No.9

Course syllabus for First cycle studies					
1.	**Course title**	Organic chemistry			
2.	**Code**	FTM3M1			
3.	**Study Program**	All study programs-technology			
4.	**Study program organizer (unit, institute, department, division)**	Institute of organic technologies, TMF, UKIM, Skopje			
5.	**Degree (first, second, third cycle)**	First			
6.	**Academic year / semester**	2 year 3 semester	7.	**Number of ECTS**	7
8.	**Instructors**	Prof. Dr. Vesna Dimova			
9.	**Prerequisites for course enrollment**	General and Inorganic Chemistry 1 (passed) General and Inorganic Chemistry 2 (verified)			
10.	**Objectives of the course syllabus (competences):** Students will gain knowledge in the field of organic chemistry: basic concepts of structure and reactions of organic compounds, nomenclature of organic compounds, physicochemical characteristics, possibility of synthesis of organic compounds and application of organic compounds in the food industry, biotechnology, textile industry, pharmacy and chemical technology. **Acquired skills (competences):** Students will acquire basic theoretical knowledge of organic chemistry and together with the gained practical knowledge of techniques and operations in organic chemistry laboratory, it will allow them to solve the problems of the synthesis and reactivity of organic molecules.				
11.	**Content of the course:** Introduction to Organic Chemistry. Structure and properties of organic compounds. Hybridization and chemical bonds. Drawing organic molecules. Resonance. Organic reactions. Classification of organic compounds. IUPAC nomenclatures. Hydrocarbons. Saturated hydrocarbons: alkanes, nomenclature, constitutional isomers, conformation, synthesis, reactions, substitution mechanisms, characteristic representatives and their application. Unsaturated hydrocarbons: alkenes, dienes, double bond characteristics, nomenclature, *cis–trans* isomers, E/Z nomenclature, synthesis, reactions, E_N1/E_N2 elimination reactions, carbocation rearrangements, addition reactions and products, polymerization, characteristic representatives and their application. Alkynes: structure, characteristics, synthesis, reactions, and applications. Cyclic hydrocarbons: cycloalkanes and cycloalkenes, nomenclature, geometric isomers, conformation, representatives and their characteristics, synthesis and reactions. Aromatic compounds: structure, aromaticity. Monocyclic: benzene and benzene derivatives, nomenclature, synthesis, electrophilic aromatic substitution (S_EA), substituents effects in electrophilic aromatic substitution, inductive/resonant effect, characteristic representatives and their application. Polycyclic: isolated rings; fused rings: naphthalene, structure, nomenclature, reactions. Aromatic cores in biologically active compounds. Alkyl halides: nomenclature, synthesis, reactions and mechanisms of elimination and nucleophilic substitution (S_E2/S_E1). Aryl halides, aryl-alkyl halides, acyclic and unsaturated halogen derivatives: nomenclature, synthesis, reactions, representatives. Organic compounds with oxygen. Alcohols: properties, nomenclature, synthesis and reactions				

