FACULTY OF PHARMACY

STUDY PROGRAM 0916.1 PHARMACY

CHAIR OF GENERAL CHEMISTRY

APPROVED
at the meeting of the Commission for Quality Assurance and Evaluation of the Curriculum faculty of Pharmacy
Minutes No. 2 of 21.12.2017

Chairman, PhD, associate professor

Uncu Livia _____

APPROVED
at the Council meeting of the Faculty of Pharmacy
Minutes No. 2 of 22.12.2017

Dean of Faculty, PhD, associate professor

Ciobanu Nicolae _____

APPROVED
approved at the meeting of the chair of
General chemistry
Minutes No.4 of 30.10.2017
Head of chair, PhD, associate professor

Cheptanaru Constantin _____

SYLLABUS

DISCIPLINE **GENERAL AND INORGANIC CHEMISTRY**

Integrated studies

Type of course: **Compulsory**

Chisinau, 2017

I. INTRODUCTION

- **General presentation of the discipline: place and role of the discipline in the formation of the specific competences of the professional / specialty training program**

  General and Inorganic Chemistry curriculum for pharmacist qualification is a normative pedagogical document and a didactic tool for the efficient organization of the educational process. At the Nicolae Testemitanu State University of Medicine and Pharmacy the curriculum development is based on several normative regulatory documents: Framework Program for Pharmaceutical Higher Education in the Republic of Moldova, based on the University Charter of PI Nicolae Testemitanu SUMPh, Regulations for organization of studies in higher education based on the National Credit Studies System, no. 1/8 of 06.04.2017, Regulation for evaluation and academic performance in State University of Medicine and Pharmacy "Nicolae Testemitanu", no. 5/4 of 12.10.2016, coordinated with the curriculum of pharmaceutical disciplines (analytical chemistry, organic chemistry, physical and colloidal chemistry, pharmaceutical chemistry).

  Chemistry is a branch of physical science that studies the composition, structure, properties and change of matter. Chemistry is typically divided into several major sub-disciplines. Some of them are General and Inorganic chemistry. General chemistry is chiefly concerned with atoms and molecules and their interactions and transformations, with gases, liquids, solids, soluble and insoluble mixtures. Inorganic chemistry is the study of the properties and reactions of inorganic compounds. Chemistry plays a central role in science and is often intertwined with other branches of science like physics, biology, geology etc. Chemistry plays an important role in meeting human needs for health care products as well as other materials aimed at improving the quality of life. Many life saving drugs have been isolated from plant and animal sources or prepared by synthetic methods. With a better understanding of chemical principles it has now become possible to design and synthesize new materials having specific properties. General and Inorganic Chemistry curriculum is for Pharmacy students, which will cover general and inorganic chemistry in relation to drug molecules. to provide the fundamental knowledge and overview of all core topics related to general, and inorganic chemistry.

- **Mission of the curriculum (aim) in professional training**

  As all drugs are chemicals, and pharmacy is mainly about the study of various aspects of drugs, including manufacture, storage, actions and toxicities, metabolisms and managements, chemistry plays a vital role in pharmacy education. Medicines or drugs that are taken for the treatment of various ailments are chemicals, either organic or inorganic. In order to have a proper understanding and knowledge of these drugs and their behavior, there is no other alternative but to learn chemistry. Everywhere, from

discovery to development, from production and storage to administration, and from desired actions to adverse effects of drugs, chemistry is involved directly. So pharmacy students need a solid foundation in chemistry knowledge and it is needless to say that to become a good pharmacist the knowledge of the chemistry of drugs is essential.

Pharmacy students will learn a great deal of the information that has been gathered by scientists about chemistry. But, chemistry is not just information. It is also a process for finding out more about matter and its changes. One of the aims of this course is to derive the main ideas of general and inorganic chemistry from chemical observations. Laboratory activities are the primary means that chemists use to learn more about matter. The activities in the general and inorganic chemistry laboratory require that students form and test hypotheses, measure and record data and observations, analyze those data, and draw conclusions based on those data and their knowledge of chemistry. These processes are the same as those used by professional pharmacists and all other scientists.

