

QUALIFICATION CHARACTERISTIC

SPECIALITY: **CHEMISTRY**

MASTER PROGRAMME: **BIOLOGICALLY ACTIVE COMPOUNDS AND DRUGS**

EDUCATIONAL-QUALIFICATION DEGREE: **MASTER**

PROFESSIONAL QUALIFICATION: **MASTER IN CHEMISTRY**

PERIOD OF STUDY: **2 YEAR (FOUR SEMESTERS)**

The current qualification characteristic of "Biological active compounds and drugs" defines the professional designation and realization of master specialists (Master in chemistry). The educational qualification degree "Master" is at level 7 of National- and European qualifications frameworks. The Master's degree syllabus builds upon the knowledge acquired in the Bachelor's degree programme in different professional qualification of 4.2. The duration of training is 2 year.

SPECIALIST PROFILE

The training in Master's degree programme "Biologically active compounds and drugs" aims to prepare specialists in the field of pharmaceutical industry, scientific research laboratories for drugs discovery, laboratories for analysis and control, clinical laboratories, and others, in accordance with their acquired qualification. The wide coverage of the programme allow the participation in various administrative and management departments, international firms.

REQUIREMENTS FOR PREPARATION OF SPECIALIST

Masters of "Biological active compounds and drugs" to possess knowledge and skills for successful solution of chemistry tasks. They should be professionals with a profound general knowledge and with a solid fundamental training. In addition, they should be with linguistic competence and significant professional training, which should allow themselves to deepen their qualification and professional skills or to continue their study in a doctoral degree.

Acquired the qualification "master" degree of specialty must possess creativity, theoretically based approach and organizational techniques in application of experimental methods of the disciplines. Degree holders must acquire the ability to improve their qualification, learning the modern achievements in chemistry and to work successfully in the field of market economy.

The subject of the current Master's program is to study chemistry of biologically active compounds, their mechanisms of action, as well as the synthesis, properties and principles of drug discovery.

Graduates in “Biologically active compounds and drugs” will gain the depth of knowledge and skills in: modern methods of organic synthesis, pharmacology and drug toxicology, structural analysis of organic compounds, drugs chemistry and their mechanisms of action, biotechnology and etc. Additional knowledge they will have acquired through the elective courses: chemistry of heterocyclic compounds, biophysical-chemistry, basic microbiology and virology, biochemistry of nutrition and health, etc.

POSSIBILITIES FOR PROFESSIONAL REALIZATION

Graduates of a master's degree should realize in the field of:

- ✓ Pharmaceutical industry;
- ✓ Scientific research laboratories for drugs discovery;
- ✓ Laboratories for analysis and control;
- ✓ Clinical laboratories;
- ✓ Commercial companies supplying drugs and biologically active compounds.

CURRICULUM
BIOLOGICALLY ACTIVE COMPOUNDS AND DRUGS (2 years)

FIRST YEAR			
First semester	ECTS credits	Second semester	ECTS credits
Compulsory courses		Compulsory courses	
Organic chemistry	10	Instrumental methods of analysis	4
Analytical Chemistry	8	Theoretical chemistry	8
Biochemistry	8	Medicinal chemistry-part I	10
		Chemometrics	4
Elective courses group I <i>(Students choose one subject from each group)</i>	4	Elective courses group II <i>(Students choose one subject from each group)</i>	4
☞ High molecular compounds; ☞ X-ray diffraction analysis, NMR and mass spectral analysis of organic compounds; ☞ Methods for analysis and control; ☞ Modern chromatography methods ☞ Steroids		☞ Microbiology ☞ Stereochemistry of organic compounds ☞ Organic analysis ☞ Combinatorial Chemistry ☞ Antioxidants	
	Total 30		Total 30
SECOND YEAR			
Third semester	ECTS credits	Fourth semester	ECTS credits
Compulsory courses		Compulsory courses	
Some current methods in organic synthesis	8	Medicinal chemistry-part II	8
Rational drug design	8	General Pharmacology and Toxicology	3
Structural analysis of organic compounds	6	Elective course (group IV)	4
Clinical practice	4	Defense of BA Thesis in Chemistry	15
Elective course (group III)	4	or	
		State Exam in Chemistry	
Elective courses group III <i>(Students choose one subject from each group)</i>		Elective courses group IV <i>(Students choose one subject from each group)</i>	
☞ Natural products chemistry ☞ Mathematical models in chemistry and biology ☞ Mathematical models of drug- receptor interactions ☞ Chemotherapy and modern chemotherapeutic agents ☞ Clinical chemistry ☞ Technology of medicines		☞ Biologically active compounds- nutrition and health ☞ Interface surfaces and biomembranes ☞ Basics of Biotechnology ☞ Neural networks ☞ Application of IR- spectroscopy for organic and biological-active compounds analysis ☞ Sampling and sample preparation in the analysis of biological active compounds	
	Total 30		Total 30

TOTAL FOR TWO YEARS: 120 credits

COURSE DESCRIPTION

ORGANIC CHEMISTRY

ECTS credits: 10

Hours per week: 3l+0se+0le+1pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: I

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Atanas Chapkanov, PhD: achapkanov@swu.bg

