UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze Agrarie, Alimentari e Forestali		
ACADEMIC YEAR	2016/2017		
BACHELOR'S DEGREE (BSC)	VITICULTURE AND OENOLOGY		
INTEGRATED COURSE	SOIL-PLANT SYSTEM SCIENCE - INTEGRATED COURSE		
CODE	15449		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	AGR/13, AGR/14		
HEAD PROFESSOR(S)	BADALUCCO LUIGI	Professore Ordinario	Univ. di PALERMO
OTHER PROFESSOR(S)	SCALENGHE RICCARDO	Professore Associato	Univ. di PALERMO
	BADALUCCO LUIGI	Professore Ordinario	Univ. di PALERMO
CREDITS	12		
PROPAEDEUTICAL SUBJECTS	01933 - ORGANIC CHEMISTRY		
MUTUALIZATION			
YEAR	2		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	**BADALUCCO LUIGI** Monday 15:00 17:00 Piattaforma Teams Tuesday 15:00 17:00 Sede CdL Viticoltura ed Enologia Wednesday 15:00 17:00 Sede CdL Viticoltura ed Enologia Thursday 15:00 17:00 Piattaforma Teams **SCALENGHE RICCARDO** Monday 08:00 19:00 Piattaforma Teams (prenotarsi con una email) Tuesday 14:00 17:00 Dipartimento SAAF - Agronomia (Edificio 4, Ingresso L, 2° piano) Wednesday 8:00 10:00 Sede del Corso di Studi Thursday 08:00 19:00 Piattaforma Teams (prenotarsi con una email) Friday 08:00 19:00 Piattaforma Teams (prenotarsi con una email)		

DOCENTE: Prof. LUIGI BADALUCCO

PREREQUISITES	Fundamentals of general and inorganic chemistry, and organic chemistry, basic knowledge.
LEARNING OUTCOMES	Knowledge and understanding skill Acquisition of cognitive bases on biochemical transformations within living organisms, but also on soil biological properties, in order to understand peculiar subjects dealing with the soil-plant system under viticulture and enology areas, with the proper use of specific language and notions. Moreover, the ability to interpret soil mapping, to describe soil profiles and to classify a soil by WRB, but also to cross-correlate a pedological classification. Skill to apply knowledge and understanding Ability to understand if and when a viticultural and/or enological issue is resolvable resorting to the acquired knowledges about the soil-plant system. Skill to search information in foreign languages, their analysis and synthesis. Study capacity through English literature Judgement autonomy Formulation of one's own logical pathway of cause-effect on the origin of recognized issues about the science of the soil-plant system, in order to sustain one's own independent hypotheses to resolution Communication skills Presentation capacity, also to an incompetent audience and resorting to multi-media technology, of the techno-scientific explanations to the identified issues on the science of the soil-plant system, as well as of the hypotheses for their resolution Learning skill Capacity to find the reliable information sources (textbooks but also specialized, scientific journals) for a one's own independent pathway to updating and techno-scientific progress, together with the most shared and established national and international trends on issues about the soil-plant system with regard to viticulture and enology.
ASSESSMENT METHODS	The purpose of examination tests will be to verify the acquisition of cognitive bases on biochemical transformations within living organisms, but also on soil biological properties, in order to understand peculiar subjects dealing with the soil-plant system under viticulture and enology areas, with the proper use of specific language and notions. Moreover, the ability to interpret soil mapping, to describe soil profiles and to classify a soil by WRB, but also to cross-correlate a pedological classification. In order to pass the whole examination, the student has to solve at least 2 questions each 3 CFU, i.e. 8 in total. The global assessment of the achieved learning will consist on a first oral ongoing test concerning 2/3 of subjects relative to the unit of "Agricultural Chemistry", i.e. dealing with "General Biochemistry" (6 CFU). Then, two more oral ongoing tests concerning together the "Soil" topic (the first one relative to the unit of "Fundamentals of Pedology" (3 CFU), and the other dealing with to the last 1/3 of the "Agricultural Chemistry", i.e. about Soil Chemistry. The failed oral ongoing tests will be tackled during a single oral final test. The final examination grade will be the weighted average of all ongoing test grades, eventually the final oral test included.
TEACHING METHODS	Lectures, laboratory tests, field trips, literature search

MODULE
AGRICULTURAL CHEMISTRY

Prof. LUIGI BADALUCCO

SUGGESTED BIBLIOGRAPHY

Principi di Biochimica (Tymoczko J.L., Berg J.M., Stryer L.), 2010. Casa Editrice Zanichelli, Bologna
Fondamenti di Chimica del Suolo (Coordinatore P. Sequi). Casa Editrice Patron, Bologna, 2005.
Da consultazione:
Biochimica (Mathews C.K., van Holde K.E., Ahern K.G.). Terza edizione, 2004. Casa Editrice Ambrosiana, Milano.
Chimica del Suolo e Nutrizione delle Piante (Autore P. Violante). Calderini Edagricole, Bologna (2001).