- Languages of the course: Romanian, Russian, English;
- Beneficiaries: students of the II year, faculty of Pharmacy.

II. MANAGEMENT OF THE DISCIPLINE

Code of discipline		**General chemistry – F.01.O.004** **Inorganic chemistry – F.02.O.016**	
Name of the discipline		**General and inorganic chemistry**	
Person in charge of the discipline		**Chistruga Loghin,** PhD, associate professor **Melnic Silvia,** PhD, associate professor	
Year	**I**	Semesters	**I and II**
Total number of hours, including:			**270**
Lectures	**68**	Practical/laboratory hours	**85**
Seminars		Self-training	**117**
Clinical internship			
Form of assessment	**CD and E**	Number of credits	**9**

III. TRAINING AIMS WITHIN THE DISCIPLINE

At the end of the discipline study the student will be able to:

- ***at the level of knowledge and understanding:***
  - to understand the goals and objectives of general and inorganic chemistry, ways and methods of their accomplishments;
  - to understand the main role and importance of general and inorganic chemistry methods in pharmacy, the scientist's practical activity in the pharmaceutical field;
  - to know the main chapters, notions and methods of general and inorganic chemistry;
  - to know connection properties between inorganic compounds and the position of elements in the periodic system;
  - to calculate the energetic parameters for chemical processes;
  - to know the bases of inorganic theory compounds structure and theory of chemical binding;
  - to know main properties of chemical elements and their compounds;
  - to know main types of inorganic compounds and their contemporary nomenclature (including complex compounds).
- ***at the application level:***
  - to work independently with the literature in the field of general and inorganic chemistry.
  - to apply the principles processes and the technique of achieving the experimental work at the general and inorganic chemistry.
  - to use at the laboratory class the main inorganic reagents, solvents and chemical dishes.
  - to use properly the nomenclature of inorganic compounds.
  - to calculate the main energetic parameters in order to study various chemical processes.
  - to prepare solutions with the concentration of dissolved substances.
  - to predict the direction of chemical reaction, applying factors that affect chemical equilibrium
- ***at the integration level:***
  - to estimate the significance of general and inorganic chemistry at the level of integration through pharmacy branches (pharmacology, pharmaceutical chemistry, toxicological chemistry, technology of medical products, etc).
  - to know the chemical actions of different medical inorganic compounds in the human body.
  - to study the most important chemical elements as well as their compounds, that are most used in the pharmaceutical field.
  - to know the presence of chemical elements, especially bio-elements in the constitution of living matters, the way that this connects to the protein components, to establish their functions and behaviors in bioinorganic chemistry , also to take and to use for human benefits from what nature offers to us.

IV. PROVISIONAL TERMS AND CONDITIONS

Combining theoretical and practical studies, the primary goal of general and inorganic chemistry is to give out a full training that improves the productive forces, acceleration of the technical progress in medicine, industry, pharmacy, etc. Chemistry is the science of matter, its properties, and changes. According to the Curriculum that is oriented to the actual pedagogical principles, the material is presented in two parts:

General chemistry deals with theoretical bases of chemistry and refers to the main notions of the physical chemistry necessary to study inorganic chemistry.

Inorganic chemistry deals with the studying of elements and their compounds. Both the elements with nonmetallic properties followed by the elements with semi –metallic properties and the elements with metallic properties are studied.

The study of general and inorganic chemistry requires some level of mathematics and physics. These disciplines are a part of the language of chemistry, and a lack of familiarity with that language can become a barrier to success in understanding chemistry. The course assumes previous knowledge of chemistry. It is designed to provide students whose background includes secondary school chemistry.

