



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Modern Methods of Synthesis of Drugs - Advanced Methods of Synthesis of API

	Course
Field of study	Year/Semester
Pharmaceutical Engineering	3/6
Area of study (specialization)	Profile of study
-	general academic
Level of study	Course offered in
First-cycle studies	polish
Form of study	Requirements
full-time	elective

Number of		
hours		
Lecture	Laboratory classes	Other (e.g. online)
0	0	0
Tutorials	Projects/seminars	
15	0	
<b>Number of credit points</b>		
1		

Lecturers	
Responsible for the course/lecturer: Dr n. farm. Tomasz Koczorowski	Responsible for the course/lecturer:
Chair and Department of Chemical Technology of Drugs	
Poznan University of Medical Sciences	
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**Prerequisites**

Before the course, students should have well-grounded theoretical and practical knowledge in the field of organic, physical and drug chemistry, as well as from the basic course of Synthesis and technology of drugs. They should also become familiar with selected procedures regarding good laboratory practice as well as health and safety and fire protection rules.

### Course objective

During the course, students will learn about modern synthesis methods, such as cross-coupling reactions, stereo- and regioselective reactions of modern pharmaceutically active substances and excipients, as well as leading substances in the search for new drugs and their synthetic blocks.



### Course-related learning outcomes

#### Knowledge

##### Student:

K\_W4 has structured, theoretically founded general knowledge in the field of inorganic, organic, physical and analytical chemistry enabling understanding, description and investigation of chemical phenomena and processes related to pharmaceutical engineering

K\_W7 knows the basic techniques, methods for characterization and identifying pharmaceutical products and research tools used in pharmaceutical engineering, knows the classical and instrumental methods used in assessing the quality of substances for pharmaceutical purposes and in quantitative analysis in drugs, knows the physicochemical properties of substances for pharmaceutical purpose on the activity of drugs, knows the classification of analytical techniques together with the criteria for the selection of methods and their validation

K\_W24 has basic knowledge in the field of searching for new drugs, natural and synthetic products as well as their biochemical and molecular gripping points, pharmacopoeial standards and norms related to pharmaceutical engineering; knows methods and techniques for researching new drug substances in chemical, pharmaceutical and toxicological terms

K\_W14 knows the development of pharmaceutical engineering and research methods used in it, as well as directions of development of the pharmaceutical industry in the country and all over the world

K\_W15 has solid knowledge in the field of separation and purification processes of raw materials and products found in the pharmaceutical, cosmetics and chemical industries

#### Skills

##### Student:

K\_U1 understands literature in the field of pharmaceutical engineering in Polish; reads and understands simple scientific and technical texts in English, is able to obtain information from literature, databases and other sources related to pharmaceutical engineering, also in English, is able to integrate and interpret them, draw conclusions and formulate opinions

K\_U2 is able to explain the basic phenomena associated with significant processes, to distinguish between types of chemical reactions and has the ability to select them for chemical processes, can characterize various states of matter, the structure of chemical compounds, including drug substances, using theories of their description, methods and experimental techniques

K\_U8 uses basic techniques, research equipment and apparatus useful in biotechnology, synthesis and analysis of pharmaceutically active substances, dosage form technology and toxicology, appropriate for pharmaceutical engineering, uses pharmacopoeial methods, prepares documentation

#### Social competences

##### Student:



K\_K2 is ready to make an independent decisions and lead a team, critically assess his own actions and those of the team, take responsibility for the effects of these activities and is able to cooperate and work in a group, inspire and integrate the professional environment

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Forming methods:

1. The structure of course includes active discussion, problem solving and seminar
2. Observation of student work during seminars and analysis of his ability to work independently and teamwork.

Summary methods:

1. The test, consisting of 20 single-choice questions.
2. The report of the exercise performed together with the solution of tasks and problem questions.

### Programme content

In the course, students take part in the search and planning of modern types of chemical reactions, make the appropriate calculations, have the opportunity to observe the physical and chemical processes performed by the assistant and prepare documentation containing observations and conclusions. In addition, students have the opportunity to participate in a demonstration of (i) modern synthesis of i.e.: acetylsalicylic acid, N-phthaloylglycine, fluorescein, phthalocyanine photosensitizers used in photodynamic therapy, (ii) modern solvents of "green chemistry" such as ionic liquid - 1-butyl-3-methylimidazolium chloride, (iii) the synthesis of dihydropyrimidine by the Biginelli method and a selected lead substance from the group of pyrazole derivatives, which are potential active substances in the treatment of myocardial hypertrophy.

### Teaching methods

The course is performed in the form of demonstration and seminar classes in the laboratory, combined with a theoretical introduction. As part of independent work during lab classes, students deal with planning processes as part of a selected synthetic task, conducting the process, developing the results obtained and analyzing the results confirming the identity of the synthesized compounds.

### Bibliography

Basic

1. D. Skwarski, L. Seńczuk, J. Kalinowska-Torz, Ćwiczenia z technologii chemicznej środków leczniczych, Wydawnictwo AM, Poznań, 1987.
2. J. Gawroński, K. Gawrońska, K. Kacprzak, M. Kwit, Współczesna synteza organiczna. Wybór eksperymentów, PWN, Warszawa, 2004.



Additional

1. R.B. Silverman, Chemia organiczna w projektowaniu leków, WNT, 2004.
2. G.L. Patrick, Chemia medyczna podstawowe zagadnienia, WNT, 2003.
3. F. Gualtieri, New trends in synthetic medicinal chemistry, Wiley-VCH, Weinheim, 2000

**Breakdown of average student's workload**

	Hours	ECTS
Total workload	25	1,0
Classes requiring direct contact with the teacher	15	0,6
Student's own work (literature studies, preparation for tutorials, preparation for tests) <sup>1</sup>	10	0,4

<sup>1</sup> delete or add other activities as appropriate