Assoc. Prof. Zhivko Velkov, PhD: jivko_av@swu.bg

Annotation:

Study of general theoretical problems: current concepts about the character of the chemical bonds in the molecules of organic compounds, reactivity of organic molecules, explanation of general types of organic reactions and their mechanisms, problems of stereochemistry of organic compounds; study of general groups of organic compounds: alkanes, alkenes, alkynes, alkenes, cyclic compounds, aromatic compounds, alkyl- and aryl halides, organometallic compounds, alcohols and ethers. Study of carbonyl compounds, carboxylic acids and their derivatives, N-containing compounds, heterocyclic compounds, important biological active natural compounds: carbohydrates, amino acids, peptides, nucleotides, lipids, isoprenes, steroids and alkaloids.

Course topics:

The aim of the course in organic chemistry is to give the students thorough knowledge about the composition, structure, properties and methods for preparation of the most important organic compounds.

The practical exercises (labs + tutorials) seek to help the student by understanding and giving a meaning of the lectures, to acquire a habit of constructive application of knowledge, to build up skills in the field of organic chemistry

Teaching Methods: lectures, tutorials, laboratory work, individual student's work

Requirements/Prerequisites: knowledge in inorganic chemistry and physics

Assessment: 4 tests; written final exam

Rating:

Running control carried out by the lecturer – 10%

Running control from the tutorial - 10%

Evaluation of the work in the lab -10%

Evaluation of the final exam – 70%

ANALITICAL CHEMISTRY

ECTS credits: 8

Hours per week: 2l+0se+0le+2pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: I

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Petko Mandjukov, Ph.D: pmandjukov@swu.bg

Chief Assist. Prof. Petranka Petrova, PhD: ppd@swu.bg

Annotation:

The discipline Analytical chemistry includes lectures and laboratory exercise.

In the course the theoretical bases of the analytical chemistry are presented. There is place of the equilibrium in solutions and classical qualitative analysis. The laboratory exercises introduce students with the analytical properties of cations and anions as well as with the typical techniques for concentration and separation used in analytical chemistry

For the successful study of the discipline it is necessary knowledge of the general chemistry, physical chemistry and mathematics.

BIOCHEMISTRY

ECTS credits: 8

Hours per week: 2l+0se+2le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: I

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Professor Ivanka Stankova, PhD: ivastankova@swu.bg

Annotation:

Study of general biochemistry processes; study of complexity organization of alive nature, chemistry processes and general metabolic chains in the alive organisms; the enzymes, their mechanisms of action; the biological oxidation, supplying and transformation of the energy in the cells; the role of vitamins and hormones in the organisms.

Course topics:

The aim of the course in Biochemistry is to give the students knowledge about main biochemistry processes in the organisms, biological oxidation and transformation of energy in the cells. The students get an idea about regulating, monitoring and integrating of biochemical processes in the organisms.

The practical exercises seek to help the students by understanding and giving a meaning of the lectures, to acquire a habit of constructive application of knowledge.

Teaching Methods: Lectures with demonstration of schemes and figures, laboratory exercises, regular tests.

Assessment: Two tests T1 и T2 and Final exam

Rating: 0,4 [(T1+ T2):2] + 0,6 (Exam)

Requirements: Knowledge in inorganic and organic chemistry

INSTRUMENTAL METHODS OF ANALYSIS

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: II

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Petko Mandjukov, Ph.D: pmandjukov@swu.bg

Annotation:

Topics of the course: Main steps in analytical procedures using instrumental analytical methods. Relative and absolute methods, calibration, basic metrological characteristics of the instrumental analytical methods. Atomic spectral, electrochemical, magneto-chemical and radiochemical methods for analysis.

Course topics:

Students should obtain basic knowledge and practical skills in most commonly used instrumental methods for analysis of composition of the various objects. Physical basis, advantages and limitations of the studied analytical methods are also presented.

Teaching Methods: lectures, tutorials, individual student's work

Requirements/Prerequisites: Basic knowledge of General and Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Physics and Mathematics; completed courses: Analytical Chemistry - Part 1 and Part 2.

THEORETICAL CHEMISTRY

ECTS credits: 8

Hours per week: 2l+1se+0e+2pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: II

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Zhivko Velkov, Ph.D: jivko_av@swu.bg

Annotation:

This course is designed for students who have not studied chemistry at bachelor level. In this course, students should familiarize themselves with the theoretical foundations of chemistry.

The program follows the development of the concepts of the atom structure until the modern quantum-chemical concepts. Then it presents the postulates of quantum mechanics. The spectral characteristics of atoms and molecules and the basic concepts - ionizing energy, electron affinity, electronegativity are studied. On this basis, the notion of the types of chemical bonds - covalent, ionic, coordinating - is built. Students then get acquainted with the types of intermolecular relationships. The latest topics in this basic course include examining the energy spectrum of molecules and the theory of transition states.

Course topics:

The aim of the program is to introduce students who are not chemically trained on the bachelor level to the basic concepts of the theoretical chemistry mentioned above.

