SYLLABUS: STRUCTURAL BIOCHEMISTRY II (IC CHEMISTRY AND STRUCTURAL BIOCHEMISTRY)

STRUCTURAL BIOCHEMISTRY (2 CFU; 22 hours – 16 T + 6 Ex) **Learning objectives: at the end of the course the students know the structure and functions of proteins, lipids and cell membranes and are able to applying knowledge in an interdisciplinary way, for the understanding at molecular level the physio-pathological processes which take place in cells and animals.**			
Matter and developed skills	**Topics**	**Specific contents**	**N of hours**
OPENING LESSON (1 HOUR)		*Course introduction, illustration of the program of the course and of examination and assessment methods*	1
1. STRUCTURE AND FUNCTIONS OF PROTEINS AND LIPIDS (TOT. 10 HOURS) (*skills in:* *a) describing structure of proteins and lipids;* *b) discussing properties and functions of proteins and lipids according to the structure)*	***Proteins: three-dimensional structure***	Amminoacids: structure, role and properties; peptide bond. Three-dimensional structure of proteins. Primary structure. Secondary structure: regular secondary structure, fibrous protein, nonrepetitive protein structure. Tertiary structure: motif (supersecondary structures) and domains. Quaternary structure.	3
	Relationship between structure and function of proteins: some example.	Protein folding and stability: protein folding pathways; molecular chaperones. Diseases related to protein folding. Myoglobin and haemoglobin: structure, properties and function.	2
	Lipids: structure and properties.	Overview on lipids. Fatty acids, acylglicerols, glycerophospholipids, sphyngolipids, glycolipids, steroids and waxes: structure and properties. Fatty acids derivatives: prostaglandins, tromboxanes and leukotrienes.	2
	Biological functions of lipids	Main functions of fatty acids, acylglicerols, glycerophospholipids, sphyngolipids, glycolipids, steroids and waxes.	3
2. ENZYMES (TOT. 3 HOURS) *(developing knowledge on enzymes and enzyme kinetics and their application in veterinary and food area)*	***Enzymes and enzyme kinetics***	The enzymes: classification, specificity and action mechanisms. The stationary state. Steady state kinetic; the Michaelis-Menten equation. Some examples of biological interest.	1
	Enzyme inhibitors	Simple inhibition systems; mechanisms of action: competitive, uncompetitive, non-competitive and mixed inhibition. Some examples of bio-medical interest. Irreversible inhibition.	1
	Enzyme regulation	Regulation of enzyme activity. Covalent modification. Feed-back inhibition. Allosteric control. Sigmoidal kinetic curves. Proteolysis.	1

3. BIOLOGICAL MEMBRANES TOT. 2 HOURS *(developing knowledge on membrane structure and properties)*	***Structure of cell membranes***	The lipid bilayer; lipid composition and properties. Membrane proteins. Lipid-protein interactions.	1
	Membrane functions	The transport through the membranes: diffusion and facilitated diffusion; active transport. Carrier and channel protein. Membrane receptors. Cell membrane enzymes.	1
4. LAB ACTIVITY BIOCHEMICAL TECHNIQUES FOR STUDYING BIOMOLECULES TOT. 5 HOURS *(skills in working in safe in the research laboratory, both individually and in groups, and in processing critically data)*	***Spectrophotometry***	Basic principles of spectrophotometry. Lambert-Beer's law. Qualitative and quantitative analysis. Determination of protein concentration: construction of a calibration curve and its use in determining the analyte concentration.	2
	Enzymology: working with the enzymes	Graphical determination of K_m and V_m. Detecting inhibition mechanisms: processing experimental data and construction of specific plots.	2
	Sample preparation	Sample preparation: traditional and modern methods; SPME. Importance of preparation and storage of samples in analyzes	1
FINAL EXERCISE AND CLOSING ACTIVITY		Simulation of exam tests and discussion in small groups of students on the program to highlight its importance and identify any doubts.	1