General Information	
Academic subject	Soil Chemistry and Pedology
Degree course	Management and conservation of the agro-forest environment (TuGest)
Curriculum	
ECTS credits	9
Compulsory attendance	No
Language	Italian

Subject teacher	Name Surname	Mail address	SSD
	Gennaro Brunetti	gennaro.brunetti@uniba.it	AGR/13

ECTS credits details			
Basic teaching activities	Lectures (6)	Practical (3)	

Class schedule	
Period	I semester
Year	2017/2018
Type of class	Lecture - Practical

Time management	
Hours	225
In-class study hours	90
Out-of-class study hours	135

Academic calendar	
Class begins	2nd October 2017
Class ends	26th January, 2018

Syllabus	
Prerequisites/requirements	The "Chemistry" examination is preparatory for the "Soil Chemistry and Pedology" examination

Expected learning outcomes	• *Knowledge and understanding*
	  ○ Knowledge and understanding of the basic aspects of soil chemistry and pedology and the soil classification
	• *Applying knowledge and understanding*
	  ○ The basic knowledge will help the student to manage the soil fertility to improve the quality of soils.
	• *Making informed judgements and choices*
	  ○ Ability of identifying and solving the problems of anomalous soils.
	• *Communicating knowledge and understanding*
	  ○ Ability of verbalizing by a rigorous and clear language
	• *Capacities to continue learning*
	  ○ Ability of updating the knowledge about the soil chemistry and geology
	The results of the expected learning, in term of knowledge and ability, are listed in the Annex A of the Didactic Regulation of the Bachelor Degree Course (expressed by the European descriptors of the study title).

Course program	

Contents	Introduction, programme, objectives and general definitions and concepts. Soil-plant-water-atmosphere interrelations. The soil formation: the rocks on the ground. The key factors of soil formation: parent material (rock), climate, relief (topography), microorganisms (biomass), the time, the anthropic factor. Equation Jenny. Soil analysis in the field. Sampling methodologies, sampling and sample preparation of soil for laboratory analysis. Rocks and primary minerals: nomenclature and composition. Disposition and packing of the ions in space. Ionic radius and cation / anion ionic ray ratio. Elementary cell. Crystal lattice. Crystal systems and Bravais lattices. Silicates: geometric structures and major chemical characteristics. Exercises Physical, chemical and biological aspects of soil formation: fragmentation and disaggregation, chemical and biological decomposition. Agents and factors of soil formation and evolution. Role of liquid water and vapor, oxygen, carbon dioxide, biomass, wind, ice, heat, temperature. Time factor. Stability / alterability of primary minerals and factors affecting it: Order of solidification of primary minerals, silicate structure, isomorphous substitution and decompensation charge, presence of oxidable ions. The transformation of primary minerals into secondary. Theory of disintegration-recombination. Theory of differential migration of the ions. Thermodynamic and kinetic aspects. Chemical potential of the ions Crystalline and amorphous minerals in soil: oxyhydroxides, phyllosilicates, allophane, carbonates, gypsum, evaporites. Examples of reactions. Stability diagrams of minerals. Levels and an evaluation of the soil. Evaluation of processes of soils transformation: decarbonation, leaching, podzolizzazione, ferrallitizzazione, salinization, sodicization, gleyfication. The pedon. Profile, soil horizons and sub-horizons. Diagnostic and genetic horizons. Autochthonous and allochthonous soils. Zonal, intrazonal and azonal soils. macroclimate-soil relationship.Examples of description of the soil profile Soil classification. Historical classifications (Dokoutchaev and Baldwin). FAO-UNESCO and USDA classifications. Italian classification. Exercises for comparing classifications. Examples of typical processes of soils formation, profiles and chains of soils. Exercises. The main orders of soils in the world: classification, description, distribution, pedogenetic processes, their utilization.