MEDICINAL CHEMISTRY- part I

ECTS credits: 10

Hours per week: 3l+0se+0le+1pe+p

Form of knowledge evaluation: Examination

Examination type: project defence

Semester: II

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Ivanka Stankova, PhD: ivastankova@swu.bg

Annotation:

Subject of the course "Medicinal Chemistry" are the main groups drugs used in modern medical practice, with particular emphasis on their mechanism of action, chemical structure, relationship structure - activity and the principles of drug design.

Discussed are basic knowledge in biochemistry, properties of the enzymes and metabolic processes. Information is given about receptors, mediators, antimetabolites, passage through cell membranes of biologically active compounds. The course is designed for chemists, whose future work will be linked to the creation of new biologically active compounds.

Practical exercises are related to synthesis of various drugs.

Objectives and expected results

The course is aimed at understanding the content of the discipline as a science for create drugs based on traditional knowledge of pharmacology. It aims to examine stages in the development of new drugs.

Examining of the drugs on the basis on pharmacological effect makes possible to trace the logic of development of the drugs, and the relationship that exists between chemical structure and pharmacological effect.

Students must gain knowledge for the fundamental group drugs, principles for development of new drugs and achieve their realization in the pharmaceutical companies.

CHEMOMETRICS

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: II

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Petko Mandjukov, Ph.D: pmandjukov@swu.bg

Annotation:

Topics of the course: Statistical evaluation of analytical results. Basic statistical criteria applied in analytical chemistry. Regression analysis, multiple linear and nonlinear regression, nonlinear calibration. Multivariate statistical methods.

Classification and pattern recognition - cluster analysis. Similarity criteria and agglomerate methods. Optimization of functions. Methods based on the direct search of the extremum. Principles of the mathematical neural networks. Application in the experimental science.

Course topics:

Students should obtain basic knowledge and practical skills in basic mathematical methods commonly applied to optimization of the instrumental parameters and for data treatment; recent metrological requirements for presentation of the results of chemical analysis; multivariate statistical methods allowing evaluation of additional information about the studied object.

Teaching Methods: lectures, tutorials, individual student's work

Requirements/Prerequisites: Basic knowledge of mathematics analytical chemistry and instrumental methods for analysis.

SOME CURRENT METHODS IN ORGANIC SYNTHESIS

ECTS credits: 8

Hours per week: 3l+0se+1le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: III

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Chief Assist. Prof. Maya Chochkova, PhD: mayachochkova@swu.bg

Annotation:

A large part of the course is concerned with reactions, which lead to the formation of carbon-carbon single and double bonds. Other reactions discussed provide methods for the fictionalization of inactivated methyl and methylene groups through intramolecular attack by free radicals at inactivated carbon-hydrogen bonds. The students will be introduced through scientific publications to the concrete examples of application of the considered synthetic methods for preparation of some organic compounds. The planning of organic synthesis is also included in the course.

Course topics:

The aim of the course is to give the students thorough knowledge about some basic reactions, used in the current organic synthesis. The course is based on the knowledge, acquired in the course of organic chemistry.

Clearly, the whole field of synthesis could not be covered in the course, even in a cursory manner, and a selection has had to be made. The course seeks to extend the knowledge in the considered field, to development of self-dependence, creative and non-standard thinking of the students. The practical exercises seek to help the student by understanding and giving a meaning of the lectures, to acquire a habit of constructive application of knowledge, to build up skills in the field of organic synthesis.

The final grade constitutes 40% of the periodical control grade and 60% of the grade from the term examination according to developed and approved in Chemistry Department system of control and grading.

RATIONAL DRUG DESIGN

ECTS credits: 8

Hours per week: 3l+se+le+1pe+p

Form of knowledge evaluation: Examination

Examination type: project defence

Semester: III

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Zhivko Velkov, PhD: jivko_av@swu.bg

Annotation:

On the base of ligand-receptor interaction mechanisms and the ability of the drug to disseminate in different organs and environments of the human body, the structural reasons of the drug action will be studied.

This course is based on the knowledge of the biochemical and physiological effects of drugs on organisms (pharmacodynamics) and the influence of the organism on the drug (pharmacokinetics), the dose-effect relationship, the benefits to the body, and the toxic effects.

The main tasks of the Rational Drug Design Program are:

- acquainting students with the qualitative and quantitative relationships between the structure of the drug and its action;
- acquiring skills to work with specialized software for calculating of specific structural descriptors.
- develop skills for skills for individual work.

Course topics:

The aim of this course is to raise general chemistry culture of students in assessing the role of the structure on the drug action. To gain experience in calculating different descriptors of drug molecule that are relevant to their effects on organisms.

STRUCTURAL ANALYSIS OF ORGANIC COMPOUNDS

ECTS credits: 6

Hours per week: 2l+1se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: III

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Atanas Chapkanov, PhD: chapkanov@swu.bg

Annotation:

The course "Structural analysis of organic compounds" is designed for students who have completed university disciplines such as organic chemistry and spectral methods, and have basic theoretical knowledge in these areas. The course is a prominent application oriented, aiming to increase the competence of the students to determine the structure of complex organic molecules.

