No._____of _____ **USAMV form 0701010101**

SUBJECT OUTLINE

1. Information on the programme

1.1. Higher education institution	University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca
1.2. Faculty	Food Science and Technology
1.3. Department	Food Science II
1.4. Field of study	Food Product Engineering
1.5.Education level	Bachelor
1.6.Specialization/ Study programme	Technology of agricultural products processing (TPPA)
1.7. Form of education	Full time

2. Information on the discipline

2.1. Name of the discipline	**Physical and Colloid Chemistry I**							
2.2. Course coordinator				Assoc.Prof. Dr. Loredana LEOPOLD				
2.3. Seminar/ laboratory/ project coordinator				Assoc.Prof. Dr. Loredana LEOPOLD				
2.4. Year of study	1	2.5. Semester	**I**	2.6. Type of evaluation	summative	2.7. Discipline status	Content[2]	DF
							Compulsoriness[3]	DI

3. Total estimated time (teaching hours per semester)

3.1. Hours per week – full time program	4	out of which: 3.2.	2	3.3. seminar/ laboratory/ proj	2
3.4.Total number of hours in the curricu	56	Out of which: 3.5.	28	3.6.seminar/laboratory	28
Distribution of the time allotted					hours
3.4.1. Study based on book, textbook, bibliography and notes					15
3.4.2. Additional documentation in the library, specialized electronic platforms and field					14
3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays					5
3.4.4.Tutorials					5
3.4.5.Examinations					3
3.4.6. Other activities					2

3.7. Total hours of individual study	44
3.8. Total hours per semester	100
3.9. Number of credits[4]	4

4. Prerequisites (is applicable)

4.1. curriculum-related	Inorganic Chemistry. Organic Chemistry
4.2. skills-related	Students must have basic knowledge on fundamental Chemistry (inorganic and organic) from hgh school

5. Conditions (if applicable)

5.1. for the lecture	The course is interactive, students can ask questions regarding the content of lecture. Academic discipline requires compliance with the start and end of the course. We do not allow any other activities during the lecture, mobile phones will be turned off.

5.2. for the seminar/ laboratory/ project	During practical works, each student will develop an individual activity with laboratory materials (made available in the book that describes the laboratory work). Academic discipline is imposed throughout the course of practical works.

6. Specific competences acquired

Professional competences	C1.1. Describe and use concepts, theories and methods specific to physical and colloidal chemistry related to atomic and molecular structure, the notion of radiation, atomic and molecular spectrum, applications of UV-Vis spectrometry, IR, mass spectrometry and electronic resonance (EPR and NMR). C1.2.To apply, explain and interpret the concepts, principles and methods specific to Food Science, with special reference to the spectrometric analysis of the active principles in foods of plant or animal origin C 1.3. Apply the principles and methods specific to Physical Chemistry to solve technological problems, including those related to food safety C 3.1. Demonstrate concern for professional development by training the skills of critical thinking
Transversal competences	CT1. To demonstrate perseverance, rigor, efficiency and responsibility in work, punctuality and taking responsibility for the results of personal activity, creativity, common sense, analytical and critical thinking, problem solving, etc., based on the principles, norms and values of the code of professional ethics in the food field. CT2. To apply to the inter-relation techniques within a team, the stimulation of the interpersonal communication, of the teamwork, based on specific attributions, with the optimal time management.

7. Course objectives (based on the list of competences acquired)

7.1. Overall course objective	Assimilation of fundamental knowledge related to atomic and molecular structure, and the interaction of food matrix with different electromagnetic rays. The practical work aims the acquisition of specific knowledge to make adequate interpretatio of electronic configuration of compounds, electronic transitions, chemical bonds formation, as well the applications of different spectrometric methods based on the interaction of radiations with food matrix, interpretation of spectra and their significance. The lab's work content includes experimental work and discussions, and follows the lecture content.
7.2. Specific objectives	Understanding the atomic and molecular structures, interactions between food matrix and compound structures, ineractions matrix-radiations, and different methods for spectrometric evaluation (e.g. UV-Vis, IR, MS, EPR, NMR). Case studies and examples of identifying molecules based on spectrum interpretation are presented. The student receives skills related to understanding the phenomena and skills on how to interpret the results. Particular attention is paid to practical knowledge and skills for spectroscopic analysis, proper use of laboratory equipment, and the identification and dosing of chemical compounds (vitamins, pigments) in food. The acquired notions are useful for other disciplines, especially those of analysis and control of raw materials and finished products.

8. Content

Lecture – **Number of hours 28 hrs**	Teaching methods	Notes
1. STRUCTURE AND SPECTRAL PROPERTIES OF ATOMS 1.1. Experimental Data related to atomic structure 1.2. Electromagnetic radiations and origins of quantic mechanics	Lectures	2 lectures = 4 hours

