Lebanese University
Faculty of Sciences

Life and earth Sciences Department

Section -1-

Course Description
First year CSVT

Head of Department

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Lebanese University
Faculty of Sciences I
Section –I-

Department of Life and Earth Sciences
Courses Syllabus

Code	Entitled	Semester	Credits	Number of hours
B 1100	**Cytology, Histology**	**S1**	**6**	**60**

CYTOLOGY (30 hours)

Objective:

This course allows the student to acquire the basic concepts and keywords needed to the understanding of the related courses in BS of Life and Earth Sciences (SVT).

Content:

The Chemical Components of a Cell; Procaryota, Eucaryota and Viruses; Plasma membrane structure; Wall of a plant cell; the Cell Nucleus; the Cytosol: Endoplasmic reticulum, Golgi apparatus, Peroxisomes; Energy Conversion: Mitochondria and Chloroplast; the Cell-Division Cycle.

GENERAL HISTOLOGY (30 hours)

Objective:

This course gives the student basic knowledge in animals and plants, prerequired for the understanding of subsequent courses of Anatomy, histology of organs and botany.

► **Animal Histology:** Introduction to histology; Epithelial tissue; Connective tissue; Muscle tissue; Nerve tissue.

► **Plant Histology:** Cell wall structure; Meristems; Parenchyma and Collenchyma; Sclerenchyma; Vascular Tissue: Xylem and Phloem.

Code	Entitled	Semester	Credits	Number of hours
B1101	**Botany and Plant Reproduction**	**S1**	**3**	**30**

The course of Organization of the Living World must allow the students to have a first contact with the Diversity and the Organization of Plant World. In a first approach, the different attempts of classification of the Living World are studied with an evolutionary approach. This will permit to students to well understand the principal objective of this course which is the acquisition of a basic knowledge about the evolution and the organization of the different kingdoms of the Plant World.

Afterwards, a detailed study of each kingdom must be done and with the following features: general characteristics, morphology, anatomy, metabolism, classification, evolution and adaptation as well as the asexual and sexual reproduction with the life cycles of the different groups in each kingdom.

Code	Entitled	Semester	Credits	Number of hours
B1102	**Genetics and Anatomy**	**S1**	**3**	**30**

GENETICS (18 HOURS)

Biochemical bases of heredity : DNA and transmission of the genetic information – Cellular division – Chromosomal and gene mutations – Basic principles of heredity : Mendel's principles of inheritance– Extensions of Mendelian genetics – Genetics and sexuality – Linkage and recombination – Human heredity and monogenic inheritance – Probability.

ANATOMY (12h)

This course provides an overview of the anatomy of different human body systems to acquire basic anatomical concepts to the understanding of basic physiological processes. It will enable students to acquire the outline of the human body architecture.

Definition and application field, terminology, anatomical position, different regions of the body and its cavities. Systematic Study. Skeleton system, Articular system, Muscular system, Nervous system, Senses organs, Integumentary system, Cardio-vascular system, Respiratory apparatus, Digestive apparatus, Urogenital apparatus.

Code	Entitled	Semester	Credits	Lecture	Problems session	Number of hours
C1100	**General chemistry**	**S1**	**6**	**30**	**30**	**60**

The general chemistry course is divided into 4 parts.

The first part describes the composition of the atom and the atomic structure (Rutherford model, photelectric effect, Planck theory, Bohr model, modern atomic model, description of the atomic orbitals (s, p, d and f), poly-electronic atoms in the quantum mecanics …).

The second part describes the chemical bonding, the molecular orbitals theory (Lewis structure, VSEPR, energy diagrams of molecular orbitals, …)

The thermochemistry is discussed in the third part of this course which includes the different types of transformations. The first and second principle of thermodynamics will be defined (work, heat, internal energy, entropy, free energy, …)

The last part is the kinetics. We study the rate of a chemical reaction (rate laws, partial and total orders, half-life time vs total order relationship, Arrhenius law, elementary process, complex process, intermediate, rate determining step, …)

Code	Entitled	Semester	Credits	Lecture	Problems session	Number of hours
M1109	**Analysis**	**S1**	**6**	**30**	**30**	**60**

Content :

Field of real numbers: operations and absolute value.
Functions of a real variable: limit, continuity of real valued functions of a real variable, derivative, mean value theorem, trigonometric functions and their inverses.
Logarithm and exponential functions: Hyperbolic sine and cosine functions and their inverses, power functions.
Taylor expansion: definition, operations, use of Taylor series to get the equation of tangent lines to curves, the equations of an asymptote to curves, the position of the curve relatively to the tangent and the asymptote, use of Taylor series to calculate limits.
Integral calculus: definition, integration by parts, integration by substitution, integration of rational and irrational, exponential and trigonometric functions.
Real valued functions of several real variables: double integral in Cartesian and polar coordinates, area calculation.
Differential equations of the first order: separable equations, homogeneous equations, and linear equations.