Training begins with a brief overview on the modern concepts and techniques applied daily in the laboratory practice, and continue with progressive handling of spectral methods (UV, IR, NMR and MS) for structural analysis.

CLINICAL PRACTICE

ECTS credits: 3

Hours per week: 0l+0se+0le+3pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: III

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Lidia Aneva, MD: lidia_aneva@yahoo.com

Annotation:

Course of Clinical practice enables students to understand the main methods used in the clinical investigations and familiarize with all necessary equipment for this purpose. The main accent is for methods used in Haemathology, Immunology, Serology and other clinical investigations.

All questions related to quality control of laboratory investigations are discussed and clarified.

Majority of the clinical exercises will be held in certified clinical laboratories located at MBAL- Blagoevgrad and all results will be explained from clinical point of view.

All the students are expected to have basic (minimal) knowledge in following subjects: Organic and Inorganic chemistry; Biochemistry; Physicochemistry

Discipline content.

- ☞ Laboratory methods and equipment
- ☞ Maintenance and cleaning of laboratory equipment
- ☞ Measuring and dosing
- ☞ Centrifugation
- ☞ Laboratory data analysis
- ☞ Laboratory results discussion

MEDICINAL CHEMISTRY- part II

ECTS credits: 8

Hours per week: 3l+0se+0le+1pe+p

Form of knowledge evaluation: Examination

Examination type: project defence

Semester: IV

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Ivanka Stankova, PhD: ivastankova@swu.bg

Annotation:

Subject of the course "Medicinal Chemistry" are the main groups drugs used in modern medical practice, with particular emphasis on their mechanism of action, chemical structure, relationship structure - activity and the principles of drug design.

Discussed are basic knowledge in biochemistry, properties of the enzymes and metabolic processes. Information is given about receptors, mediators, antimetabolites, passage through cell membranes of biologically active compounds. The course is designed for chemists, whose future work will be linked to the creation of new biologically active compounds.

Practical exercises are related to synthesis of various drugs.

Course topics:

The course is aimed at understanding the content of the discipline as a science for create drugs based on traditional knowledge of pharmacology. It aims to examine stages in the development of new drugs.

Examining of the drugs on the basis on pharmacological effect makes possible to trace the logic of development of the drugs, and the relationship that exists between chemical structure and pharmacological effect.

Students must gain knowledge for the fundamental group drugs, principles for development of new drugs and achieve their realization in the pharmaceutical companies.

GENERAL PHARMACOLOGY AND TOXICOLOGY

ECTS credits: 4**Hours per week:** 2l+0se+0le+0pe+p**Form of knowledge evaluation:** Examination**Examination type:** written**Semester:** IV**Methodological guidance:**

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturer:Assoc. Prof. Lyubka Tancheva MD: lyubkatancheva@gmail.com**Annotation:**

In the course of *General Pharmacology and Toxicology* includes the study of general principles, related to fundamental processes of pharmacokinetics and pharmacodynamics of the drugs, drug biotransformation and factors, affecting drug action, as well as the drug interaction in the body. Will be study some basic principles of toxicology as drug side effects, toxic and carcinogenic effect of the drugs, drug objectionable (drug toxicomania), ect.

Course topics:

The course aim is to study the general principles of pharmacology and toxicology and basic processes of pharmacokinetics and pharmacodynamics of the drugs, drugs biotransformation and factors, affecting drug action, as well as the drug interaction in the body.

The students get an idea about regulating, monitoring and integrating of the pharmacological processes in the organism. Receiving a general knowledge of pharmacology and toxicology students reflect on the material studied chemistry, biochemistry, ect.

The seminars seek to help the students by understanding and giving a meaning of the lectures, to acquire a habit of constructive application of knowledge.

Teaching Methods: Lectures with demonstration of schemes and figures and seminars.

Requirements: Knowledge in Chemistry and Biochemistry

HIGH MOLECULAR COMPOUNDS

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: I

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Chief Assist. Prof. Maya Chochkova, PhD: mayachochkova@swu.bg

Annotation:

Study of the main composition, structure, configuration and conformation of the high molecular weight compounds, their chemical and physical characteristics and their widely application into practice.

Course topics:

The aim of the course in *High molecular compounds* is to give the students knowledge about the composition, structure, configuration and conformation, chemical and physical properties, methods for preparation and analysis and the application into practice of the most important high molecular weight compounds.

The practical exercises seek to help the students by understanding and giving a meaning of the lectures, to acquire a habit of constructive application of knowledge.

Teaching Methods: Lectures with demonstration of schemes and figures, regular tests.

Assessment: Two tests T_1 и T_2 and Final exam

Rating: $0,4 [(T_1 + T_2):2] + 0,6$ (Exam)

X-RAY DIFFRACTION ANALYSIS, NMR AND MASS SPECTRAL ANALYSIS OF ORGANIC COMPOUNDS

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: I

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Atanas Chapkanov, PhD: achapkanov@swu.bg

Annotation:

The offered subject aims at providing students with a thorough fundamental and scientific applied knowledge in the field of modern synthesis and characterization of organic compounds that are widely used in practice, either as materials for advanced technology and high household products either as to obtain new drugs using traditional chemical or biotechnological way.