V. THEMES AND ESTIMATE ALLOCATION OF HOURS

Lectures, practical hours/ laboratory hours/seminars and self-training

No. d/o	THEME	Number of hours		
		Lectures	Practical hours	Self-training
1.	Atomic structure. The quantum mechanical model of the atom. Arrangements of electrons in atoms. Quantum numbers. Electron configurations.	2	2	-
2.	Periodic repetition of elements physical and chemical properties. Lanthanide contraction.	2	2	6
3.	Chemical bond. Valence bond theory. Covalent bond and its properties.	2	2	6
4.	Chemical bond. Molecular orbital theory.	2	2	6
5.	Chemistry of coordination compounds. Werner's theory. Nomenclature and classification of coordination complexes.	2	2	6
6.	Chelates. Intracomplexes. Notions of chelatoterapy. Complex ion equilibrium. Isomers of coordination complexes.	2	2	6
7.	Types of redox reactions. Balancing redox reactions. Predicting the direction of redox reactions.Quiz nr.1.	2	2	6
8	Energy change in chemical processes. Internal energy. Enthalpy. Hess's Low. Direction of chemical reactions. Entropy. Gibbs free energy.	2	2	6
9	Chemical equilibrium. The law of mass action. Equilibrium constants Kc, Kp, Ka. Le Châtelier's Principle.	2	2	6
10	Chemical kinetics. Reaction rates. Factors that affect reaction rates. Notion of pharmacokinetics.	2	2	6
11	Solutions. Composition of solutions. Expressions of concentration.	2	2	6

No. d/o	THEME	Number of hours		
		Lectures	Practical hours	Self-training
	Equivalent and equivalent factor.			
12	Colligative properties of solutions. Quiz nr.2.	2	2	5
13	Weak electrolytes. Degree of dissociation. Ionization constant. Ostwald's dilution low.	2	2	5
14	Strong electrolytes. Ionic activity and ionic strength.	2	2	5
15	Hydrolysis. Hydrolysis constant. Degree of hydrolysis.	2	2	5
16	The theory of acids and bases. The exponent of Hydrogen and Hydroxyl. Quiz nr.3.	2	2	5
17	Acids and bases strength. Acidity and basicity constants.	2	2	
18	*s* block elements. Chemistry of hydrogen. Hydrogen peroxide.	2	3	2
19	Group IA: the alkali metals. The sodium-potassium pump. Medicinal compounds of sodium and potassium.	2	3	2
20	Group IIA: the alkaline-earth metals. Biological role and toxicity of calcium and magnesium. Toxicity of beryllium and radioactive Sr-90. Quiz nr.4.	2	3	2
21	The *d* block elements. Properties of VIB group elements. Chemistry of chromium. Biological role of chromium and molybdenum.	2	3	2
22	Properties of VII B group elements. Chemistry of manganese. Manganese compounds in medicine and pharmacy.	2	3	2
23	Properties of VIII B group elements. Chemistry of iron, cobalt and nickel. Medicinal compounds of iron and nickel. Platinum group metals. Antitumor activity of platinum compounds. Quiz nr.5.	2	3	2
24	Properties of I B group elements. Chemistry of copper, silver and gold. Biological importance of copper. Medicinal compounds of silver and gold.	2	3	2
25	Properties of II B group elements. Chemistry of zinc, cadmium and mercury. Medicinal compounds of zinc and mercury. Toxicity of cadmium and mercury.	2	3	2
26	The *p* block elements. Properties of IIIA group elements. Chemistry of aluminium and boron. Their compounds in medicine.	2	3	2
27	Properties of IVA group elements. Chemistry of carbon and silicon. Their biological importance.	2	3	2
28	Chemistry of germanium and lead. Toxicity of lead, its compounds in medicine. Antitumor activity of germanium compounds.	2	3	2
29	Properties of VA group elements. Chemistry of nitrogen. Its biological importance. Medicinal compounds of nitrogen.	2	3	2
30	Chemistry of phosphorous. Its biological importance. Quiz nr.6	2	3	2
31	Chemistry of arsenic, antimony and bismuth. Toxicity of arsenic compounds. Medicinal compounds of arsenic, antimony and bismuth.	2	3	2

