|  |  |  |  |
| --- | --- | --- | --- |
| **Course title**  Organic chemistry – ERASMUS  Chemia organiczna – ERASMUS | | | **ECTS code**  13.3.1277 |
| **Name of unit administrating study**  Faculty Chemistry | | | |
| **Studies**   |  |  |  |  | | --- | --- | --- | --- | | **Field of study** | **Type** | **Form** |  | | Chemistry | Bachelor | Full-time studies |  | | Chemistry | Master | Full-time studies |  | | Environmental sciences | Bachelor | Full-time studies |  | | | | |
| **Teaching staff**  Prof. dr hab. Adam Prahl, dr hab. Andrzej Nowacki | | | |
| **Forms of classes, the realization and number of hours** | | **ECTS credits 6**  classes 60 h  tutorial classes 20 h  student’s own work 70 h  TOTAL: 150 h - 6 ECTS | |
| 1. **Forms of classes, in accordance with the UG Rector’s regulations**   laboratory classes | |
| 1. **The realization of activities**   In-class | |
| 1. **Number of hours**   60 h - laboratory | |
| **The academic cycle**  winter | | | |
| **Type of course**  facultative | **Language of instruction**  English | | |
| **Teaching methods**  Laboratory experiments | **Form and method of assessment and basic criteria for evaluation or examination requirements** | | |
| **A. Final evaluation, in accordance with the UG study regulations**  course completion (with a grade) | | |
| **B. Assessment methods**  Writing test | | |
| **C. The basic criteria for evaluation** or exam requirements  Evaluation criteria in accordance with the UG Studies Regulations; | | |
| **Required courses and introductory requirements**  no requirements | | | |
| **Aims of education**  • making students familiar with all the issues listed in the contents of the lecture program, basic types of organic compounds, methods of writing their structures and prediction of their spatial structures  • developing of skills in planning of a number of consecutive reactions, leading to a specific product;  • introducing students to the possibility of predicting the behavior of bi-functional;  • developing of self-experimentation skills and problem solving while conducting chemical experiments  • making students familiar with both the toxicity, as well as the healing properties of selected organic compounds | | | |
| **Course contents**  Chemical nomenclature, electronic structure of organic compounds, atomic and molecular orbitals, hybridization,  isomerism (constitutional, stereoisomerism). Alkanes, cycloalkanes, alkenes, alkynes: synthesis and reactivity. Radical substitution, addition to multiple bonds. The structure and stability of radicals and carbocations, rearrangement of carbocations. Con-jugated dienes, resonance. Electrophilic addition to alkynes. The stereochemistry: chiral centers, the enantiomers, diastereoisomers, mesocompounds, racemic mixtures and their separation. Conformational analysis of ethane, butane, cyclohexane (axial and equatorial bonds), three-dimensional and Newman projections. Aromatic compounds. The aromaticity criteria. Electrophilic aromatic substitution. Isomerism of polysubstituted aromatic compounds. The mechanism of the nucleophilic substitution of aromatic compounds. Polycyclic aromatic hydrocarbons. Alcohols, phenols, ethers, and epoxides - synthesis and reactivity. The reactions with alkyl halides, the dehydration, the reactions with metals, oxidation, acylation. Nucleophilic substitution: Sn1 and Sn2. Elimination reactions: E1 and E2 - mechanism and stereochemistry. Aldehydes and ketones. The structure and properties of the  carbonyl group. Nucleophilic addition of water, alcohols, amines and Grignard compounds to carbonyl group. Aldol condensation, Cannizzaro reaction, Wittig reaction. Carboxylic acids and their derivatives. Synthesis of carboxylic acids and their reactivity. Esterification reactions, the formation of acid halides, anhydrides, amides and others. Substitution inside acyl group . Keto-enol tautomerism. The use of ethyl acetoacetate and diethyl malonate in organic synthesis. The condensation reactions e.g. aldol, Claisen, Michael addition and similar reactions. Amines, alkalinity and nucleophilicity. Synthesis and reactions of amines. Heterocyclic compounds. Structure and nomenclature. Reactions with electrophilic and nucleophilic reagents, oxidation and reduction, acid-base properties. Organophosphorus compounds, Halo and hydroxy acids, amino acids and peptides. Modern strategies of organic  synthesis, such as retrosynthesis, protection and transformation of functional groups.  Laboratory classes: practical acquisition and improvement of skills in the chemical laboratory, performing of  exercises/experiences related with thin-layer chromatography, crystallization and identification of selected organic compounds, synthesis of four preparations | | | |
| **Bibliography of literature**  R. Morrison, R. Boyd – Organic chemistry, vol. 1-2;  J. McMurry – Organic chemistry;  L.G. Wade Jr. - Organic chemistry; | | | |
| **Knowledge**  1. understands and describes the electron structure of individual organic compounds;  2. knows the main principles of naming organic compounds;  3. formulates and defines laws and concepts in the field of organic chemistry;  4. characterizes and understands the systematics of the most important classes of organic compounds;  5. knows the methods of obtaining specific organic compounds;  6. illustrates and describes by means of chemical equations the properties of organic compounds;  7. recognizes and names the basic types of organic reactions;  8. knows the basic laboratory techniques. | | | |
| **Skills**  1. in a comprehensible way (in both speech and in writing), presents correct chemical reasoning;  2. understands differences in the structure and reactivity of individual classes of organic compounds, (including stereochemistry and mechanisms);  3. correctly designs the synthesis of the organic compound and selects appropriate methods for their separation, purification and identification;  4. recognizes basic laboratory equipment and uses it to carry out chemical experiments;  5. carefully observes the experiment, keeping laboratory notes up to date;  6. predicts, verifies and criticizes the results of conducted experiments,  7. independently searches for information in the chemical literature;  8. talks about chemical issues in correct chemical language | | | |
| **Social competence**  1. understands the need for further education;  2. has responsibility in working with chemical reagents;  3. shows creativity in both, independent and team work;  4. follows established research procedures;  5. is careful in dealing with hazardous chemicals. | | | |