Course topics:

The course enables for obtaining a more specialization in the field of organic synthesis, on methods for analysis of substances of natural and synthetic origin.

The training is based on already acquired in the Bachelor's degree basic knowledge of the major groups of organic compounds and their structure, and their characteristic chemical behavior and the mechanisms by which interactions occur between them.

Students will gain knowledge which will help them in their professional career in research and analytical control laboratories, departments of universities and institutes of BAS.

METHODS FOR ANALYSIS AND CONTROL

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: I

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Petko Mandjukov, PhD : pmandjukov@swu.bg

Annotation:

The purpose of this discipline is familiarizing the students with the possibilities of instrumental methods for carrying out scientific research and solving problems related to the identification of substances, determination of their structure and quantitative composition, study of chemical equilibrium and others.

Will be examined and compared analytical characteristics of the most of the methods used for qualitative and quantitative analysis components. Special attention is given to the choice of analytical method in solving analytical problems. The course provides an overview for methods for chemical analysis of instrumental analytical detection signal. It is a natural continuation of the course in analytical chemistry.

Course topics:

The aim of the course is to gain information about spectrometric, electrochemical, and combined methods (for separation and identification) that are used in chemical technology and biotechnology. Laboratory exercises are individual, being carried out in specialized laboratories of the department. For studying the subject is necessary to have completed courses in analytical chemistry, physics, physical chemistry and mathematics.

MODERN CHROMATOGRAPHY METHODS

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: I

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Chief Assist. Prof. Radoslav Chayrov, PhD: rchayrov@swu.bg

Annotation:

The applications of chromatography have grown extensively in the last four decades, owing to the development of new techniques and to the increasing need of scientists for better methods of separating complex mixtures. The course of "Modern chromatographic methods" is based on the different modern chromatographic methods, widely used in analytical laboratory. The versatility of this technique allow to separate gases and volatile compounds by GC; involatile compounds with extremely high molecular weight (including biopolymers) by LC and by cheaply preparative TLC. It will be described the attempt to use microwave reversed phase high performance liquid chromatography (MW-HPLC) to carry out the separation of organic compounds.

Course Aim:

The goal is to get a deeper insight in theoretical knowledge of chromatography to the students, followed by a detailed treatment of the principles and practice of all the major modern techniques used in the industrial and academic sectors.

STEROIDS

ECTS credits: 4**Hours per week:** 2l+0se+0le+0pe+p**Form of knowledge evaluation:** Examination**Examination type:** written**Semester:** I**Methodological guidance:**

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:Chief Assist. Prof. Maya Chochkova, PhD: mayachochkova@swu.bg**Annotation:**

The course in *Steroids*, is concerned with the structure, classification, methods of isolation from natural sources, purification and structure characterization. They might well comprise a structural lead for drug design.

Course Aim:

The goal of the course is to systematize, summarize and update the huge material on chemistry of the main classes of steroid compounds, the relationship between methods of synthesis and properties of different cyclic systems it will be discussed. The major reactions and transformations of steroids will be affected. The students' attention will be also focused with unusually broad areas of application of steroids in medicine.

The course in "Steroids" is built on the knowledge acquired by students at the course in Organic Chemistry and Biochemistry.

MICROBIOLOGY

ECTS credits: 4**Hours per week:** 2l+0se+0le+0pe+p**Form of knowledge evaluation:** Examination**Examination type:** written**Semester:** II**Methodological guidance:**

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Lidia Sakelarieva, PhD: sakelarieva.lidia@swu.bg

Annotation:

The course is designed to introduce students with the current state of microbiology as a leading biological science. The characteristics of microorganisms like microbiological objects, structural and functional organization of prokaryotic cells and peculiarities of eukaryotic microorganisms are discussed. Also seen in comparative terms the characteristics in the energy and constructive metabolism of microorganisms and practical use of metabolic capabilities.

The main characteristics of viruses and chemical composition, structure, replication, basic types viruses are considered. The peculiarities of organization of microorganisms, forms of genetic exchange in bacteria and their changeability are examined.

The special place of spread of microorganisms in the environment and their role in the transformation of substances in nature, the basic principles of ecology of microorganisms and forms of relationships between them and other living organisms are discussed.

The envisaged seminars consider classical and modern methods for the study of microorganisms and viruses, these concepts of classification and some aspects of their practical application. The seminars enable students to work and prepare independently.

The students must use their knowledge of biology, biochemistry and chemistry to make relations with the teaching material.

STEREOCHEMISTRY OF ORGANIC COMPOUNDS

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: II

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Atanas Chapkanov, PhD: chapkanov@swu.bg

Annotation:

The course of "Stereochemistry of organic compounds" describes chemistry as a function of a molecular geometry. The students will gain insight in molecular geometry and chemical bonding, symmetry and chirality, definition and classification of stereoisomerism, racemisation and methods for resolution.

Course topics:

The aim of course is to provide underpinning knowledge of influence of drug stereochemistry on the biological activity, the pharmacokinetics and the metabolism. The importance of the tri-dimensional structures are discussed and illustrated.

