

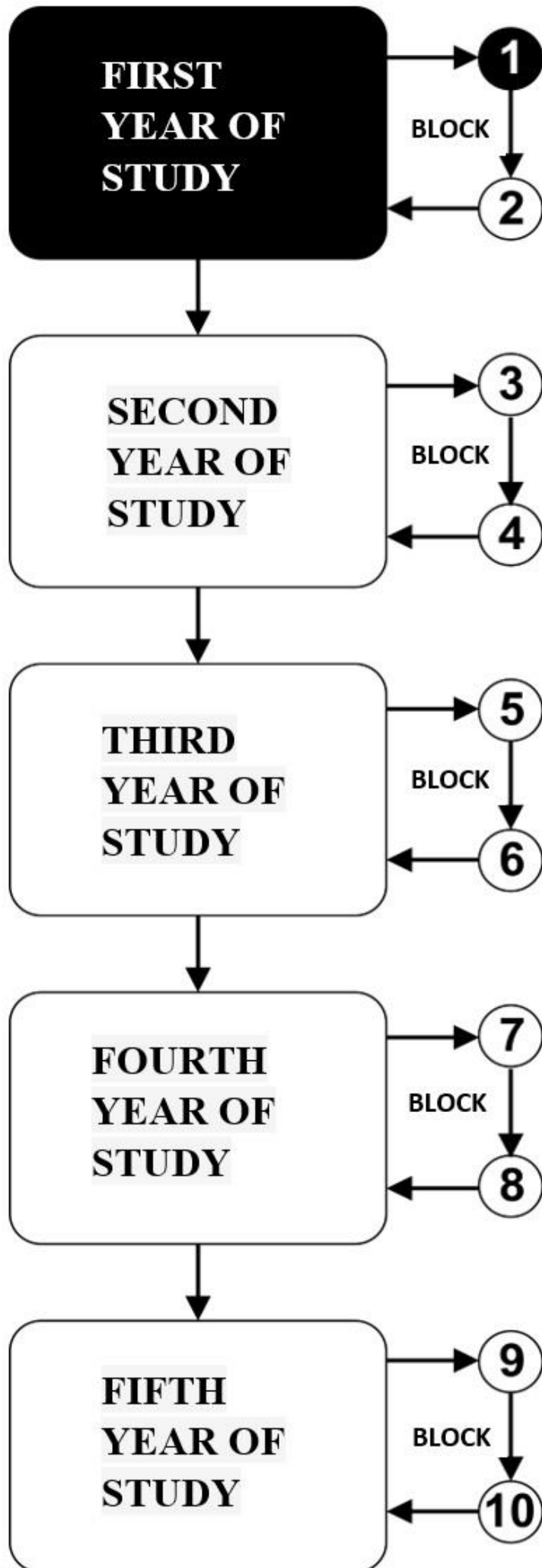


**INTEGRATED ACADEMIC
PHARMACY STUDIES**

FIRST YEAR OF STUDY

academic 2023/2024.

ORGANIC CHEMISTRY



Course:

ORGANIC CHEMISTRY

The course is evaluated with 9 ECTS. There are 6 hours of active teaching per week (4 hours of lectures and 2 hours of work in a small group).

TEACHERS AND ASSOCIATES:

	First and last name	Email address	title
1.	Snežana Jovanović Stević	snezana.j@kg.ac.rs	Assistant professor
2.	Gordana P. Radić	vasic_gordana@yahoo.com	Full Professor
3.	Marija D. Živković	mzivkovic@kg.ac.rs	Associate Professor

СТРУКТУРА ПРЕДМЕТА:

Module	Module name	Week	Lectures	Work in a small group	Teacher-supervisor module
1	Fundamentals of organic chemistry; Hydrocarbons, alkanes and cycloalkanes; Alkenes; Alkynes and dienes, aromatic hydrocarbons; Haloalkanes, alcohols, aldehydes and ketones; Carboxylic acid and carboxylic acid derivatives, unsaturated carbonyl compounds, amines and phenols; Macromolecules, organic nitrogen compounds, amino acids, proteins, lipids and oils; Carbohydrates and nucleic acids.	8	4	2	Assist. professor Snežana Jovanović Stević
2	Structures of organic compounds; Electronic effects in organic molecules, electromeric effect, hyperconjugation, aromaticity; Stereochemistry, stereochemistry of acyclic, unsaturated and cyclic compounds; Acidity and basicity of organic compounds; Division and nomenclature of heterocyclic compounds, five-member heterocycles with one heteroatom; Six-member heterocycles with one heteroatom, benzopyridines; Five-member and six-member heterocycles with two heteroatoms.	7	4	2	Assist. professor Snežana Jovanović Stević
					Σ 60+30=90

SCORING:

The student overcomes the course based on the points achieved in the pre-examination activities and the final test. The score is equivalent to the number of gained points (see tables). Points are earned as follows:

ACTIVITY DURING CLASSES: The student can gain up to 15 points by taking 1 exam question from that week, answering and receiving 0-1 points in accordance with the demonstrated knowledge.