AMBIT	10689-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	135
COURSE ACTIVITY (Hrs)	90

EDUCATIONAL OBJECTIVES OF THE MODULE

The course aims to provide students with required knowledges for understanding the chemical reactions that living matter undergoes within the organisms, especially plants and microbes. At first, the structure of the most important biological molecules will be treated, in order to predict their function (aminoacids, proteins, monosaccharides, polysaccharades, etc.). Then, the relation between structure and function in enzymes will be deepened, also in view of their regulation mechanisms.Emphasis will be placed to the bioenergetics, i.e. to the understanding of mechanisms governing the energy transfer within cells, particularly to glycolysis and Krebs cycle. Lastly, biochemical processes of peculiar viticultural and enological interest will be stressed. Moreover,the course aims to provide students with cognitive bases for a suitable understanding of physical, chemical and biological key factors regulating the crop yield within a vineyard soil. Particularly, it will be provided the basic knowledge on soil chemical properties and on its aptitude within the selection of new sites to be established at vineyard, either in relation to the grape yield and the quality of produced wine. Also, the centrality of the soil as main resource will be highlighted since, being the soil basically renewable during millennia only, its importance exceeds that of a simple support for vine growth.

SYLLABUS

Hrs	Frontal teaching
3	What does biochemistry deal with: Aims - Chemical elements and the composition of living matter - Peculiar attributes of living matter - Biological plimers and their monomers - Functional classification of organisms based on energy and carbon sources
4	Role of water in biological processe - Structure and properties of water - Water as a solvent - Water ionization - Weak interactions within aqueous systems -Titration of weak acids: the Henderson-Hasselbach's equation - Buffer solutions against pH changes within biological systems - Ampholytes, polyampholytes, and polyelectrolytes
3	Aminoacids and peptides: Structure and stereochemistry of alfa-aminoacids - Properties of aminoacid branch chains: classes of alfa-aminoacids - Ionization, titration and isoelectric point of aminoacids -Absorbarbance spectrum of aromatic aminoacids - Formation, structure and stability of peptide bond.
3	The Proteins: primary (covalent) structure - three-dimensional structure: secondary (alfa-elix and beta-sheet), tertiary, and quaternary - Forces and bonds allowing the formation and maintenance of three-dimensional structure - Relationships between structure and function of proteins - Prosthetic groups - Denaturation
5	The enzymes; Role - Rate and order of reaction - How does an enzyme work as catalyst - Models of enzyme-substarte interaction - Kinetics of enzymatic catalysis (steady state hypothesys) - Meaning of KM and Vmax - Assessment of enzyme activity - Enzyme co-factors (co-enzymes, vitamins and essential metals) - Regulatory allosteric enzymes - Enzyme inhibition (competitive, uncompetitive, acompetitive) - Classification of enzymes
5	Bionergetics and thermodynamics - Energetic changes within biological systems - Meaning of free energy of reaction - Mechanisms for energy transfer Coupled reactions - Catabolic and amphibolic pathways
10	Metabolic processes for energy production: interrelationships between glycolysis and other metabolic pathways - Aerobic and anaerobic glycolysis - Fermentations - The reactions of glycolysis - Metabolic fates of pyruvate - Energetic balance - Glycolysis regulation - The entry of other sugars into glycolysis - Catabolism of polysaccharides - The cycle of tricarboxilic acids and its regulation - Mithocondrial electron transfer chain - Oxidative phosphorilation - -Cycle of glioxilate - Pentoso phosphate pathway
5	Biochemistry of alcoholic fermentation: Nutrition and growth of yeasts - Final products of yeast metabolism - Nitrogen metabolism during fermentation - Sulfur metabolism during fermentation - Problematic fermentations - Ethanol tolerance - Fermentation bouquet and other volatile esthers
1	Introduction to the Soil Science: Soil as a natural resource - Different concepts of soil - Different consituents of soil.
3	The mineral constituents of soil: Minerals and constituents of rocks and soil - Dimensional scale - Mineralogy of sand and silt fractions - Mineralogy of clay fraction - Surface area and surface charge
1	Physico-mechanical properties of soil: The cooloidal state - Soil texture - Soil structure - Importance of soil structure - The porosity

