UNIVERSITATEA DE ȘTIINȚE AGRICOLE ȘI MEDICINĂ VETERINARĂ CLUJ-NAPOCA
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**No._____of _____** **USAMV form 0701010102**

# SUBJECT OUTLINE

## 1. Information on the programme

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|---|---|
| 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 |
| 1.4. Field of study | Food Engineering |
| 1.5. Education level | Bachelor |
| 1.6. Specialization/ Study programme | Technology of agricultural products processing |
| 1.7. Form of education | Full time |

## 2. Information on the discipline

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| 2.1. Name of the discipline | **Inorganic chemistry and analytical chemistry 1** | | | | | | | |
| 2.2. Course coordinator | **Prof. dr.Edward Ioan Muntean** | | | | | | | |
| 2.3. Seminar/ laboratory | **Prof. dr.Edward Ioan Muntean** | | | | | | | |
| 2.4. Year of study | **I** | 2.5. Semester | **I** | 2.6. Type of evaluation | Continuous | 2.7. Discipline status | Content[2] | **DF** |
| | | | | | | | Compulsoriness[3] | **DI** |

## 3. Total estimated time (teaching hours per semester)

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|---|---|---|---|---|---|
| **3.1. Hours per week – full time programme** | 4 | out of which: 3.2. lecture | 2 | 3.3. seminar/ laboratory | 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** | | | | | |
| **3.7. Total hours of individual study** | 44 | | | | |
| **3.8. Total hours per semester** | 100 | | | | |
| **3.9. Number of credits[4]** | 4 | | | | |

## 4. Prerequisites

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| 4.1. curriculum-related | Fundamental knowledge of inorganic chemistry, organic chemistry, physical chemistry, physics and algebra - according to high school curricula. |
| 4.2. skills-related | • Oral and written communication in Romanian<br>• Carrying out practical work using the instructions from the Practical work guide<br>• Teamwork<br>• Digital competencies - use of information technology for word processing, data processing (spreadsheets and graphical representations) and documentation using the Internet |

**5. Conditions**

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| 5.1. for the lecture | ▪ Academic discipline requires compliance with the start and end of the course.<br>▪ Other activities during the lectures are not allowed; mobile phones will be turned off.<br>▪ The course is interactive, students can ask questions regarding the content of the lecture;<br>▪ The classroom must be equipped with a blackboard, a computer, a video projector and a projection screen<br>▪ Attendance required: min. 50% of the number of courses |
| 5.2. for the seminar/ laboratory | ▪ Punctuality, wearing protective equipment (white coat), compliance with the academic discipline, the norms of technique and safety of workers and those of prevention and extinguishing of fires are compulsory on the whole duration of the practical works.<br>▪ During practical works it is mandatory the prior reading of the Practical works' guide; students will carry out individual activities with the materials provided, according to the instructions from the guide.<br>▪ The laboratory must be equipped with a blackboard, analytical reagents, laboratory utensils, glassware, equipment and specific apparatuses.<br>▪ Attendance required: 100% (absences will be recovered!) |

**6. Specific competencies acquired**

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| Professional competences | ▪ C1.1. To describe and use basic concepts, theories and methods in inorganic chemistry and analytical chemistry, related to the structure, properties and transformations of food components and contaminants.<br>▪ C1.2. To explain and interpret concepts, processes, models and methods in inorganic chemistry and analytical chemistry, using basic knowledge on the composition, structure, properties and transformations of food components.<br>▪ C1.3. To identify the specialized terminology regarding the quality of food products to collaborate with the institutions in the field of food quality and safety.<br>▪ C1.4. To evaluate the qualitative and quantitative characteristics, the performances and the limitations of the analytical processes applied in the agri-food chain.<br>▪ C1.5. To perform critical analysis, evaluation of the characteristics, performances and limits of some analytical processes and some laboratory equipment in the agri-food industry |
| Transversal competences | ▪ CT1. Efficient use of various ways and techniques of learning training for the acquisition of information from bibliographic and electronic databases, both in Romanian and in a language of international circulation.<br>▪ CT2. Applying interrelationship techniques within a team, amplifying and refining the empathic capacities of interpersonal communication and assuming specific tasks in carrying out group activity to resolve conflicts, as well as optimal time management. |