Code	Entitled	Semester	Credits	C	TS	Number of hours
P 1104	**Fluids, Mechanics & Thermodynamics**	**S1**	**6**	**30**	**30**	**60**

Content:

Kinematics: Dynamics: Types of forces, Newton's three laws of motion. Applications: motion on an inclined plane, free fall, satellites, central forces.

Rotation: Moment of a force, moment of inertia, angular momentum.

Energy: work of a constant force, work of the weight of a body, work of a frictional force and of the tension force in a spring. Theorem of kinetic energy.

Conservation laws: conservation and non-conservation of mechanical energy, conservation of linear momentum and angular momentum.

A solid in equilibrium: Conditions of equilibrium.

Hydrostatics: fundamental principle and hydrostatics. The buoyant force.

Fluid dynamics: Bernoulli's theorem.

First law of thermodynamics: Enthalpy, energetic treatment of thermal cyclic - processes. Concept of work.

Second law of thermodynamics: Performance of a heat engine, Carnot's theorem. Entropy.

Code	Entitled	Semester	Credits	Number of hours
B1103	**Ecology and Geology**	**S2**	**3**	**30**

ECOLOGY (18h)

General Basics
Terminology.Abiotic and biotic ecological factors of the environment, terrestrial and aquatic Biomes.

Dynamic of ecosystems
-Concept of ecosystems, energy and matter in the biosphere, energy flow in the ecosystems and their function regulation.
-Ecology of the communities, structure and development of the communities, of organisms, food chains, succession and biodiversity.

GEOLOGY (12 h)

Planet earth and univers (4h)
-Origin evolution of the Univers, formation de star systems, genesis of the solar system.
-Characteristics and evolution of the planet earth and differentiation of the terrestrial envelopes.

Dynamic of the envelopes (8h)
-Dimensions and structures of the superficial envelopes (ocean, atmosphere). Energy balance at the surface of the Earth, gas cycle with greenhouse effects, atmospheric and oceanic surface and deep circulations, cycle of chemical elements in the ocean current sedimentation.
-Acquisition of fundamental knowledge the cycle of endogenous and exogenous rocks, geodynamics of the lithosphere, horizontal and vertical mouvements, deformations process of the rocks.

Code	Entitled	Semester	Credits	lectures	Exercises	Number of hours
C 1102	**Introduction to organic chemistry**	**S2**	**6**	**35**	**25**	**60**

Electronic effects and reaction intermediate:
Electronegativity, polarity, polarizability, inductive effect, resonance effect, conjugated systems. Formation, stability and reaction intermediates (free radical, carbocation and carbanion). Electrophiles and nucleophiles.

Conformation and stereochemistry:
Perspective representation, Newman representation and Fisher projection. Cahn-Ingold-Prelog rule, stereochemistry (Enantiomer and diastereoisomers), chirality and optical activity.

Alkanes:
IUPAC Nomenclature (Alkane, cycloalkane, alkyle groups).
Reactions of alkanes: Radical halogenation.

Alkenes and Dienes:

Nomenclature. Alkenes reactions: Catalytic Hydrogenation, electrophilic addition of X_2, HX, H_2O, and X_2/H_2O (mechanism, stereochemistry, Markovnikov rule, carbocation rearrangements. Hydroboration-oxydation, epoxydation (mechanism of hydrolysis), dihydroxylation (*syn-anti*), ozonolyse, oxidation with $KMnO_4$ (conc), reactions with conjugated dienes. Addition 1,2 and 1,4 Diels Alder cycloaddition (stereochemistry of dienophile only).

Alkynes:

Nomenclature. Alkynes reactions: acidity of terminal alkyne, catalytic hydrogenation, reduction by metal and ammonia, addition of HX, of X_2, and of H_2O.

Alcohols and halogenated derivatives:

Nomenclature

Acidity and basicity of alcohols.

Nucleophilic Substitution reactions (S_N1 and S_N2), mechanism, stereochemistry, competition between the two reactions, solvent effect, nucleophilic effect, leaving groups, and rearrangements of carbocations.

Elimination reactions (E1 and E2), mechanism, stereochemistry, competition between the two reactions. Competitions between substitution and elimination, heat effect, Zaytsev rule.

Other methods of converting alcohols to halogenated derivatives.

Oxydations of alcohols.

Organometallics RMgX.