5	Soil organisms and organic matter: Organic constituents of soil - Origin of soil organic matter - Organisms living within soil - Transformations of crop residues after soil biological activity - Soil organic matter properties - Factors affecting the decomposition rate of soil organic matter.
4	Surface reactions and adsorbing capacity of soil: Physical adsorption - Chemical adsorption - Chemico-physical adsorption - Charge origin on soil particles - Cationic exchange - Anionic exchange - Interactions among colloidal soil components.
3	Water and air in soil: interactions betweenwater and soil solids - Salinity and hardness of irrigation water - Sodium Adsorption Ratio – Air in soil - Soil respiration - Mechanisms of gas exchange - Effects of scanty aeration on microbial and root activities - Chemistry of flooded soils- Redox reactions in soil.
5	Nutrient cycles: Nutrients for plant growth - Processes of mineralization and immobilization of Nitrogen - The Nitrogen cycle - Tranformations of phosphorus and sulphur Potassium, calcium and magnesium - Trace nutrients.

Hrs	Practice
8	Baboratory tests: Biochemical techniques I: Photometry (Lambert-Beer Law) - Colorimetric assays of proteins - Linearization of Michaelis-Menten equation - Numarical examples for extrapolation of KM and Vmax - Identification of enzyme inhibition type through the reaction kinetics

Hrs	Workshops
4	Chemical properties of proteins and methods for their separation (electrophoresis; SDS-PAGE; isoelectrofocusing)
10	Laboratory tests: Biochemical techniques II: Strategy set-up for protein purification - Extraction of enzymes - Clarification of lysates and solutions, centrifugation and filtration - Basic principles and different types of chromatography (liquid phase, gel filtration, ion exchange, affinity). Glances on industrial biochemistry
8	Determination of soil organic C and total N - pH reaction in soil - Forms of soil acidity - Degree of base saturation - Soil buffer capacity - Causes of soil acidification - Alkaline soils - Salt-affected soils - Corrections of pH anomalies in soil

MODULE
PRINCIPLES OF PAEDOLOGY

Prof. RICCARDO SCALENGHE

SUGGESTED BIBLIOGRAPHY

- Certini G, Scalenghe R. 2007. Soils: Basic Concepts and Future Challenges. Cambridge University Press, Cambridge UK EU, 310 p.
- FAO. 2006. Guidelines for Soil Description. Fourth edition. FAO, Roma IT EU, 109 p
- IUSS Working Group WRB. 2015. World Reference Base for Soil Resources 2014, update 2015 International soil classification system for naming soils and creating legends for soil maps. World Soil Resources Reports No. 106. FAO, Roma IT EU, 192 p.
- Soil Survey Staff. 2014. Keys to Soil Taxonomy. 12th Edition. Natural Resources Conservation Service. United States Department of Agriculture. Washington DC USA, 362 p.

AMBIT	10689-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	45
COURSE ACTIVITY (Hrs)	30

EDUCATIONAL OBJECTIVES OF THE MODULE

This module provides a basic introduction to the study of soils and landscape. Topics include soil forming factors, soil classification, physical, chemical and biological properties of soils. The module provides visions and tools to analyse complex situations from soil to grape to wine on a strategic and operational level. The module aims to provide students with the skills: i) understanding and analysing pedological, and climatic components of the terroir of a vineyard, ii) judging the relevance of choices and cultural techniques applied on a given vineyard in relation to environmental risks. The course is divided into sections: 1-basic concepts that integrate the formation, distribution and classification of soils; 2-influence of soil on living organisms, particularly human use of land for plant growth; 3-current and future problems associated with the management, conservation, and sustainability of soil resources.

SYLLABUS

Hrs	Frontal teaching
2	The concept of soil.Factors of soil formation. Soil functions. Pedogenic processes
4	FAO guidelines for soil description I: general site information, registration and location. Soil formation factors. FAO guidelines for soil description II: soil horizon designation. Master horizons and layers. Subordinate characteristics within master horizons. FAO guidelines for soil description III: subordinate characteristics within master horizons.
4	USDA Field Book for Describing and Sampling Soils I: master horizons and layers. Munsell colour, Attenberg limits, COLE
5	Soil Taxonomy (ST): the 12 Orders
5	WRB:the 32 Great Groups
1	Harmonisation ST-WRB
1	Land Capability Classification

Hrs	Others
8	Field trip