FINAL TESTS BY MODULES: The student can gain up to 55 points according to the attached table.

FINAL EXAM:

Final exam: 30 points

Modul		Maximum points		
		activity during classes	final exam	Σ
1	Fundamentals of organic chemistry; Hydrocarbons, alkanes and cycloalkanes; Alkenes; Alkynes and dienes, aromatic hydrocarbons; Haloalkanes, alcohols, aldehydes and ketones; Carboxylic acid and carboxylic acid derivatives, unsaturated carbonyl compounds, amines and phenols; Macromolecules, organic nitrogen compounds, amino acids, proteins, lipids and oils; Carbohydrates and nucleic acids.	8	30	38
2	Structures of organic compounds; Electronic effects in organic molecules, electromeric effect, hyperconjugation, aromaticity; Stereochemistry, stereochemistry of acyclic, unsaturated and cyclic compounds; Acidity and basicity of organic compounds; Division and nomenclature of heterocyclic compounds, five-member heterocycles with one heteroatom; Six-member heterocycles with one heteroatom, benzopyridines; Five-member and six-member heterocycles with two heteroatoms.	7	25	32
	Final exam		30	30
	Σ	30	70	100

In order to pass the course, student must gain a minimum of 51 points and pass all the modules.

To pass the module the student must:

1. Gain more than 50% of the points in that module
2. Gains more than 50% of the points provided for teaching activity in each module
3. Pass the module test, ie to have more than 50% correct answers.

NUMBER OF POINTS GAIN	MARK
0 - 50	5
51 - 60	6
61 - 70	7
71 - 80	8
81 - 90	9
91 - 100	10

TESTS BY MODULES

MODULE 1.

FINAL MODULE TEST
0-30 POINTS

EVALUATION OF FINAL MODULE TEST

The test has 15 questions
Each question is worth 1 or 2 points

MODULE 2.

FINAL MODULE TEST
0-25 POINTS

EVALUATION OF FINAL MODULE TEST

The test has 15 questions
Each question is worth 1 or 2 points

FINALE TEST

FINALE TEST
0-30 POINTS

EVALUATION OF FINAL TEST

The test has 15 questions
Each question is worth 2 points

LITERATURE:

Modul	BOOK NAME	AUTHORS	PUBLISHER	LIBRARY
Fundamentals of organic chemistry; Hydrocarbons, alkanes and cycloalkanes; Alkenes; Alkynes and dienes, aromatic hydrocarbons; Haloalkanes, alcohols, aldehydes and ketones; Carboxylic acid and carboxylic acid derivatives, unsaturated carbonyl compounds, amines and phenols; Macromolecules, organic nitrogen compounds, amino acids, proteins, lipids and oils; Carbohydrates and nucleic acids.	Organic Chemistry Structure and Function	P. C. Vollhardt, N. E. Schore	W.H. Freeman & Co. Ltd, New York, 2014.	/
Structures of organic compounds; Electronic effects in organic molecules, electromeric effect, hyperconjugation, aromaticity; Stereochemistry, stereochemistry of acyclic, unsaturated and cyclic compounds; Acidity and basicity of organic compounds ; Division and nomenclature of heterocyclic compounds, five-member heterocycles with one heteroatom; Six-member heterocycles with one heteroatom, benzopyridines; Five-member and six-member heterocycles with two heteroatoms.				/
All the lectures and materials for small groups work could be found on the website of Faculty of Medical Sciences: www.medf.kg.ac.rs				

Program

TEACHING UNIT 1 (FIRST WEEK):

FUNDAMENTALS OF ORGANIC CHEMISTRY

lectures 4 hours	work in a small group for 2 hours
Fundamentals of organic chemistry; Organic chemistry's significance for pharmaceutical chemistry; Structure of atom; Bonding in organic compounds;	Laboratory glassware and equipment; Distillation of organic compounds; Purification and drying of the solvent; Qualitatively detection of different organic compounds;

TEACHING UNIT 2 (SECOND WEEK):

HYDROCARBONS. ALKANES AND CYCLOALKANES

lectures 4 hours	work in a small group for 2 hours
Hydrocarbons; Alkanes and cycloalkanes: Structures and reactions; Stereochemistry	Nomenclature of alkanes; mechanism of free-radical reaction substitution of alkane; cycloalkane conformation