ORGANIC ANALYSIS

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: II

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Atanas Chapkanov, PhD: chapkanov@swu.bg

Annotation:

The students will obtain basic knowledge on methods for description of various organic compounds and functional groups. Application of instrumental analytical methods for qualitative and quantitative analysis is given for various organic compounds.

Course topics:

The aim of the course is to give students knowledge on methods and approaches to separation and identification of various organic compounds. The lab exercises should give students knowledge and skilfulness to carry out analysis.

Teaching Methods:

Lectures are illustrated with examples for solving problems related to analysis of complicated samples. For lectures presentation multimedia PC system are used.

Prerequisite: Knowledge in organic chemistry, instrumental methods.

COMBINATORIAL CHEMISTRY

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: II

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Chief Assist. Prof. Maya Chochkova, PhD: mayachochkova@swu.bg

Annotation:

Combinatorial approaches have been introduced from the beginning of the '80 in the drug discovery field, given their enormous impact for the production of large numbers of different molecules by combinations and permutations of structurally related molecules. Solid-phase combinatorial chemistry (SPCC) is considered as an outstanding branch in pharmaceutical chemistry research and is used extensively as a tool for drug discovery through the use of solid supports (resins) and their modified forms.

Course topics:

The objective of the course in Combinatorial chemistry provides a basic introduction to the field of combinatorial chemistry describing the development of general techniques, aspects of Boc- and Fmoc- strategies, used resins and etc., and some areas of their applications it will be discussed.

The current discipline will focus mainly on the medicinal and synthetic organic chemistry aspects of combinatorial chemistry. Approaches, such as computer-aided rational drug design and studied course in QSAR, are complementary and integrated with combinatorial technologies.

ANTIOXIDANTS

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: II

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Zhivko Velkov: jivko_av@swu.bg

Annotation:

The main types of antioxidants and antioxidant activity will be studied in the course, the content of antioxidants in different foods and medicines as well as their intake possibilities.

Students are acquainted with the chemistry of chain-radical processes and their flowing into the higher organisms. Acquiring knowledge about the nature of antioxidants and benefits of the organism, as well as the developing self-reflection in the field of chemistry of natural substances.

Course topics:

The main objective of the Antioxidant course will be to study the reasons, which cause different metabolites and xenobiotics to show antioxidant activity in the body.

NATURAL PRODUCTS CHEMISTRY

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: III

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Chief Assist. Prof. Maya Chochkova, PhD: mayachochkova@swu.bg

Annotation:

The course of *Natural products chemistry* covers a wide range of different aspects concerning the importance of chemistry of polyfunctional organic derivatives in living systems. In the current course some of the most important classes natural compounds such as: carbohydrates, nucleic acids, proteins, steroids and phenolic compounds will be discussed. Additional attention will be paid to their classification; structures, chemical properties, the role that they play in the living systems; the structure-activity relationship and unusually broad application areas will be shown.

Course topics:

The aim of the course is to prepare specialists, possessing the basic understanding of natural products chemistry, necessary for successful dissolving of the chemical tasks.

The course „ Natural products chemistry” is the vast part of Organic chemistry. The current discipline lies on the border of biological disciplines and is connected with other courses in the curriculum, such as Bioorganic, Biochemistry and Pharmaceutical Chemistry.

Expected results:

Students to become conversant with the following main aspects of discipline:

- ☞ to classify the natural compounds;
- ☞ to have good knowledge of the structural peculiarities of natural compounds and their basic chemical transformation *in vivo* and *in vitro*;
- ☞ to be familiar with the methods of isolation, purification and also with their synthetic methods;
- ☞ To have an idea of the effects of natural compounds in living organisms and their participation metabolism.

MATHEMATICAL MODELS IN CHEMISTRY AND BIOLOGY

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: III

Methodological guidance:

Department: “Chemistry”

Faculty: Mathematics and Natural Sciences

Lecturers:

Prof. Peter Milanov, PhD: milanov@swu.bg

Annotation:

The enclosed curriculum discusses the tasks related to the theory of mathematical models in biology and chemistry. The course will examine basic concepts and principles in this area. The basic concepts and techniques of mathematical modelling and its application in the concerned areas will be explained. The practical application of mathematical models in areas such as: molecular biology, crystallography, pharmacology and drug design will be illustrated using examples.

Course topics:

This course aims to help the students to understand the concept and some basic theoretical results in the theory of mathematical modeling, its application in biology and chemistry. Every student must acquire practical skills for preparing mathematical models.

Organization of training

1. Lectures - audiovisual technologies are intended to be used:

- a. overhead
- b. computer projector
- c. lecture will be uploaded on the website of the University

2. Exercises – during the lectures, the tasks will be given and the students must do their homework and further will be estimated.

MATHEMATICAL MODELS OF DRUG - RECEPTOR INTERACTIONS

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: III

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Prof. Peter Milanov, PhD: milanov@swu.bg

Annotation:

The enclosed curriculum discusses the tasks related to the theory of mathematical models in quantitative pharmacology. The course will examine the basic concepts and principles in this area. The mathematical modeling of drug-receptor interactions and its application in pharmacology will be described. Different approaches as graph theory, operations research and *etc.* will be used in model design. The application of mathematical models will be illustrated and discussed by examples in the drug design.

