetrahedral and octahedral structures. Charge distribution in sheets. Isomorphic substitutions. Structure and properties of silicates. Permanent load and variable charge. Classification of silicates. Phyllosilicates. Clay soil minerals. Non-silicates: oxides, hydroxides and carbonates. Colloidal soil properties.

Physical chemical properties of soil (9 h L)

Soil adsorption power. Mechanical, biological and chemical absorption. Exchange absorption. Cationic exchange: phenomenon and characteristics. Cation exchange capacity. Exchange bases and degree of saturation. Double Layer models: Helmholtzut, Guy and Chapman, Stern. Double layer thickness. Effect of charge and ion concentration. Double Layer Potential. Cation affinity for the exchanger. Lyotropic series. Quantitative Aspects of Exchange Processes. Anionic adsorption. Negative adsorption or anionic repulsion. Non-specific positive adsorption. Specific or chemical adsorption. Phosphate adsorption.

pH (9 h L)

Factors influencing the degree of reaction. Reaction and soil . pH effect on the availability of nutrients. Forms of acidity: active and exchange. Acid Soils: causes and factors of acidification of the soil, nature of soil acidity, H-clay and Al-clay. Aluminum chemistry: hydrolysis forms of Al ion, distribution curves, monomers and polymers of Al. Correction of acid soils. Potential redox of the soil. PE-pH charts. Cycles of the main nutrient elements in the soil-plant system: macroelements (N, P, K) and microelements. Land Pollution: causes, sources, direct and indirect effects. Environmental risk from agricultural practices: agro-pharmaceuticals, phosphorus and nitrogen, heavy metals.

Soil organic matter (9 h L)

Carbon cycle in soil-plant system. Nature and origin of Organic Matter. Processes of transformation: decomposition, mineralization, humification. Humic substances and non humic substances. Humic and fulvic acids, humus. Theories of Humification. Agronomic properties and functions of organic matter in soil. Forest humus. Humus: fractionation and chemical-physical properties.

Nitrogen cycle (3 h L)

Nitrogen fixation. Amino acids and proteins. Mineralization of protein, transamination and deamination, nitrification and denitrification

Biochemistry Elements (14 h L)

Exogenous and endergonic reactions. ATP cycle. Oxidation Reduction Reactions. Enzymes: classification, characteristics, composition, coenzymes, cofactors, prosthetic groups. Enzyme kinetics: Michaelis-Menten equation and its elaborations. Factors that affect enzymatic activity: pH and temperature. Enzyme Inhibition.

Carbohydrates Amino acids and proteins. Nucleotides. Lipids: biosynthesis and catabolism of fatty acids. Fitnormones: auxin, gibberellin, cytokinin, abscisic acid and ethylene.

Laboratory Experiences (16 hrs E)

Soil sampling: methodological approaches, sample types, number elementary samples. Reading and Interpreting a Certificate. Color and profile of a soil profile. Determination of the granulometric distribution; Determination of the pH and the conductivity of the soil; Determination of the cationic exchange capacity and organic matter of the soil; Determination of total nitrogen.

TEACHING METHODS

Theoretical lessons, Laboratory tutorials. The topics of the course will be treated with the help of PowerPoint presentations both for lectures and for the laboratory exercises.

EVALUATION METHODS

Oral examination.

Verifying the learning of teaching is to find the level of achievement of the previously mentioned educational goals and is through an oral examination. The evaluation is addressed on the arguments developed in the lectures and will be placed six basic questions, two for each thematic area (soil chemistry, agricultural biochemistry and pedology). It will proceed to the appropriate inquiries on the topics. It is necessary that the candidate reaches a sufficient assessment in each of the three subject areas that characterize this course.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

AA.VV., 2003. Biochimica agraria, Scarponi L. Coord., Pàtron Editore, Bologna.

AA.VV., 2005. Fondamenti di Chimica del Suolo, Sequi P. coord., Pàtron Editore, Bologna.

Mengel K. e Kirkby E.A., 2001. Principles of Plant Nutrition. 5th Edition. Pp. 849. Kluwer Academic Publishers, Dordrecht, Boston, London.

Lesson notes.

In relation to the contents of the course will be specified the parts to be explored.

INTERACTION WITH STUDENTS

At the beginning of the course, after describing the objectives, program and methods of verification, the teacher collects the list of students accompanied by name and email.

SCUOLA DI SCIENZE AGRARIE, FORESTALI, ALIMENTARI ED AMBIENTALI

The teacher receives from Monday to Friday from 9.00 to 11.00 and he is available at all times for a contact with the students, through its e-mail or telephone.

EXAMINATION SESSIONS (FORECAST)[1]
https://unibas.esse3.cineca.it

EVALUATION BOARD
Prof. Antonio SCOPA (member, president)
Prof. Adriano SOFO (member)
Prof. Sabino Aurelio BUFO (member)
Prof. Piergiorgio GHERBIN (additional member)
Dr.ssa Laura SCRANO (additional member)
Dr.ssa Maria NUZZACI (additional member)

SEMINARS BY EXTERNAL EXPERTS YES ☐ NO x

FURTHER INFORMATION

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