No. d/o	THEME	Number of hours		
		Lectures	Practical hours	Self-training
32	Properties of VI A group elements. Chemistry of sulphur. Biological importance of sulphur and its medicinal compounds.	2	3	2
33	Properties of VII A group elements. Chemistry of halogens. Biological importance of halogens and their compounds in medicine.	2	3	2
34	Macro- and micro- biogenic elements. Interaction of elements in a human body. Environmental protection.	2	3	
Total		**68**	**85**	**117**

VI. REFERENCE OBJECTIVES OF CONTENT UNITS

Objectives	Content units
Chapter 1. Atomic structure and chemical bond.	
• To understand the quantum mechanical model of the atom • To know the periodic law and its application • To know quantum numbers and to be able to write electron configurations of atoms • To know physical and chemical properties of elements and to understand their periodic repetition • To understand valence bond theory and molecular orbital theory • To define coordination compounds and to know the theory of coordination compounds • To be able to write correct chemical formulas of coordination compounds and to name them • To be able to write and balance redox reactions	Atomic structure. The quantum mechanical model of the atom. Arrangements of electrons in atoms. Quantum numbers. Electron configurations. Lanthanide contraction. Periodic repetition of elements physical and chemical properties. Chemical bond. Covalent bond and its properties. Valence bond theory. Molecular orbital theory. Chemistry of coordination compounds. Werner's theory. Nomenclature and classification. Chelates. Intracomplexes. Notions of chelatoterapy. Complex ion equilibrium. Formation (stability) constant. Instability (dissociation) constant. Isomers of coordination compounds. Types of redox reactions. Balancing Redox Reactions. Predicting the direction of redox reactions.
Chapter 2. Energy change in chemical processes and reaction rates.	
• to define the first and the second law of thermodynamics, and relate them to human body as an open system • to know the notions of internal energy, enthalpy, entropy, Gibbs free energy	Energy change in chemical processes. Internal energy. First and second law of thermodynamics. Enthalpy. Standard state of a substance. Hess's Low. Entropy. Gibbs free energy. Direction of chemical reactions. Chemical

Objectives	Content units
• to be able to determine enthalpy of a chemical reaction • to be able to determine the dependence of the rate on concentration and temperature • to define the notion of activation energy and to be able to determine it for a given chemical reaction • to know the notion of pharmacokinetics • to define Le Châtelier's principle and to understand factors that affect chemical equilibrium • to be able to do thermodynamic and thermo chemical calculations	equilibrium. Equilibrium constants Kc, Kp, Ka. Factors that affect chemical equilibrium. Le Châtelier's Principle. Chemical kinetics. Reaction rates. Factors that affect reaction rates. Activation energy. Reaction mechanisms. Molecularity and order of chemical reactions. Van´t Hoff equation. Arrhenius equation. Notion of pharmacokinetics.
Chapter 3. Solutions and their properties	
• To define solutions • To know various expressions of concentration and their relations • To be able to prepare a solution with a given concentration • To be able to convert one kind of concentration measure into another • To know properties of electrolytes and non-electrolytes • To define ionization constants of acids and bases and relate them to the strengths of acids and bases • To defined degree and constant of dissociation and relate them to the strength of an electrolyte • To predict the acidity of salt solutions and to explain hydrolysis reactions	Solutions. Composition of solutions. Expressions of concentration. Equivalent and equivalent factor. Colligative properties of solutions. Osmosis. Osmotic pressure. Raoult's law. Weak electrolytes. Degree of dissociation. Ionization constant. Ostwald's dilution low. Strong electrolytes. Ionic activity. Free-ion activity coefficient. Ionic strength. Hydrolysis. Hydrolysis constant. Degree of hydrolysis. Arrhenius acid –base theory. Brønsted–Lowry acid–base theory. Strengths of acids and bases. Acid (base) ionisation constant (Ka, Kb). Ion product of water. pH scale. pH and pOH.
Chapter 4. *s* block elements	
• To define s block elements and their position in the periodic system • To know the properties of *s* elements • To know the biological role of sodium, potassium, magnesium and calcium • To understand the toxicity mechanism of beryllium and radioactive Sr-90 • To know about the application of some *s* element compounds (NaCl, $Na_2SO_4 \cdot 10H_2O$, KCl, $NaHCO_3$, NaBr, KBr, NaI) in medicine and pharmacy	Group IA: the alkali metals. Group IIA: the alkaline-earth metals. Biological role and toxicity of alkali and alkaline earth metals. The sodium-potassium pump. Toxicity of beryllium and radioactive Sr-90. Medicinal compounds of sodium, potassium, magnesium and calcium.
Chapter 5. *d* block elements	
• To define *d* block elements and their position in the periodic system • To know the properties of *d* elements in different oxidation states • To know test reactions for the following ions: Cr^{2+},	The *d* block elements. Specific properties of *d* elements. Properties of VIB, VIIB, VIIIB, IB and IIB group elements. Medicinal compounds of iron, cobalt, silver,