Course topics:

The aim of this course is to introduce the student to concept and some basic theoretical results in the theory of mathematical modeling of drug - receptor interactions and its application in drug design. Every student must acquire practical skills for preparing mathematical models in area in quantitative pharmacology.

Organization of training

1. Lectures - audiovisual technologies are intended to be used:

a. overhead

b. computer projector

c. lecture will be uploaded on the website of the University

2. Exercises – during the lectures, the assignments will be given and students must do their homework and further to be estimated.

CHEMOTHERAPY AND MODERN CHEMOTHERAPEUTIC AGENTS

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: III

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Professor Ivanka Stankova, PhD: ivastankova@swu.bg

Annotation:

In the curriculum, "Chemotherapy and modern chemotherapeutic agents" is presented modern approaches of new chemotherapeutic agents design.

Particular attention is paid to the drugs used in chemotherapy of cancer, viral, bacterial and fungal infections.

The chosen examples have to clarify general principles of farmaco-biochemistry.

Course content:

Teaching material covers theoretical tasks:

- Introduction into the basis for the development of antimetabolites for antibacterial, antifungal, antiviral and anticancer chemotherapy;
- Clarifying the biochemical mechanisms of drugs actions.

Teaching and assessment:

Lectures are provided for the students in the course of the education The lectures are held following the classical manner and are visualized by Power Point presentations.

The final grade constitutes 30% of the periodical control grade and 70% of the grade from the semestrial examination according to developed and approved in Chemistry Department system of control and grading students' competence.

CLINICAL CHEMISTRY

ECTS credits: 4**Hours per week:** 2l+0se+0le+0pe+p**Form of knowledge evaluation:** Examination**Examination type:** written**Semester:** III**Methodological guidance:**

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:PhD Irena Ivanova, MD: irena.dimitrova@gmail.com**Annotation:**

The course in Clinical Chemistry comprises 30 hours. Clinical chemistry and molecular diagnostics are key components of modern clinical laboratory. The course aims to introduce students to the fundamentals of clinical chemistry and molecular diagnostics, applied according to the standards of good medical practice. The course outlines the main trends in modern clinical laboratory tests and reveals the nature of work in modern clinical, biochemical, microbiological, etc. laboratories.

The course provides basic knowledge on experimental work in research laboratories engaged in the search of biologically active compounds and the development of new drugs. The course will contribute to the understanding of the diagnostic set-ups, the application of certain principles and the subsequent interpretation of the results of diagnostic tests.

TECHNOLOGY OF DRUGS SUBSTANCES

ECTS credits: 4**Hours per week:** 2l+0se+0le+0pe+p**Form of knowledge evaluation:** Examination**Examination type:** written**Semester:** III**Methodological guidance:**

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:Prof. Ivanka Stoyneva, Dsc: istoineva@yahoo.com

Annotation:

The main objective of the course "Technology of Drugs Substances " is to teach students of the basic theoretical questions of the pharmaceutical manufacture of drug substances. The main pharmaceutical terms and concepts of drug technology, historical review and technological objectives, classification and nomenclature of pharmaceutical forms will be discussed in detail. Understand the dosing methods, the requirements for packaging materials used to pack medicines, reflect the main biopharmaceutical factors affecting the bioavailability of drugs in specific dosage forms. The lecture material is divided into 3 modules.

Expected result

Students acquiring a Master's degree course will acquire basic knowledge about the processes and devices used in the preparation of various dosage forms such as capsules, granules, ointments, injectable forms, etc. It is expected that their training in this discipline will be useful to them as professionals in various pharmaceutical companies.

BIOLOGICALLY ACTIVE COMPOUNDS - NUTRITION AND HEALTH

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: IV

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Ivanka Stankova, PhD: ivastankova@swu.bg

Annotation:

The course on "Biologically active compounds - Nutrition and Health" aims to introduce students with the use of substances that are necessary for a balanced and healthy meal. Before our ancestors are received everything need for their body from the food which they are used.

In the last decade worldwide are observed that eating habits are increasingly moving away from the principles of balanced nutrition, leading to a shortage of biologically active substances, vitamins and minerals. It is believed that the solution to this problem is the use of additional biological active compounds / BAC. /. Today BAC rightly called the food of the 21st century.

In opinion of many leading scientists in the world, natural BAC that increasingly entering in market in developed countries that ensure a population all necessary substances such as vitamins, minerals and bioactive substances. The adoption of a BAC has optimal, preventive and quick healing effect.

The course will help to build an objective and contemporary glance of students on the following functions of biologically active additives:

- Provide a body of necessary vitamins and minerals and all other biologically active substances, without adding unnecessary calories;
- There a preventive effect and will help to increase the duration of life;
- Improve performance and facilitate adaptation to the environment;
- Ensure the growth and development of children

Assessment: written examination / coursework

INTERFACE SURFACES AND BIO-MEMBRANES

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: IV

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Prof. Boryan Radoev, DSc: radoev@chem.uni-sofia.bg

Annotation:

Aim of the course is to introduce basic models applied in the study of real bio-membranes. It includes monomolecular (Langmuir) layers of soluble/insoluble surfactants; thin (soap) liquid films; ultra thin (Newtonian) films and bi-layers. Attention will be paid to their chemical composition, to their physico-chemical (including their mechanical) properties, as well as some important biological properties taking place at the bio-membranes in the real systems. More precisely it concerns trans-membrane mass transfer caused by osmosis and electro-osmosis. The course is supported by real and laboratory illustrations.