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

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| 7.1. Overall course objective | To acquaint students with the fundamental concepts, processes and methods of classical qualitative analytical chemistry, with the principles of analysis methods and main working techniques, by exposing and explaining specific theories, phenomena, processes and methods, regarding the structure, properties and transformations of some inorganic chemicals of interest for the food industry, thus accomplishing the necessary foundation for approaching the second module of this discipline and the technological disciplines of the following years. |
| 7.2. Specific objectives | ▪ To train and develop exploration, observation and experimentation skills through the use of specific reagents, equipment, devices, utensils and operations.<br>▪ To initiate students in performing qualitative chemical analyses through their involvement in identifying relevant ions in the composition of food products.<br>▪ To ensure the concepts and abilities necessary to solve the computing applications in the laboratory activity.<br>▪ To create adequate conditions for stimulating teamwork.<br>▪ To form a deontological attitude regarding the informational impact of the qualitative chemical analysis.<br>▪ To develop the scientific curiosity specific to a researcher, the analytical rigour and the scientific exigency.<br>▪ To empower and involve students individually in approaching current and future scientific issues by including them in research activities. |

**8. Content**

| **8.1. LECTURE**<br>**Number of hours –28** | Teaching methods<br>Lecture | Notes<br>1 lecture = 2 hours |
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|---|---|---|---|
| **I. INORGANIC CHEMISTRY – 14 HOURS** | | | |
| 1. | Chemical elements, electronic configurations of the elements, the periodic table of elements, blocks of elements. | Lecture<br>Explication<br>Modelling | 4 hours |
| 2. | Electrochemical character. Chemical bonds: ionic, covalent, coordinative, metallic. The hydrogen bond. | | 2 hours |
| 3. | Chemical reactions: combination reactions, decomposition reactions, change reactions, redox reactions | | 2 hours |
| 4. | Representative chemical elements and combinations: methods of production, physical properties, chemical properties, uses. | | 2 hours |
| 5. | Acids and bases: general methods of preparation, chemical properties, representatives (sulfuric acid, phosphoric acid, nitric acid, hydrochloric acid, sodium hydroxide, ammonia) | | 2 hours |
| 6. | Salts: general methods of preparation, chemical properties, representatives ($Na_2CO_3$, $CaCO_3$, $NaHCO_3$, $NH_4NO_3$, $Na_2SO_4$, $K_2SO_4$, $Al_2(SO_4)_3$, $(NH_4)_2SO_4$, KCl, NaCl, $CaCl_2$) | | 2 hours |
| **II. ANALYTICAL CHEMISTRY – 14 HOURS** | | | |
| 7. | The purpose and importance of analytical chemistry. Classification of analytical methods. | Lecture<br>Explication<br>Modelling<br>The exercise | 1 hour |
| 8. | Electrolyte solutions. Solubility of substances. Ways of expressing the concentration of solutions. Calculation applications. | | 2 hours |
| 9. | Electrolytic dissociation. The ionic product of water. pH, pOH. pH indicators. | | 2 hours |
| 10. | Analytical reactions: classification, characteristics (specificity, selectivity, sensitivity). | | 1 hour |
| 11. | Acid-base reactions in chemical analysis. Theories on acids and bases. Analytical applications of acid-base reactions. | | 2 hours |
| 12. | Reactions with precipitate formation. Solubility of precipitates, solubility product. Factors influencing solubility. Analytical applications. | | 2 hours |
| 13. | Redox reactions. Analytical applications of redox reactions. | | 1 hour |
| 14. | Reactions with the formation of complex combinations. Analytical applications of complex combinations. | | 1 hour |
| 15. | Analytical classification of anions. Analytical classification of cations. Identification reactions. | | 2 hours |

| **8.2. PRACTICAL WORK**<br>**Number of hours – 28** | Theoretical presentation of practical works | 1 lab work = 2 hours |
|---|---|---|
| Working instructions and technical norms of laboratory work safety. Work organization, fire prevention and rules for fire extinguishing and first aid measures in case of accidents. | Explication<br>Heuristic conversation | 2 hours |
| Atomic structure; atomic number, mass number, isotopes, isotones, isobars - calculation applications. | Explication<br>Heuristic conversation<br>The exercise | 2 hours |
| Electronic configurations. Locating the elements in the periodic table based on their electronic configurations. Blocks of elements | Explication<br>Heuristic conversation<br>The exercise | 2 hours |
| Atomic mass, molecular mass, mole - computational applications. | Explication<br>Heuristic conversation<br>The exercise | 2 hours |
| Establishing the coefficients in the equations of chemical reactions - the algebraic method. Stoichiometric calculations. | Explication<br>Heuristic conversation<br>The exercise<br>Problem-solving | 2 hours |
| Establishing the coefficients in the equations of chemical reactions – the redox method. | Explication<br>Heuristic conversation<br>The exercise | 2 hours |
| Colloquy | Evaluation | 2 hours |
| Preparation of solutions. Ways of expressing the concentration of solutions: | Demonstration | 2 hours |