Objectives	Content units
Fe^{2+}, Fe^{3+}, Co^{2+}, Ni^{2+}, Cu^{2+}, Ag^{+}, Hg^{2+}, Hg_2^{2+}, Mn^{2+} • To know the biological role of chromium, manganese, iron, cobalt, nickel, copper, zinc, cadmium • To conclude about application of *d* element compounds in medicine and pharmacy • To understand the toxicity mechanism of cadmium, mercury, molybdenum • To know about antitumor activity of platinum compounds • To know how to reduce the disorder of metal balance in the biosphere	gold, manganese, zinc and mercury. Biological role of bio metals. Toxicity of cadmium and mercury compounds. Platinum group metals. Antitumor activity of platinum compounds.
Chapter 6. *p* block elements	
• To define *p* block elements and their position in the periodic system • To demonstrate the change of properties of *p* elements in groups and periods • To know the properties of *p* elements from IIIA – VIIA groups • To know biological importance of nitrogen, oxygen, phosphorous, carbon, halogens etc • To conclude about application of *p* element compounds in medicine and pharmacy • To understand the toxicity mechanism of arsenic and halogen compounds • To apply accumulated knowledge at other disciplines	The *p* elements. General characteristics of the p elements. Properties of IIIA – VIIA groups elements. Maine types of compounds: oxides, hydroxides (bases). Variable oxidation states. Biological importance of *p* elements. Medicinal compounds of boron, aluminium, lead, germanium, nitrogen, antimony, bismuth, sulphur. Halogens and their compounds in medicine. Their toxicity. Macro- and microelements in the human body. Toxicity of arsenic compounds. The Marsh test. Antitumor activity of germanium compounds.

VII. PROFESSIONAL (SPECIFIC (SC)) AND TRANSVERSAL (TC) COMPETENCES AND STUDY OUTCOMES

✓ Professional (specific) (SC) competences

- PC1. Students to acquire familiarization with the basic notions, concepts, theories, laws and models of chemistry.
- PC2. Ability to use adequate chemical terminology.
- PC3. An in-depth understanding of general and inorganic chemistry. Ability to demonstrate knowledge of chemical elements and their compounds (structure, physical chemical properties, synthesis etc.). Skills at applying theoretical knowledge of general and inorganic for the practical pharmaceutical purposes.
- PC4. Identification, description and adequate use of specific notions to complete the image of general and inorganic chemistry as applied science.
- PC5. Increase students interest in study and investigation of inorganic compounds and chemical processes. Stimulation of analytical and synthetic thinking. Numeracy and calculation skills. Ability to interpret data from laboratory experiments in terms of their significance.
- PC6. Understanding the value of cultivating work-discipline, based on motivation, fairness, perseverance and efficiency.

✓ Transversal competences (TC)

- TC1. Interpersonal skills, relating to the ability to interact with other people and to engage in team-working.
- TC2. Formation of professional and civic attitudes, allowing students to be honest, non-conflicted, cooperative, available to help people, interested in community development; to know and apply ethical principles related to medical-pharmaceutical practice; ability to recognize and analyze problems and plans strategies for their solution.
- TC3. To have openness to lifelong learning; to become aware of the need for individual study as a basis for personal autonomy and professional development.
- TC4. Ability to participate effectively in transdisciplinary teams working on research related to general and inorganic chemistry.

