МЕДИЦИНСКИ УНИВЕРСИТЕТ – ПЛОВДИВ
MEDICAL UNIVERSITY – PLOVDIV

Фармацевтичен факултет
Faculty of Pharmacy

КАТЕДРА „ХИМИЧНИ НАУКИ"
DEPARTMENT OF CHEMICAL SCIENCES

ПОСВЕТЕНИ НА ХУМАННОСТТА

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LECTURE COURSE SYLLABUS IN ORGANIC CHEMISTRY
FOR STUDENTS IN PHARMACY – SECOND YEAR, III SEMESTER
ACADEMIC 2021/2022

1. **Electronic effects in organic molecules**. Localized and delocalized chemical bonds – examples of systems with delocalized bonds. Induction effect. Mesomeric (resonance) effect. Resonance theory – canonical structures, hybrid structure, resonance energy. **2 h**

2. **Mechanism of organic reactions**. Homolytic and heterolytic bond cleavage, electrophiles, and nucleophiles. Types of ionic reactions – substitution, addition, elimination, condensations, rearrangements (examples). Energy diagrams, endothermic and exothermic processes. Kinetic and thermodynamic control – examples. Methods to study the mechanism of organic reactions. **2 h**

3. **Alkanes and cycloalkanes**. Basic principles of the IUPAC nomenclature. Preparation of alkanes, synthesis of *Würtz*. Halogenation of alkanes – mechanism of radical substitution reactions (S_R); reactivity and selectivity. Nitration and sulfochlorination. Stability and specific reactions of cycloalkanes. Cracking, petroleum products. **2 h**

4. **Stereochemistry – Part I.** Conformational isomerism. Perspective and *Newman* projections. Conformation analysis of ethane and butane. Cyclohexane – "chair" and "boat" conformations, equatorial and axial substituents. Conformation analysis of substituted cyclohexanes. Conformations of polycyclic compounds. Conformation and biological activity. **2 h**

5. **Stereochemistry - Part II.** Enantiomers and σ-diastereomers. Optical activity and chirality of molecules – examples of asymmetry in organic molecules. Absolute and relative configuration. *Fischer* projection formulas, D, L-configuration. *Kang-Ingold-Prelog* system (R, S-nomination system). Enantiomers and biological activity. Sigma -diastereomers. **3 h**

6. **Alkenes and cycloalkenes**. π-diastereomeric alkenes. Preparation – mechanism and stereochemistry of β-elimination reactions (E2, E1 and Ecb). *Zaytsev*'s rule, *Hoffman*'s rule – examples. Addition reactions of alkenes – hydrogenation, halogenation, addition of hydrogen halides, water, etc. Mechanism and stereochemistry of electrophilic addition (A_E) reactions. Oxidation of alkenes. Examples of alkenes polymerization. **3 h**

7. **Alkynes and dienes**. Preparation and properties of alkynes. *Kucherov*'s reaction (tautomerism), acidity of alkynes. 1,2- and 1,4-addition to conjugated dienes – kinetic and thermodynamic control of the reaction. The *Diels – Alder* reaction (examples). Polymerization of dienes. **2 h**

8. **Arenes**. Classification and nomenclature. Criteria for aromaticity, *Hükkel's* rule. Benzene and benzene homologues, styrene, biphenyl, condensed arenes. Chemical properties of benzene and its derivatives – mechanism of electrophilic substitution reactions (S_E), energy diagram. Nitration, sulfonation, halogenation, *Friedel-Crafts'* alkylation and acylation. Radical substitution, oxidation, and reduction of arenes. **2 h**

9. **Effect of substituents on reactivity and orientation in electrophilic aromatic substitution**. Activating and deactivating substituents, o-, m- and p-direction. Stability of the corresponding arenium ions (σ-complexes) in o-, m- and p-substitution. Influence of two or more substitutes. Naphthalene sulfonation. **2 h**

10. **Alcohols, diols, and thioalcohols**. Industrial and laboratory methods for preparation. Chemical properties of alcohols – mechanism and stereochemistry (*Walden* inversion, racemization) of the nucleophilic substitution (S_N) reactions; dehydration, etherification, esterification. Laboratory and biological oxidation of alcohols. Periodate oxidation of diols. Properties of thioalcohols. **4 h**

11. **Phenols**. Acidity of phenols, influence of substitutes in aromatic ring. Natural sources of phenols, industrial production of phenols. Electrophilic substitution in the benzene ring. Competitive acylation and alkylation reactions in the benzene ring and the phenol group. Laboratory and biological oxidation of phenols. Concept of polyphenols. **2 h**

12. **Aldehydes and ketones**. Classification and nomenclature. Keto-enol tautomerism. Industrial and laboratory synthetic methods – ozonolysis of alkenes, hydration of alkynes, oxidation of alcohols. *Gattermann–Koch* and *Reimer–Tiemann* reaction. *Friedel-Crafts* acylation of aromatic compounds. Chemical properties – mechanism of nucleophilic addition (A_N) and addition – elimination (A_N + E) reactions. Reactions with *Grignard* reagents. Aldol condensation and crotonylation (mechanisms of the reactions). *Cannizzaro* reaction. Oxidation and reduction of carbonyl compounds. Quinones. **4 h**

Prepared by: ..... Head of the Department: .....

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