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| calculation applications. The pH of solutions: determination and calculation applications. | Problem-solving<br>The exercise<br>Problem-solving | |
| Identification reactions for anions $Cl^-$, $I^-$, $S^{2-}$; $CO_3^{2-}$, $PO_4^{3-}$, $NO_3^-$, $NO_2^-$ and $SO_4^{2-}$. | Demonstration<br>Practical work | 2 hours |
| Identification of the anion from an unknown sample | Practical evaluation | 2 hours |
| Cations of groups 1 and 2; identification reactions for $Ag^+$, $Pb^{2+}$, $Cu^{2+}$, $Hg^{2+}$ | Demonstration<br>Practical work | 2 hours |
| Cations of group 3; identification reactions for $Al^{3+}$, $Cr^{3+}$, $Co^{2+}$, $Fe^{2+}$, $Fe^{3+}$, $Mn^{2+}$, $Zn^{2+}$, $Ni^{2+}$. | Demonstration<br>Practical work | 2 hours |
| Cations of groups 4 and 5; identification reactions for $Ca^{2+}$, $Ba^{2+}$, $NH_4^+$ and $Mg^{2+}$ | Demonstration<br>Practical work | 2 hours |
| Identification of the ions from an unknown sample | Practical evaluation | 2 hours |

***Compulsory bibliography:***

1. Muntean, E., 2003, Chimie anorganică. Editura AcademicPres Cluj Napoca.
2. Muntean, E., 2007, Chimie analitică şi analiză instrumentală. Editura AcademicPres Cluj Napoca.
3. Muntean, E., 2006, Chimie analitică şi analiză instrumentală: tehnici de lucru şi aplicaţii de calcul. Editura AcademicPres Cluj Napoca.

***Optional bibliography:***

1. Luca C., A.Duca, A.Crişan, 1983, Chimie analitică şi analiză instrumentală. Ed. Didactică şi Pedagogică, Bucureşti.
2. Pietrzyk D.J., W.Frank, 1989, Chimie analitică. Editura Tehnică, Bucureşti.
3. Rădulescu G., M.I.Moise, I.Ceteanu, 1997, Chimie analitică calitativă. Editura Didactica şi Pedagogică Bucureşti.

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

The disciplines of Inorganic Chemistry and Analytical Chemistry have the role of providing students with theoretical knowledge and practical skills with which they can justify and control aspects related to the nature and properties of raw materials/ their processes of transformation into finished products. The activities carried out by the students aim at developing the capacities of individual work, of analysis and interpretation of the results, of the capacity to offer solutions to some practical problems. The content of the disciplines is in accordance with what is studied in other universities with similar study programs in the country and abroad. To adapt to the requirements of the labour market, the proposals of the graduates of the Faculty of Food Science and Technology working in the field were taken into account when drawing up the subject outline. By mastering the theoretical and methodological concepts and by approaching the practical aspects involved by these disciplines, students acquire an adequate body of knowledge, by the skills required for the occupations provided in RNCIS.

**10. Assessment**

| Type of activity | 10.1. Assessment criteria | 10.2. Assessment methods | 10.3. Percentage of the final grade |
|---|---|---|---|
| **10.4. Lecture** | The level of assimilation of knowledge. Correctness of answers, acquisition and understanding of the addressed issues. Logical coherence | Evaluation 1 - inorganic chemistry<br>Evaluation 2 - qualitative analytical chemistry | 70% |
| **10.5. Seminar/ Laboratory** | The manner of preparing the study topics, solving the calculation applications, the quality of the activity carried out. Ability to analyze and interpret results | Continuous evaluation<br>Practical evaluation | 30% |

**10.6. Minimum performance standards**

- solving simple problems based on given algorithms;
- carrying out a project in a team - identifying an unknown substance from a sample;
- elaboration of a study by using relevant documentation resources (including internet, databases, online courses, etc.);
- specifying the properties and uses for the studied substances;
- description of the behaviour of the chemical species studied in a given context;
- the correct naming of the studied substances, according to the IUPAC requirements;
- identification of the stages of performing some experimental, laboratory activities;
- the correct use of laboratory apparatus and equipment;
- proper reporting of the experimental observations in the form of tables, graphs, diagrams.

[1] Level of study- to be chosen one of the following - Bachelor/Postgraduate/Doctoral

[2] Course regime (content) - for bachelor level 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
9.09.2021

Course coordinator
Prof.dr.ing. Edward Ioan Muntean

Laboratory work/seminar coordinator
Prof.dr.ing. Edward Ioan Muntean

Subject coordinator
Prof. dr. ing. Edward Ioan Muntean

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