UNIVERSITATEA DE ŞTIINŢE AGRICOLE ŞI MEDICINĂ VETERINARĂ CLUJ-NAPOCA
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No._____of _____ **USAMV form 0703010108**

SUBJECT OUTLINE

1. Information on the programme

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

2. Information on the discipline

2.1. Name of the discipline	**Physical and Colloid Chemistry II**							
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	I	2.5. Semester	II	2.6. Type of evaluation	continuous	2.7. Discipline status	Content[2]	FD
							Compulsoriness[3]	CD

3. Total estimated time (teaching hours per semester)

3.1. Hours per week – full time programme	4	out of which: 3.2. lecture	2	3.3. seminar/ laboratory/ project	2
3.4.Total number of hours in the curriculum	56	Out of which: 3.5.lecture	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	Physical and Colloid Chemistry I, Inorganic Chemistry. Organic Chemistry, Biochemistry
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). C 1.3. Apply the principles and methods specific to Physical Chemistry to solve technological problems, including those related to food safety
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 nonspectroscopic methods (thermodynamics, kinetics, electrochemical) applied in the characterization of food physicochemical parameters, and also the study of disperse systems (homogeneous and heterogeneous) charactersitic for food matrices (colloid chemistry). The practical works aim to achiev specific skills in order to interpretat thermodynamic, kinetic and electrochemical parameters, the using of biosensors, characterization of the structure and the stability of food colloidal systems. The thematic of the practical works follow closely the practical topics of the course
7.2. Specific objectives	Understanding disperse systems in food matrices, particulary the colloidal system (suspensions, foams, emulsions, hydrocolloids, gels) as well as of colloidal organic macromolecules in food (proteins, peptides, poliglucide, lipoproteins, etc.). The last part presents specific methods of separation of colloidal systems: dialysis, gas and liquid chromatography, electrophoresis, etc. The course and practical works are correlated and cover the necessary knowledge for the application of quality control methodologies used in practice. Particular attention is paid to knowledge and practical skills for chromatographic analysis, suitabable use of laboratory equipment, and identification and separation of food components. The concepts learned are connected to other disciplines, especially the analysis and control of raw materials and finished products.

8. Content

Lecture – **Number of hours 28 hrs**	Teaching methods	Notes
1. THERMODYNAMICS 1.1. Energy. Entropy. Enthalpy. 1.2. Gibbs free energy. Chemical potential	Lectures	2 lectures = 4 hours
2. PHYSICO-CHEMISTRY OF SURFACES 2.1.Interfază. Excess surface. 2.2 Surface tension. 2.3 Surface phenomena: surfaces and interfaces 2.4 Surface free energy: mechanical work of cohesion and adhesion	Lectures	1 lectures = 2 hours
3. DISPERSED SYSTEMS 3.1 Classification of dispersed systems 3.2 Food as a dispersed system 3.3 Stability of dispersed systems	Lectures	2 lectures = 4 hours
4. SURFACES 4.1.Clasificare 4.2. Hydrophilic-lipophilic balance 4.3.Association colloids	Lectures	2 lectures = 4 hours
5. EMULSIONS IN THE FOOD INDUSTRY 5.1 Formation and stability of emulsions 5.2 Adsorption at the liquid-liquid interface. 5.3 Solubility parameters, surfactants and emulsions 5.4 Relationship between HLB and solubility parameter 5.5 Multiple emulsions 5.6 Mechanical stability of emulsions	Lectures	2 lectures = 4 hours
6. FOAMS IN THE FOOD INDUSTRY 6.1 Importance and formation of foams 6.2 Properties of foams 6.3 Stability, control and persistence of foams 6.4 Foam formation and structure of surfactants 6.5 Effect of additives on foams 6.6 Inhibition of foams	Lectures	1 lecture= 2 hours
7. AEROSOLS IN THE FOOD INDUSTRY 7.1Importance of aerosols 7.2 Colloidal properties of aerosols 7.3 Liquid and solid aerosols	Lectures	1 lecture= 2 hours
8. CHROMATOGRAPHIC METHODS USED FOR SEPARATION IN FOOD MATRICES 8.1 Fundamentals principles: adsorption, partition, ion exchange, molecular exclusion 8.2 Chromatographic techniques: TLC, GC, LC and	Lectures	3 lectures = 6 hours

HPLC 8.3 Applications of chromatography		

8.2. PRACTICAL WORK **Number of hours –28**	Theoretical presentation of practical works	
1. Safety and Protection in the Lab. Periodic system of elements	Practice and seminar	1 lab work (2 hours)
2. Refractometry: measuring the refractive index of honey	Experimental work	1 lab work (2 hours)
3. Chemical thermodynamics (enthalpy, entropy, Gibbs free energy).	Experimental work	1 lab work (2 hours)
4. Azeotropic mixtures distillation: diagram phase.	Practice and seminar	1 lab work (2 hours)
5. Classification of chromatographic separation methods	Experimental work	1 lab work (2 hours)
6. Liquid and gas chromatography - TLC, SPE, HPLC and GC separations.	Experimental work	3 lab work (6 hours)
7. Optical properties of colloids: refraction, adsorption, diffusion.	Experimental work	1 lab work (2 hours)
8. Emulsions water/oil, oil/water - obtaining methodology and application in food	Experimental work	1 lab work (2 hours)
9. Preparation of colloidal systems (synthesis of metal nanoparticles)	Experimental work	1 lab work (2 hours)
10. Gel type polysaccharides (alginates, cellulose and pectin)	Experimental work	1 lab work (2 hours)
11. Foams and membrane systems used in food industry	Experimental work	1 lab work (2 hours)
12. Knowledge verification - Colloquium	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 about nospectroscopic methods, assessment of food matrix property: (thermochemistry).	Verification during the semester (a written	75%

	Knowledge of the types of disperse systems that constitute the food matrix and colloid properties Knowledge of separation principles and chromatographic identification (TLC, HPLC, GC).	verification)	
10.5. Seminar/Laboratory	Theoretical and practical knowledge of thermochemical methods of analysis. The chromatographic separation of molecular mixtures from food matrices. Theoretical and practical knowledge of chromatographic analysis using different methods and techniques. Solving specific problems related to to the stabilisation of colloids (emulsions, gels, foams).	Verification during the semester -face-to-face or *online* Verification – Colloquium (a written verification)	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] Education levels- choose of the three options: Bachelor/ * Master/Ph.D.

[2] Discipline status (content)- for the undergraduate level, choose one of the options:- **FD** (fundamental discipline), **BD** (basic discipline), **CS** (specific disciplines-clinical sciences), **AP** (specific disciplines-animal production), **FH** (specific disciplines-food hygiene), **UO** (disciplines based on the university's options).

[3/] Discipline status (compulsoriness)- choose one of the options – **CD** (compulsory discipline) **OD** (optional discipline) **ED** (elective discipline).

[4] One credit is equivalent to 25-30 hours of study (teaching activities and individual study).

[5 / *] Disciplines: AK- Advanced knowledge, CT- Complementary Training, S- Synthesis

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. Dr. Ramona SUHAROSCHI

Approved by the Faculty Council on
28.09.2021

Dean
Prof. Dr. Elena MUDURA