TEACHING UNIT 3 (THIRD WEEK):

ALKENES

lectures 4 hours	work in a small group for 2 hours
Alkenes: Structures, properties and reactions	Nomenclature of alkenes and mechanism of their reactions

TEACHING UNIT 4 (FOURTH WEEK):

ALKYNES AND DIENES. AROMATIC HYDROCARBONS

lectures 4 hours	work in a small group for 2 hours
Nomenclature, physical and chemical properties and production of alkynes; division of dienes; mechanism of addition; arenes and aromaticity, electrophilic aromatic substitution	Synthesis and characterization of acetylene; Mechanism of reaction electrophilic aromatic substitution; Reaction of addition

TEACHING UNIT 5 (FIFTH WEEK):

HALOALKANES, ALCOHOLS, ALDEHYDES AND KETONES

lectures 4 hours	work in a small group for 2 hours
Alkyl- and aryl- halides; Introduction to nucleophilic substitution and elimination reactions; Alcohols and ethers; Epoxides; Aldehydes and ketones;	Preparation of organic Alkyl- and aryl- halides; Differences between mechanisms S_N1 и S_N2 reaction of nucleophilic substitution; Differences between mechanisms $E1$, $E2$ и $E1_{cb}$ elimination reactions; Preparation of Alcohols, chemical properties of alcohols; Synthesis of aromatic ethers; Evidence reactions for aldehydes and ketones

TEACHING UNIT 6 (SIXTH WEEK):

CARBOXYLIC ACIDS AND CARBOXYLIC ACID DERIVATIVES. UNSATURATED CARBONYL COMPOUNDS. AMINES AND PHENOLS.

lectures 4 hours	work in a small group for 2 hours
Carboxylic acids; Carboxylic acids and derivatives; Reactions at the carbonyl group; Amines and phenols, α,β -unsaturated carbonyl compounds	Preparation of carboxylic acids; Using carbanion in the reaction of condensation; Reactions of amines and phenols

TEACHING UNIT 7 (SEVENTH WEEK):

MACROMOLECULES. ORGANIC NITROGEN COMPOUNDS, AMINO ACIDS, PROTEINS, LIPIDS AND OILS

lectures 4 hours	work in a small group for 2 hours
Division, reactions and obtained of organic nitrogen compounds, amino acids; proteins; lipides and oils	Mechanism of electrophilic aromatic substitution reactions

TEACHING UNIT 8 (EIGHTH WEEK):

CARBOHYDRATES AND NUCLEIC ACIDS

lectures 4 hours	work in a small group for 2 hours
Representatives and chemical properties of monosaccharides; disaccharides; polysaccharides; types of nucleic acids; their structure and biological significance	Nomenclature of carbohydrates; Determination of the primary, secondary and tertiary structure of nucleic acids

TEACHING UNIT 9 (NINETH WEEK):

STRUCTURES OF ORGANIC COMPOUNDS

lectures 4 hours	work in a small group for 2 hours
Kekule's structural theory Structural isomerism Configuration, stereoisomerism and conformation Conjugated 1,3-diene system - butadiene Aromatic system - benzene Polarity of covalent bonds Inductive effects Resonance	Kekule's structural theory Structural isomerism Configuration, stereoisomerism and conformation Conjugated 1,3-diene system - butadiene Aromatic system - benzene Polarity of covalent bonds Inductive effects Resonance

TEACHING UNIT 10 (TENTH WEEK):

ELECTRONIC EFFECTS IN ORGANIC MOLECULES. ELECTROMERIC EFFECT. HYPERCONJUGATION. AROMATICITY.

lectures 4 hours	work in a small group for 2 hours
Polarity of covalent bonds Inductive effects Resonance Electromeric effect Hyperconjugation Aromaticity (aromatic character)	Polarity of covalent bonds Inductive effects Resonance Electromeric effect Hyperconjugation Aromaticity (aromatic character)

TEACHING UNIT 11 (ELEVENTH WEEK):

STEREOCHEMISTRY. STEREOCHEMISTRY OF ACYCLIC, UNSATURATED AND CYCLIC COMPOUNDS

lectures 4 hours	work in a small group for 2 hours
Configuration and factors affecting configuration Enantiomerism Racemic modifications Conformations of acyclic compounds Stereoisomerism in unsaturated compounds Stereochemistry of cyclic compounds	Configuration and factors affecting configuration Enantiomerism Racemic modifications Conformations of acyclic compounds Stereoisomerism in unsaturated compounds Stereochemistry of cyclic compounds