	mechanisms, characteristic representatives and their application. Unsaturated alcohols. Polyols: characteristics, synthesis and application. Phenols: properties, nomenclature, synthesis, reactions, acidity of phenols, application. Ethers and cyclic ethers (epoxides): nomenclature, synthesis, reactions, characteristic representatives and their application. Esters of mineral acids: structure, synthesis, and representatives. Organic sulfur compounds: thioalcohols, thioethers, nomenclature, synthesis,, reactions. Organometallic compounds: Grignard compounds; organosilicon compounds, silicones. Organic compounds with nitrogen. Nitro compounds: structure, characteristics of the nitro group, nomenclature, synthesis and reactions. Amino compounds (amines): structure, characteristics of an amino group, synthesis, reactions involving amines, basicity of amines. Biologically important amines containing an amino group in the side chain. Amino alcohols. Diazo and azo compounds: nomenclature, synthesis, and reactions. Azo dyes: classification, structure, characteristics and application in the textile industry. Carbonyl compounds. Aldehydes and ketones: properties, nomenclature, synthesis, nucleophilic addition of C=O, oxygen substitution reaction of C=O, Cannizzaro reaction, condensation reaction. Aromatic aldehydes and ketones. Some biological nucleophilic addition reactions. Carboxylic acids: aliphatic saturated/unsaturated mono and dicarboxylic acids, aromatic mono and dicarboxylic acids, structure, acidity of carbonyl group, nomenclature, synthesis and reactions. Acid derivatives: halides, anhydrides, esters, amides, structure, nomenclature, properties, synthesis and reactions. Nitriles. Derivatives of carbonic acid. Substituted acids: halogen, hydro, keto and amino substituted acids, structure, nomenclature, properties, synthesis and reactions. Biomolecules. Proteins: structure, classification and synthesis of amino acids, acidity and basicity of amino acids, isoelectric point, peptides and proteins, nomenclature, synthesis, calcification and structure of proteins, enzymes. Lipids: fats, oils and waxes, structure, reaction, soaps, detergents, phospholipids, terpenes and terpenoids, isoprene rule, steroids. Stereochemistry: conformation, enantiomers, chirality, optical activity, specific rotation, R/S configuration, examples of chirality in nature. Carbohydrates: structure and classification. Monosaccharides: optical activity, classification, perspective formulas, mutarotation, reactions, characteristic pentoses and hexoses. Disaccharides: representatives of reducing and non-reducing disaccharides. Polysaccharides: representatives of homo and hetero polysaccharides (starch, cellulose, cellulose derivatives, glycogen, chitin, hyaluronic acid) and their application. Deoxy sugars. Nucleic acids: amino bases, structure and types, deoxyribonucleic and ribonucleic acid, Watson-Crick model, nucleic acids and heredity, protein synthesis. Heterocyclic compounds: nomenclature, basic heterocyclic with nitrogen, oxygen and sulfur, condensed heterocyclic compounds, important biologically active molecules with a heterocyclic nucleus. Synthetic polymers: structure, nomenclature, types of polymerizations. Biodegradable polymers.			
12.	**Study methods:** lectures and consultations, laboratory exercises, homework, home study (exam preparation)			
13.	**Total available time**		210	
14.	**Allocation of available time**			
15.	**Teaching activities**	15.1.	Lectures theoretical teaching	45

		15.2.	Exercises (laboratory, numerical, seminars, teamwork)	45
16.	**Other types of activities**	16.1.	Projects	10
		16.2.	Independent tasks	20
		16.3.	Homework and self-learning	90

17.	**Grading system**		
	17.1.	Test	80 points
	17.2.	Successfully realized laboratory/auditory exercises	10 points
	17.3.	Individual work/homework	5 points
	17.4	Participation	5 points

18.	**Grading criteria (points/grade)**	Up to 61 points	5 (five) (F)
		From 61 to 69 points	6 (six) (E)
		From 70 to 79 points	7 (seven) (D)
		from 80 to 89 points	8 (eight) (S)
		From 90 to 95 points	9 (nine) (B)
		from 95 to 100 points	10 (ten) (A)

19.	**Prerequisites for taking the final exam**	11 points minimum from 17.2 – 17.4
20.	**Language in which lectures are conducted**	English
21.	**Method for monitoring the quality of lectures**	Survey

22. **LITERATURE**

22.1. Compulsory literature

No.	Author	Title	Publisher	Year
1.	J. Mcmurry	Organic Chemistry: A Tenth Edition	OpenStax Rice University	2023
2.	T. W. G. Solomons, C. B. Fryhle, S. A. Snyder	Organic Chemistry 12th edition	John Wiley & Sons, Inc. A	2016
3.	J. Clayden, N. Greeves, S. Warren	Organic Chemistry Second edition	Oxford University Press	2012

22.2. Additional literature

No.	Author	Title	Publisher	Year
1.	F. A. Carey	Organic chemistry, Fourth edition	The McGraw-Hill Companies, Inc.	2000
2.				
3.				