✓ Study outcomes

- To have adequate theoretical and practical knowledge of general and inorganic chemistry
- To know the principles of the electronic structures of inorganic compounds and theories of chemical bonding
- To know the main properties of chemical elements and their compounds
- To understand periodic repetition of elements physical and chemical properties
- To be able to do thermodynamic and kinetic calculations
- To be experienced in the safe handling of chemical materials as well in the handling of different chemical glassware and laboratory equipment
- To know biological importance as well as toxicity of inorganic medicinal compounds
- To be competent in the solving some chemical problems regarding to a given inorganic drug compounds

Note. Study outcomes (are deduced from the professional competencies and formative valences of the informational content of the discipline).

VIII. STUDENT'S SELF-TRAINING

No.	Expected product	Implementation strategies	Assessment criteria	Implementation terms
1.	Working with information sources	Careful reading of the assigned material before of each theoretical and practical lesson. Read the text-book in order to participate in class discussion, better follow the lecture, and ask meaningful questions. Reflect on the content as you read and take notes. Study worked out examples, which provide further illustration the ideas explained in text. Answer the questions. Prepare some instructions, notes as well as questions prior to arriving in the lab or in the class. Make acquaintance with supplementary bibliography units from the field of the studied discipline. Summarize and take notes in you own words to help you understand and retain information. Don't rely on highlighting as your main method of note-taking	Ability to extract the essentials, ability to survey the topics and concepts being studied; ability to review and reflect on the concepts that studied.	Throughout the semester
2.	Working problems	Solve the assigned problems. Working on problems in the book and other sources is an ideal way to prepare for chemistry disciplines.	Ability to work problems independently and correctly (not memorization). Achieving final answers that are completely correct is important.	Throughout the semester
3.	Working scientific essay	Select the topic and analyze it. The essay purpose should be unambiguously defined. Prepare a detailed outline of the essay and basic bibliography. Write definitions for each of the key terms. Start on the reading list, tacking the more general textbooks first and moving on the more specialized books, review articles etc. Take notes when reading. Working of the essay. Once the essay is finished it should be submitted to the lecturer.	The primary function of an assessment essay is to document what a student has learned. The higher quality student's essay the greater the progress the student will make in the session. Assessment student understanding; judgment about student achievement at certain relevant points in the learning process of study.	Throughout the semester

IX. METHODOLOGICAL SUGGESTIONS FOR TEACHING-LEARNING-ASSESSMENT

- ***Teaching and learning methods used***

The discipline General and Inorganic Chemistry is taught in a classical manner, which includes theoretical lectures and practical lessons. During the lecture the information of the course is presented. At practical classes students study the most necessary and significant laws of chemistry: Chemical thermodynamics, Chemical equilibrium, Chemical kinetics, Solution and their properties, Complex compounds, The atomic structure and chemical bond. The second part deals with principles of descriptive inorganic chemistry. The most important chemical elements, as well as their compounds which are most used in the pharmaceutical practice are studied.

Six (6) quizzes and seminars are given throughout the semesters: 3 in the Ist semester and 3 in the IInd semester. Quizzes and seminars test student knowledge of central concepts, ability to synthesize information. They are intended to test student understanding of the course material before the exams. According to fix schedule, the students five hour per week work with the teacher and 2-6 hours by themselves. Main practical oriented skills and abilities are retained only due to student's hard individual work while doing tasks in solving problems, exercises, etc.

- ***Applied teaching strategies / technologies****(specific to the discipline)*

It is necessary to point out some of the discipline's features, along with some suggestions about how to achieve the greatest advantage in General and Inorganic chemistry. Here are some ways that may help students to study.