TEACHING UNIT 12 (TWELFTH WEEK):

ACIDITY AND BASICITY OF ORGANIC COMPOUNDS

lectures 4 hours	work in a small group for 2 hours
Definitions and general properties of acids and bases Influence of structure on acidity of organic compounds Influence of structure on the basicity of organic compounds Tautomerism	Definitions and general properties of acids and bases Influence of structure on acidity of organic compounds Influence of structure on the basicity of organic compounds Tautomerism

TEACHING UNIT 13 (THIRTEENTH WEEK):

DIVISION AND NOMENCLATURE OF HETEROCYCLIC COMPOUNDS. FIVE-MEMBER HETEROCYCLES WITH ONE HETEROATOM

lectures 4 hours	work in a small group for 2 hours
Division and nomenclature of heterocyclic compounds. Five-membered heterocycles with one heteroatom	Division and nomenclature of heterocyclic compounds. Five-membered heterocycles with one heteroatom

TEACHING UNIT 14 (FOURTEENTH WEEK):

SIX-MEMBER HETEROCYCLES WITH ONE HETEROATOM. BENZOPYRIDINES

lectures 4 hours	work in a small group for 2 hours
Six-membered heterocycles with one heteroatom. Benzopyridines.	Six-membered heterocycles with one heteroatom. Benzopyridines.

TEACHING UNIT 15 (FIFTEENTH WEEK):

FIVE-MEMBER AND SIX-MEMBER HETEROCYCLES WITH TWO HETEROATOMS

lectures 4 hours	work in a small group for 2 hours
Five-membered heterocycles with two hetero atoms. Six-membered heterocycles with two hetero atoms.	Five-membered heterocycles with two hetero atoms. Six-membered heterocycles with two hetero atoms.

LECTURE SCHEDULE

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EXERCISE SCHEDULE

LESSON SCHEDULE FOR THE SUBJECT ORGANIC CHEMISTRY

modul	week	date	time	place	type	the name of the method unit	teacher	
1	1				L	Fundamentals of organic chemistry.		
					E	Fundamentals of organic chemistry.		
	2				L	Hydrocarbons, alkanes and cycloalkanes.		
					E	Hydrocarbons, alkanes and cycloalkanes.		
	3				L	Alkenes.		
					E	Alkenes.		
	4				L	Alkynes and dienes. Aromatic hydrocarbons.		
					E	Alkynes and dienes. Aromatic hydrocarbons.		
	5				L	Haloalkanes, alcohols, aldehydes and ketones.		
					E	Haloalkanes, alcohols, aldehydes and ketones.		
	6				L	Carboxylic acid and carboxylic acid derivatives, unsaturated carbonyl compounds. Amines and phenols.		
					E	Carboxylic acid and carboxylic acid derivatives, unsaturated carbonyl compounds. Amines and phenols.		
	1	7				L	Macromolecules, organic nitrogen compounds, amino acids, proteins, lipids and oils.	
						E	Macromolecules, organic nitrogen compounds, amino acids, proteins, lipids and oils.	

LESSON SCHEDULE FOR THE SUBJECT ORGANIC CHEMISTRY

modul	week	date	time	place	type	the name of the method unit	teacher
	8				L	Carbohydrates and nucleic acids.	
					E	Carbohydrates and nucleic acids.	
						Final test of the first module	
2	9				L	Structures of organic compounds.	
					E	Structures of organic compounds.	
	10				L	Electronic effects in organic molecules. Electromeric effect. Hyperconjugation. Aromaticity.	
					E	Electronic effects in organic molecules. Electromeric effect. Hyperconjugation. Aromaticity.	
	11				L	Stereochemistry. Stereochemistry of acyclic, unsaturated and cyclic compounds.	
					E	Stereochemistry. Stereochemistry of acyclic, unsaturated and cyclic compounds.	
	12				L	Acidity and basicity of organic compounds.	
					E	Acidity and basicity of organic compounds.	
2	13				L	Division and nomenclature of heterocyclic compounds. Five-member heterocycles with one heteroatom.	
					E	Division and nomenclature of heterocyclic compounds. Five-member heterocycles with one heteroatom.	
	14				L	Six-member heterocycles with one heteroatom. Benzopyridines.	
					E	Six-member heterocycles with one heteroatom. Benzopyridines.	

LESSON SCHEDULE FOR THE SUBJECT ORGANIC CHEMISTRY

modul	week	date	time	place	type	the name of the method unit	teacher
	15				L	Five-member and six-member heterocycles with two heteroatoms.	
					E	Five-member and six-member heterocycles with two heteroatoms.	
						Final test of the second module	
						FINALE EXAM	
						EXAM	