	Soil physical properties: texture, structure, density, porosity, heat, temperature. Soil gaseous phase. Gas exchange processes. Air dissolved in water. Inorganic solid (mineral) components of soil. Crystalline and amorphous minerals. Crystallinity order, crystal cell. Structural ions. Coordination number. Tetrahedral and octahedral units and sheets. Gibbsite, goethite, soil fillosilicates: structures, formulas, properties. Isomorphism and charge. Soil organic components: Biomass and humus. Organic carbon cycles in soil. Sources and transformation processes of soil organic matter: mineralization, humification, carbonification. Turnover times. Non-humic and humic compounds. Composition, structure and chemical properties of humic and fulvic acids and humin. Functions of soil organic matter. Cation exchange process and characteristics. Cation exchange capacity. Cations affinity. Models of double layer. Isotherms and equations of cation exchange. Selectivity coefficients. Dilution effects. Anion adsorption: Anion in soils. Physical (electrostatic) adsorption: Factors and mechanisms. Chemical (ligand exchange) processes. Reaction scheme. Adsorption of phosphates: kinetics, isotherms and dissolution and precipitation mechanisms. Molecular retention processes and mechanisms. Soil pH and reaction. Soil pH-buffering capacity and buffering systems. Acidity forms in soil. Soil titration curves. Acidic soils: causes and factors of soil acidification, nature of soil acidity, the role and effects of Al on soil acidity and on plants. Correction of acidic soils. Redox potential of soil. Electron acceptors and donors in soil. The role of oxygen and organic matter. Submerged soils: properties and processes. Rice cropped soils. The liquid phase of soil. Water potential in soil. Water retention curves. Effects of texture. Alomorphic soils. Origin of salts in soil. Classification: saline and sodic soils, properties. Effects of sodium on soil and salts on plants. Restoration of saline and sodic soils. Chemical quality of irrigation waters, hazards and problems related to salinity, sodicity and presence of pollutants. Electrical conductivity, SAR, toxic ions. Leaching factor, tollerance/sensitivity of crops to salinity. Wastewaters used for irrigation: problems and solutions. Fertilizers. Organic amendments. Composting process, phases, factors and controlling parameters. Quality parameters of composts. Soil pollution/contamination by heavy metals and pesticide residues: sources, processes, factors and effects, persistence and toxicity. Acid rain contamination of soil: sources, causes and effects.

Bibliography	• P. Sequi (Coord.), Fondamenti di Chimica del Suolo, Patròn Editore, Bologna 2005. • Oss. Naz. Pedologico e Qualità del Suolo, M.I.R.A.A.F., Metodi Ufficiali di Analisi Chimica del suolo, Roma, 1994.
Notes	The notes of the lectures integrate the contents of bibliography
Teaching methods	Lectures will be held using PowerPoint slide shows and exercises using the blackboard with involvement of the students
Assessment methods	Only the students enrolled in the academic year during which this module is offered, can have an intermediary exam during the teaching period of module. The result of this intermediary exam remains valid for the whole academic year and concurs to the final evaluation of the student. The intermediary exam will be given on the subjects treated during the lessons and the practical activities as reported in the Didactic Regulation of Management and conservation of the agro-forest environment (art. 9) and syllabus (annex A) and which is correlated to the actual teaching period. The evaluation of the intermediary exam is expressed in thirtieths. At the end of the module teaching period, the students, who passed positively the intermediary exam, can give the final exam concerning on the subjects treated during the lessons and the practical activities since the intermediary exam, as reported in the Didactic Regulation, and which is correlated to the actual teaching period. Students who did not pass or give the intermediary exam will be examined on the whole subjects treated during the lessons and the practical activities as reported in the Didactic Regulation, and which is correlated to the actual teaching period. The intermediary and the final exams consist of an oral examination. The evaluation of the student is based on criteria previously fixed such as reported in the Didactic. The exam for foreign students can be given in English according to the above reported modalities.

Evaluation criteria	• *Knowledge and comprehension ability*
	  ○ The student will get the knowledge on the role of soil in the agro-forest systems and on soil conservation and protection from the various factors of degradation
	• *Knowledge and applied comprehension ability*
	  ○ Description of the main components of soils and comprehension of their effects on the soil physical and chemical features.
	• *Autonomy of judgement*
	  ○ Provide reasonable hypotheses regarding the detection of anomalous soil conditions and remediation operations needed to restore them.
	• *Abilità comunicative*
	  ○ Descrivere e illustrare in modo esaustivo, con appropriatezza nei termini, con ricchezza di esempi e con collegamenti gli aspetti di base che caratterizzano la fertilità chimica e chimico-fisica dei suoli
	• *Communication skills*
	  ○ Exhaustive description and illustration, with appropriateness of term, richness of examples and

	correlation the basic aspects that characterize the chemical and Physico-chemical- fertility of the soils • *Learning ability* ○ Adaptation of the basic cognitive tools acquired during the module in order to explain and solve numerous applied problems and diversified case studies
Further information	