STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
New Methods of Organic Compounds Synthesis	**1010702211010720081**

Field of study	Profile of study (general academic, practical)	Year /Semester
Chemical Technology	**(brak)**	**1 / 1**
Elective path/specialty	**Subject offered in:**	**Course (compulsory, elective)**
Organic Technology	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **2** Classes: **1** Laboratory: **3** Project/seminars: **-**	**5**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
(brak)	**(brak)**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**5 100%**
Technical sciences	**5 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	1. The student has structured, theoretically founded knowledge of general and organic chemistry obtained during studies in chemical technology first degree, knows the characteristic, basic reactions of the most important groups of organic compounds. 2. The student has a basic knowledge of information technology.
2	**Skills**	1. The student is able to solve the basic problem tasks of organic chemistry based on his knowledge. 2. The student has the ability to obtain information from the identified sources.
3	**Social competencies**	1. The student is aware of the need to supplement his knowledge and its continuous updating. 2. The student knows the basic principles of teamwork.

Assumptions and objectives of the course:

1. Provide students with extensive and solid knowledge of organic chemistry in modern synthetic methods, how to plane and choose the most optimal method of obtaining the selected groups of organic compounds.

2. Develop students' ability to solve basic problems in the one-step and multi-step syntheses of organic compounds, ability to prepare recipe preparative of selected organic compound based on the literature source using advanced laboratory techniques.

3. Mastering the students' ability to use molecular modeling to analyze and evaluate the structural and physicochemical properties of simple and complex organic molecules as well as planning the synthesis of compounds.

4. Develop students' awareness of the responsibility for their future decisions relevant to the chemical engineer work.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. The student has an extended, solid knowledge of modern methods of organic synthesis, methods of planning and selection of the optimal methods of obtaining the selected groups of organic compounds. - [K_W02]

2. The student has in-depth knowledge of new, versatile and efficient chemical reactions that allow to reduce or even exclude some of the issues related to environmental protection during the synthesis on an industrial scale. - [K_W08]

3. The student knows the modern methods of study of the structure and properties of materials based on molecular modeling, useful for the characterization of raw materials and products of chemical industry. - [K_W07]

Skills:

1. The student can reliable select source of chemical and environmental information, critically evaluate the information obtained from the literature and electronic databases and carry out their analysis and draw conclusions. - [K_U01]

2. The student based on source material (also in English) and his own research can make a professional presentation of studied scientific issue. - [K_U06]

3. The student is able to use professional software, using them for the design of chemical processes and intermolecular interactions. - [K_U07]

4. The student knows and respects the principles of work-related health and safety in the chemical laboratory. - [K_U18]

Social competencies:

1. The student understands the need for continuous professional development. - [K_K01]

2. The student understands the importance of the responsibility that rests on all members of the team performing the task assigned; is aware of the need to respect the principles of teamwork. - [K_K04]

Assessment methods of study outcomes

Lectures - Assessment of knowledge and skills on the basis of the written exam (6 problem tasks based on course description of lectures).

Classes - Assessment prepared by the student (based on reference literature) presentation discusses the selected type of modern chemical reactions and to assess the knowledge he has acquired on the basis of test summary.

Laboratory:

1) Synthesis of the product - oral answer before the preparation, analyzing how to execute of the planned synthesis (based on the research literature); evaluation of the practical implementation of the synthesis of the desired product; evaluation report containing an analysis of research literature and discuss the progress and result of the synthesis of an organic compound.

2) Molecular modeling - final test.

Course description

Lectures:

Factors influencing the reactivity of molecules and chemical reactions direction: types of interactions between molecules, acidity and basicity of organic compounds, electrophiles and nucleophiles, hard and soft acids and bases - sort by Pearson, Hammett equation, the role of the catalyst and solvent. Classification of solvents. Empirical parameters of solvent polarity. Phase transfer catalysis. Chemo-, regio- and stereoselective reactions. Stereospecific reactions. Selectivity and mechanisms of organic reactions: direct and conjugate addition (?1,2-addition? and ?1,4-addition?), elimination, electrophilic and nucleophilic substitution, reactions of oxidation and reduction. Protection of functional groups. Retrosynthetic analysis. Selective formation of carbon-carbon and carbon-heteroatom bonds, for example a metathesis reaction of alkenes, aldol condensation, Michael addition, Robinson annulation, coupling reactions with the participation of organometallic catalysts, pericyclic reactions. The use of organosilicone compounds, and organo-boron(III) compounds in organic synthesis. Examples of multi-step syntheses of organic compounds present in the environment (total syntheses).

Classes:

Learning to use the primary literature. The discussion of the subject areas, with the active participation of students, some types of modern chemical reactions used in the multi-stage syntheses, among other compounds present in the environment.

Laboratory:

1) Carrying out research literature on methods of obtaining the selected organic compound. Synthesis of the preparation using professional equipment and advanced purified techniques. Before making the preparation - a reminder and update industrial safety rules in force in the organic chemistry lab.

2) The introduction of the basic principles of molecular modeling - spatial manipulation of molecules with certain models of structural parameters in two and three dimensions, the basic techniques of molecular structures, modeling and measurement of structural parameters, building of multi-functional molecules, minimizing the energy of the molecule or molecules in the vacuum system.

Basic bibliography:

1. McMurry J., Chemia organiczna, PWN, Warszawa 2007.

2. Clayden J., Greeves N., Warren S., Wothers P., Chemia organiczna, tom I, II i III, WNT, Warszawa 2009.

3. Mąkosza M., Fedoryński M., Podstawy syntezy organicznej. Reakcje jonowe i rodnikowe, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2006.

4. Skarżewski J., Wprowadzenie do syntezy organicznej, PWN, Łódź 1999.

5. Buza D., Sas W., Szczeciński P., Chemia organiczna. Kurs podstawowy, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2006.

Additional bibliography:

1. Willis C., Wills M, Synteza organiczna, Wydawnictwo Uniwersytetu Jagiellońskiego, Kraków 2004.

2. Smith M.B., March J., Advanced Organic Chemistry, Reaction, Mechanism and Structure, J.Wiley & Sons, New Jersey 2007.

3. Vogel A.I., Preparatyka organiczna, WNT, Warszawa 2006.

4. Przewodnik do nomenklatury związków organicznych, Polskie Towarzystwo Chemiczne, Warszawa 1994.

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures, exercises	45
2. Participation in the laboratory	45
3. Participation in consultations related to the preparation of presentation to exercise, preparation of synthesis and preparation of the student for classes laboratory tests, test summary and exam	8
4. Preparation of the presentation	5
5. The research literature and preparing the report after class laboratory	7
6. Preparation for final test	5
7. Preparation for the test carried out on exercises	7
8. Preparation for the exam and the presence of the exam	17

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	139	5
Contact hours	101	3
Practical activities	57	2