BASICS OF BIOTECHNOLOGY

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: IV

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Prof. Ivanka Stoyneva, DSc: istoineva@yahoo.com

Annotation:

The aim of the course "Basics of Biotechnology" is to provide students with a Master's program "Biologically Active Substances and Drugs" to gain new knowledge in the field of modern and fast-growing pharmaceutical biotechnology. This technology is based on the use of the catalytic potential of various biological agents and systems such as microorganisms, viruses, plant and animal cells and tissues as well as extracellular substances and cellular components.

Within the course the students will acquire the theoretical knowledge about the basic principles of protein and genetic engineering as well as the design of new drugs for prevention and therapy of the main diseases of our century. They will familiarize themselves with the chemical structure and the production of valuable bioproducts used in medicine, such as some new enzymes, hormones, antibodies, inhibitors, vaccines and genetically engineered preparations.

Students have obtained a Master's degree on the basis of new crafts and skills in this course can develop creative thinking and critical analysis of phenomena and processes in their realization as specialists in different pharmaceutical companies.

The course is based on the knowledge gained by students from the main disciplines such as organic chemistry, biochemistry, physicochemistry and prepares students for the modern methods of production in pharmacy, chemistry and food technology.

NEURAL NETWORKS

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: IV

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Prof. Peter Milanov, PhD: milanov@swu.bg

Annotation:

Neural networks are composed of simple elements operating in parallel. These elements are inspired by biological nervous systems. As in nature, the network function is determined largely by the connections between elements. Neural networks can be trained to solve problems that are difficult for conventional computers or human beings.

Course topics:

Students should obtain knowledge and skills for designing of the neural network.

Teaching Methods: lectures, demonstrations and work on project

Requirements/Prerequisites:

Assessment: course project

Registration for the Course: by request at the end of the current semester

Registration for the Exam: coordinated with the lecturer and Student Service Department

APPLICATION OF IR- SPECTROSCOPY FOR ORGANIC AND BIOLOGICALLY ACTIVE COMPOUNDS ANALYSIS

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: IV

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Assoc. Prof. Atanas Chapkanov, PhD: chapkanov@swu.bg

Annotation:

The study aid of Application of IR- spectroscopy for analysis of organic and biological-active compounds course is to include elements of the theory, basic and specific technique of IR-spectral analysis and its application for structure characterization of organic compounds and drugs. The course covered characteristics bands of the typical functional groups of the organic compounds which are basic structural units in the drug compounds. Comparative IR-spectral analysis with other biological-active compounds is included. The principals and application of IR-LD- spectral analysis are introduced. The possibilities and application of the method are showed by discussion of different samples IR-LD spectra.

The lecture course is illustrated and visualization by different examples solving the problems in connection with analysis of organic compounds and drugs. For presentation it is used multimedia and PC system.

Course topics:

The study aims of the Application of IR- spectroscopy for analysis of organic and biological-active compounds course are:

1. Introduction of the students in the principals and specific technique of the IR-and IR-LD-polarized spectroscopy for analysis of the organic compounds and drugs.
2. Acquisition of the systematic knowledge and skills for identification and characterization of the organic compounds investigation and correct interpretation of the results obtained.
3. Developed of the thought creative and ability for self-dependent choice of approaches and methods for the problems solved.

The students will be evaluated based on their cumulated score from tests and quizzes. There will be two exams including one final exam. The several quizzes will be given during the class.

Two current exams: K1, K2

Exam: (combined form – written and oral) E

Final rating: $0.3 (K1 + K2)/2 + 0.7 E$

After middle evaluation different from 2 (two)

SAMPLING AND SAMPLE PREPARATION IN THE ANALYSIS OF BIOLOGICAL ACTIVE COMPOUNDS

ECTS credits: 4

Hours per week: 2l+0se+0le+0pe+p

Form of knowledge evaluation: Examination

Examination type: written

Semester: IV

Methodological guidance:

Department: "Chemistry"

Faculty: Mathematics and Natural Sciences

Lecturers:

Chief Assist. Prof. Petranka Petrova, PhD: ppd@swu.bg

Annotation:

The course presents the basic concepts of the sampling and sample preparation in the analysis which are the weakest links in the chain in any analytical procedure. The main principle to be observed when selecting a sample for analysis is that the sample must be representative to the overall composition of the analysed object. If the sample does not accurately represent the population from which it is drawn, then an analysis, that is otherwise carefully conducted, will yield inaccurate results. Sample preparation is also of great importance for the accuracy and precision of analytical results.

Course topics:

The aim of the course is to introduce students to the design of sampling and sample preparation, as well as to the evaluation of random and systematic errors during the analysis. In this course we consider how the collection of the sample and the sample preparation for analysis can affect the accuracy and precision of our results.