If you 'think around' the subject you can generate the answer or more easily understand the topic. Brainstorming is a group creativity technique by which efforts are made to find a conclusion for a specific problem by gathering a list of ideas spontaneously contributed by its members. In other words, brainstorming is a situation where a group of people meet to generate new ideas and solutions around a specific domain of interest by removing inhibitions. Students are able to think more freely and they suggest many spontaneous new ideas as possible. All the ideas are noted down and are not criticized and after brainstorming session the ideas are evaluated.

Working on problems in the book and other sources is an ideal way to prepare for chemistry disciplines. Problem solving requires application of a previously learned theory by the students. This requires analytical capacity and a capacity to analyze a problem and to solve it. Problem solving also plays an important role in developing some important skills like observing the problem, questioning, hypothesizing, investigating; analyzing and interpreting data, communicating results.

From the pedagogical point of view one of most pure methods of education is the passive listening of a course, even in case of its careful structuring and illustration. Carrying out of practical lesson as well as laboratory experiments is more effective, than the simple reading about task execution, and even more effective when teaching somebody else. The science

learning goals of laboratory experiences include enhancing mastery of science subject matter, developing scientific reasoning abilities, developing practical skills, increasing understanding of the nature of science, cultivating interest in science and science learning, and improving teamwork abilities. The research suggests that laboratory experiences will be more likely to achieve these goals if they are designed with clear learning outcomes in mind, are thoughtfully sequenced into the flow of classroom science instruction, integrate learning of science content and process, and incorporate ongoing student reflection and discussion.

- ***Methods of assessment****(including the method of final mark calculation)*

Current: front and / or individual control via

1. applying the tests,
2. solving problems / exercises,
3. analysis of practical problems,
4. quizzes.

Final*:* Differentiated colloquium (semester I), exam (semester II).

The differentiated colloquium on General chemistry emphasizes the first semester and is held during final semester week. The midterm exam on qualitative analysis is composed of two sections: writing (tests) and oral section.

The final exam is at the end of the II semester and it comprises only material on Inorganic Chemistry. The final exam is composed of two sections: writing (tests) and oral section. It covers new material not covered on the midterm exam.

The final colloquium mark as well as exam mark is based on total points earned for the oral exam section, writing exam section and the average mark for the semester. The final average mark for the semester will be based on total points earned for quizzes.

Exams designed to reward understanding of the material and the ability to work problems independently and correctly (not memorization).The questions for exams are always approved by the head of department and are given to the students one month before exams.

Only a student whose average mark is 5.0 or better on the semester is allowed for the midterm or final exams. Attendance at all lectures is mandatory if students wish to be allowed to the exams.

Method of mark rounding at different assessment stages

Intermediate marks scale (annual average, marks from the examination stages)	National Assessment System	ECTSEquivalent
1,00-3,00	**2**	**F**
3,01-4,99	**4**	**FX**
5,00	**5**	**E**
5,01-5,50	**5,5**	
5,51-6,0	**6**	
6,01-6,50	**6,5**	**D**
6,51-7,00	**7**	
7,01-7,50	**7,5**	**C**
7,51-8,00	**8**	
8,01-8,50	**8,5**	**B**
8,51-8,00	**9**	
9,01-9,50	**9,5**	**A**
9,51-10,0	**10**	

The average annual mark and the marks of all stages of final examination (computer assisted, test, oral) - are expressed in numbers according to the mark scale (according to the table), and the final mark obtained is expressed in number with two decimals, which is transferred to student's record-book.

Absence on examination without good reason is recorded as "absent" and is equivalent to 0 (zero). The student has the right to have two re-examinations.

X. RECOMMENDED LITERATURE:

A. Compulsory:

1. STEVEN S. ZUMDAHL. *Chemistry.* Lexington, Massachusetts, Toronto, 1986/
2. FRANCIS MARION MILLER. *Chemistry, Structure and dynamics.* McGraw-Hill book company, USA., 1984/

B. Additional

1. CONUNOV Ţ.; POPOV M.; FUSU I. *Curs de chimie.* Ch., 1994.
2. ОГАНЕСЯН Е.Т. *Неорганическая химия.* М., 1984.