Arenes and Aromaticity :

Benzene, structure, bonds, Huckel rule

Benzene substituted derivatives and their nomenclatures.

Reactions of Benzene: Addition reactions: Catalytic hydrogenation. Electrophilic aromatic substitution reactions (EAS): Mechanism, Nitration, Sulfonation, Halogenation, Friedel-Crafts (alkylation and acylations), synthesis of alkylbenzens (acylation-reduction). Regioselective disubstition reaction of benzenes. Activating groups and deactivating groups. Oxidation of alylbenzenes.

Code	Entitled	Semester	Credits	Lecture	Problems session	Number of hours
C1103	**Chemistry of solutions**	**S2**	**6**	**35**	**25**	**60**

The objective of this course is to provide the student with the basic knowledge necessary for understanding chemical equilibrium.

At the end of this course, the student will have understood and assimilated:

1.The concept of chemical equilibrium in aqueous solution; the relationship between thermodynamic equilibrium constant and reaction progress;

2. The concept of acid, base, pH and its importance in the phenomena of life, the prediction of the pH of aqueous solutions in simple cases; the acid-base titration and calculation of the pH at any point of the titration;

3. Complexation reactions, titration by complexation; precipitation reactions in aqueous solution, the influence of pH and complexation on solubility;

4. The concept of oxidant, reducer, Nernst potential, the prediction of dominant reaction and the calculation of the equilibrium constant; the realization of an electrochemical cell and the description of its operation; the influence of complexation and precipitation on the oxidizing power of an oxidant; the redox titration.

Code	Entitled	Semester	Credits	C	Number of hours
P 1105	**Electricity, Electromagnetism and Optics**	**S2**	**6**	**30**	**30**

Content:

Electric field and field lines created. Electric flux and Gauss's law.

Electric potential: the electric dipole.

Electrical conductor: Induction and dielectric phenomenon.

Electric capacitor: Capacitance of a parallel-plate, spherical and cylindrical capacitors. Energy density in a capacitor.

Electrodynamics: Electric current. Ohm's Laws and Joule's law. Electric resistance, receivers and generators (Pouillet's Law) .Circuits and networks - Kirchhoff's Laws.

Magnetic induction: Biot-Savart's law (straight wire, coil and solenoid). Ampere's theorem.

Properties and effect of the magnetic field: Lorentz formula, and Laplace's law. Motion of a charged particle in a uniform magnetic field.

Propagation of light: Propagation velocity, refractive index and frequency.

Reflection and refraction: Dioptric systems: Optical instruments: The eye and its defects.

Code	Entitled	Semester	Credits	CM
S 1100	**Statistics**	**S2**	**3**	**30**

The main objective of this course is to complete the information already acquired in descriptive statistics and probability. It includes three chapters:

- **Descriptive univariate statistics**: we present the use of tables, graphics and parameters in the description of discrete and continuous variables. We also introduce the variable changing and the calculation of mean and variance in the case of pooling many samples with different means and variances
- **Descriptive bivariate statistics**: we present all the cases of 2 discrete variables, discrete-continuous and 2 continuous. We learn how to verify the independence of 2 variables, to determine the coefficient of correlation and the regression lines
- **Rules of counting and probability**: we present most of the formulas used in counting, we also introduce to the Newton's binom and Pascal's triangle. All the probabilities properties are presented and the chapter is culminated by introducing the Bayes' Formula

Code	Entitled	Semester	Credits	CM
B 1104	**Animal Reproduction and Embryology**	**S2**	**3**	**30**

ANIMAL REPRODUCTION (15h)

Objective:

This course presents the main aspects of the reproductive functions in animals from the formation of gametes to fertilization, ensuring therefore the sustainability and the continuity of species.

Content: Sexual Reproduction, Spermatogenesis, Oogenesis, Fertilization, Parthenogenesis.

ANIMAL EMBRYOLOGY (15h)

Objective:

This course enables students to acquire basic concepts on the different stages of embryonic development from the fertilized egg to the organogenesis.

Content:

Introduction. Experimental approaches in Developmental Biology.
Early Developmental Stages in Insects, Echinoderma, Amphibians, Birds and Mammals.
Cellular interactions (induction) during organ formation.

Code	Entitled	Semester	Credits	CM
M1110	**Algebra**	**S2**	**3**	**30**

Matrix: operations on matrix, row echelon form of a matrix, invertible matrix. Determinant of a matrix: properties, rank of a matrix. System of linear equations: Cramer's system, echelon form and system of linear equations. Vector spaces: subspace, system of generators, linearly independent vectors, basis of a vector space. Reduction of matrix: eigenvalues, eigenvectors, characteristic polynomial, diagonalization.