**Study program:** Integrated academic studies of Pharmacy

**Type and level of the study program:** integrated academic studies

**Course title: ORGANIC CHEMISTRY I (PhI-OCHEMI)**

**Teacher:** Mihalj M. Poša, Ana S. Pilipović

**Course status:** compulsary

**ECTS Credits: 7**

**Condition:** General chemistry; Inorganic Chemistry

**Course aim**

The main aim in this course of Organic chemistry is to develop the logic of thinking about organic molecules. It is necessary to understand many pharmaceutical courses which come later. Also, it is necessary basic knowledge for all students in the field of pharmaceutical science.

**Expected outcome of the course:**

Necessary elementary knowledge about all classes of organic molecules, also, elementary knowledge about covalent bonds, structure and reactivity, stereochemistry of molecules. This knowlegde is necessary to better understand how different organic molecules, such as medicines, work.
Students need to build elementary skills for work in an organic laboratory, most importantly to learn about laboratory safety. In addition, they need to learn how to work with molecular models which will enable them to study Pharmaceuitical Chemistry and Pharmacognosy later on.

**Course description**

*Theoretical education*

1. Structure of organic molecules and covalent bonds. 2.Molecular orbitals and bonding. 3.Hybrid orbitals: sp3, sp2, sp. 4. Electronic effects in organic molecule: dipole moment, inductive effect, resonance effect and hyperconjugation effect. 5.Structures and formulas of organic molecules. IUPAC nomenclature of organic molecules and functional groups as centers of reactivity. 6.Structural effects on acidity and basicity of organic molecules. 7.Types of organic reactions and reaction mechanisms. 8.Shapes of molecules - stereochemistry . Display of three-dimensional molecules ( molecular models ) . chirality and optical activity and absolute configuration of R / S Sequential rules. Fischer projection formulas. 9.Alcanes : structure, physical and chemical properties . Conformation of cyclic and acyclic alcane molecules. Radical reactions of halogenic alcanes . Alkanes in nature. 10.Haloalcanes . nucleophilic substitution . The stereochemical course and mechanism of SN1 and SN2 reactions. Mono-molecule elimination bimolecule E1 and E2 elimination . Competency between substitution and elimination reactions. Haloalcanes in harmony with nature. 11.Alkynes : structure and physical and chemical reactions. Cis / trans isomerism . Electrophilic addition and Markovnik's rule. Alkynes and dienes . The reactions of the alkynes and conjugated diene . Alkenes and alkynes in nature. 12.Alcohols and thiols . Substitution reaction , elimination and oxidation. Organic and inorganic esters of alcohol. Ethers, epoxides and their sulfur analogs . Physiological characteristics and use of alcohol, ether and their sulfur anaoga. 13.Phenols : properties and reactions. Getting phenols - nucleophilic substitution . electrophilic substitution. phenol and its derivatives . Phenols in nature. 14.Aromatic compounds: benzene and its derivatives and other aromatic systems . Strukrura aromatic system and the Hückel rule ( 4n +2) pi electrons. Aromatic electrophilic substitution: nitration, sulfonotion , halogenation , Friedel - Krafts alkylation and acilatio, nucleophilic substitution of aromatic system. 15.Aldehydes and ketones . The structure and reactivity of the carbonyl group - mechanism of addition. Nucleophyle addition: water , alcohols , ammonia and amines . Enolatni ions and keto - enol tautomerism . Halogenic aldehydes andketones. Carbanionic condensation. Oxidation aldol and reduction of aldehydes and ketones. 16.Carboxylic acids . Structural and physical properties. Acid and alkaline character of carboxylic acids. Substitution of the carboxyl carbon , the addition - elimination mechanism . functional derivatives carboxylic acid: esters and lactones , amides and lactams, halides, peroxi, sulfonamides reduction carboxylic acids. Claisene condensation. Decarboxylation of carboxylic acids. Biological activity of carboxylic acids. 17. Amines : structural and physical person . Alkalinity and acidity amina. Synthesis amina. Quartenric ammonium salt. Hoffman elimination . N- nitrozoamini and diazonium salts . Diazo coupling . Reactions of amines and their derivatives with mineral acids. 18. Amino acids : structure and properties. Structure and chirality essential amino acids. Synthesis amino acids: a combination of chemical amines and carboxylic acids. Acid and base properties of amino acids. Peptides and proteins.

*Practical education: exercises, other forms of education, research related activities*

1. Introduction. General information: safety, glassware used in organic chemistry, the laboratory notebook. Simple distillation and fractional distillation. 2. Steam distillation. Extraction and drying the organic compounds. 3. Recrystallization of organic compounds from water and from organic solutions. 4. Experimental exam: experimental laboratory techniques. 5. Molecular models: conformations of cyclohexane, enantiomers and tetrahedral carbon, sequence rules for specification. of configuration. 6. Reactions of alkanes, alkenes and alkynes. 7. Reactions of alkyl halides. 8. Reactions of aromatic compounds. 9. Reactions of alcohols and phenols. 10. Reactions of aldehydes and ketones. 11. Reactions of carboxylic acids and their derivatives. 12. Reactions of amines. 13. Animation of reaction with computers techniques.

**Literature**

*Compulsory*

1. Vollhardt KPC, Schore NE. Organic chemistry: structure and function, fourth edition. USA, 2003

*Additional*

1. Yurkanis Bruice P. Organic chemistry, fourth edition. Pearson Education, 2004.

| **Number of active classes** | | | | Other: |
|---|---|---|---|---|
| Lectures: 60 | Practice: 30 | Other types of teaching: | Research related activities: | |

**Teaching methods:** lectures; laboratory practice

**Student activity assessment** (maximally 100 points)

| **Pre-exam activities** | **points** | **Final exam** | **points** |
|---|---|---|---|
| Lectures | 5 | Written | 35 |
| Practices | 15 | Oral | 10 |
| Colloquium | 2x15 | Other | 5 |
| Essay | | | |