1.3. Theories of classical versus quantic mechanics 1.4. Duality wave-corpuscul for subatomic particles 1.5. Periodic System of elements: corellations between atomic structure and position in the periodic system 1.6. Spectra: defintion; Atomic spectra. 1.7.Aplications of atomic emission, absorption and fluorescence 2. MOLECULAR STRUCTURE 2.1. Chemical bonds 2.2. Theories related to molecular structure 2.3. Molecular spectra 3. METHODS TO INVESTIGATE THE MOLECULAR STRUCTURE 3.1. X Ray Spectrometry 3.2. Spectrometry of molecular absorption 3.2.1. Electronic absorption spectra (UV-VIS) 3.2.2. Vibrational absorption spectra in Infrared (IR) 3.2.3. Raman Spectrometry 4. METHODS BASED ON MAGNETIC PROPERTIES OF COMPOUNDS 4.1. Magnetic susceptibility, paramagnetism and diamagnetism 4.2. Electronic Spin Resonance (EPR) 4.3. Magnetic spin Resonance nucleară (NMR) 5. MASS SPECTROMETRY 5.1. General Principles 5.2. Ionization and fragmentation 5.3. Applications. Interpretation of mass spectra 6. TERMODINAMICS 6.1. Thermodynamic Potentials 6.2. Physical equilibrium in mono-and polycomponent systems 6.3. Chemical equilibrium 7. CHEMICAL KINETICS 7.1. Formal kinetics and its theories 7.2. Enzymatic Kinetics 7.3. Applications in Food Science and technology 8. ELECTROCHEMISTRY 8.1. Electrochemical sources of electricity (electric primary cells). Electric potential and pH. 8.2. Electrolysis and its applications 9. PHYSICO-CHEMISTRY OF SURFACES AND APPLICATIONS IN FOOD SCIENCE 9.1. Clasification of surfaces, absorption nd distribution 9.2.Principles and applications of chromatography (gas and liquid) 9.3. Principles and applications of electrophoresis		2 lectures = 4 hours 2 lectures = 4 hours 1 lecture= 2 hours 1 lecture= 2 hours 2 lectures = 4 hours 1 lecture= 2 hours 1 lecture= 2 hours 2 lectures = 4 hours

8.2. PRACTICAL WORK **Number of hours –28**		

1. Safety and Protection in the Lab. Periodic system of elements	Theoretical presentation of practical works	1 lab work (2 hours)
2. Spectrometry of atomic absorption	Practice and seminar	1 lab work (2 hours)
3. Spectrometry of atomic emission	Practice and seminar	1 lab work (2 hours)
4. X-ray Spectrometry	Practice and seminar	1 lab work (2 hours)
5. Molecular absorption spectrometry UV-Vis	Practice and seminar	1 lab work (2 hours)
6. Determination of carotenoid pigments by UV-Vis spectrometry	Experimental work	1 lab work (2 hours)
7. Qualitative analysis of edible oils by UV-Vis spectrometry	Experimental work	1 lab work (2 hours)
8. Vibrational Spectrometry infrared (IR), spectra interpretation	Practice and seminar	1 lab work (2 hours)
9. Applications: Food Quality Control by IR spectrometry	Experimental work	1 lab work (2 hours)
10. Analysis of edible oils by Raman spectrometry		
11. Magnetic Resonance Spectrometry (NMR) and its applications in food analysis	Experimental work	1 lab work (2 hours)
12. Mass Spectrometry and applications in food science	Experimental work	1 lab work (2 hours)
13. Surfaces' chemistry and molecular separations: applications in food science and industry	Experimental work	1 lab work (2 hours)
14. Verification - Colloquium	Experimental work	1 lab work (2 hours)
	Verification of knowledge	2 hours

Compulsory bibliography:

1. Atkins P.W., Tratat de Chimie Fizica , Oxford Univ. Press, 1994 (trad. RO)
2. Socaciu C., Chimie Fizica si coloidală, AcademicPres, Cluj-Napoca, 2000
3. Socaciu C., Chimie Fizica si coloidală, AcademicPres, lucrari practice, Cluj-Napoca, 2000

Optional bibliography:

1. C.Neniţescu, Chimie generală, Ed.Did. şi Ped., Bucureşti, 1973
2. L.Stryer , Biochemistry, third edition, W.H.Freeman & Co., New York, 1988
3. Pogany I., Banciu M., Metode fizice in Chimia organică, ed. Stiintifica, Bucuresti, 1972

9. Corroborating the course content with the expectations of the epistemic community representatives, of the professional associations and of the relevant stakeholders in the corresponding field

The course and practical works provide necessary and sufficient information to be applied in food quality and safety control laboratories, from health departments, Consumer Protection Agencies, the Association of Food Industry Specialists (ASIAR) in Romania and economic agents in the industry and grocery shops.

10. Assessment

Type of activity	10.1. Assessment criteria	10.2. Assessment methods	10.3. Percentage of the final grade
10.4. Lecture	Knowledge of the types of electromagnetic radiation and the mechanisms of interaction with the atomic and molecular structure. Use of atomic and molecular spectrometry in the analysis of components of the food matrix	Verification along the semester (a written verification *online*) Exam (face to face or *online*)	75%

10.5. Seminar/Laboratory	Theoretical and practical knowledge of spectroscopic analysis using different methods and techniques. Resolving specific chemical bonding issues. Electronic configuration, the relationship between the periodic table and the structure of chemical combinations	Verification – Colloquium face-to-face or *online*	25%
10.6. Minimum performance standards			
Description of the specific steps of a spectrometric analysis Elaboration of a concrete solution for the analysis of a certain food matrix. Obtaining the pass mark for the periodic control work is a condition of pass ability.			

[1] Level of study- to be chosen one of the following - Bachelor/Post graduate/Doctoral
[2] Course regime (content) – for bachelor level it will be chosen one of the following - **DF** (fundamental subject), **DD** (subject in the domain), **DS** (specific subject), **DC** (complementary subject).
[3] Course regime (compulsory level) - to be chosen one of the following - **DI** (compulsory subject), **DO** (optional subject), **DFac** (facultative subject)
[4] One ECTS is equivalent with 25-30 de hours of study (didactical and individual study).

Filled in on
10.09.2021

Course coordinator
Assoc. Prof. Dr. Loredana LEOPOLD

Laboratory work/seminar coordinator
Assoc. Prof. Dr. Loredana LEOPOLD

Subject coordinator
Assoc. Prof. Dr. Loredana LEOPOLD

Approved by the
Department on
22.09.2021

Head of the Department
Prof. Ramona SUHAROSCHI, PhD

Approved by the Faculty
Council on
28.09.2021

Dean
Prof. Elena Mudura, PhD