SUBJECT/COURSE SYLLABUS

1.	Course name in Polish and English **Biotechnology of pharmaceutics** Biotechnologia farmaceutyczna
2.	Scientific discipline **Medical sciences** **Biotechnology**
3.	Language of instruction **English**
4.	Unit conducting the course **Faculty of Biotechnology**
5.	Type of course **elective - choice limited to Bioengineering and Biotechnology of pharmaceutics**
6.	Field of study **Biotechnology**
7.	Level of study **first-cycle**
8.	Year of study **3rd**
9.	Semester **summer**
10.	Course form and number of hours **Lecture, 30 h**
11.	Prerequisites in terms of knowledge, skills and social competences for the course: • Knowledge of the **fundamentals of analytical and physical chemistry**, **human physiology**, **cell and molecular biology**, as well as the **basics of enzymology and biochemistry**

12.	Learning objectives for the course: To familiarize students with the basic terminology of preclinical and clinical research in R&D processes. To provide fundamental knowledge and practical skills in pharmacology, pharmacokinetics, and pharmacodynamics, with a particular focus on bioavailability and biotechnological drugs.	
13.	Curriculum content: • Significance of pharmaceutical biotechnology, basic issues, and historical background. • Pharmaceutical aspects of plant biotechnology. • The role of modern biotechnology in the discovery of new drugs and drug targets. • Fundamental problems and concepts: selection models for compounds with potential therapeutic use (specificity, cost, translatability, automation). • Importance of physiological effects tests. • Lifestyle diseases as targets for therapy/diagnostics (cancer, cardiovascular, respiratory diseases) and genetic disorders. • Overview of key challenges in searching for substances with anticancer potential. • Discussion of specific signaling pathways as targets in anticancer therapy and their interrelationships. • Drug targets within these pathways and associated challenges. • Introduction to *in vitro* cell cultures and *in vivo* animal models (cytotoxicity, etc.). • Cardiovascular diseases as therapeutic targets - primary signaling pathways – hypoxia, ischemia, and angiogenesis as therapeutic targets. • Basic research models and problems. • Respiratory diseases as therapeutic targets - primary signaling pathways - restoration of homeostasis as a therapeutic goal. • Perspectives on gene therapy.	
14.	Description of learning outcomes Student: • defines key concepts in pharmaceutical biotechnology and describes its contemporary significance in the drug industry. • characterizes the pharmaceutical aspects of plant biotechnology. • explains the molecular mechanisms of signaling pathways as potential targets for anticancer, cardiovascular, and respiratory therapies. • describes the principles of modern drug selection models, including high-throughput screening. • identifies the basic principles of gene therapies.	Symbols for relevant directional learning outcomes: **K1_W01** **K1_W09** **K1_W12** **K1_U08** **K1_U09** **K1_K06**

	• identifies and justifies molecular targets for drugs based on the etiology of lifestyle diseases. • recognizes connections between different signaling pathways in the context of designing targeted therapies. • critically analyzes research models (*in vitro* and *in vivo*). • proposes an appropriate model for testing the cytotoxicity or biological activity of a compound. • is aware of the responsibility for the reliability of conducted biotechnological research and the interpretation of drug safety data. • understands the need for lifelong learning in the face of the dynamic development of modern therapeutic technologies. • formulates opinions on the ethical and economic aspects of introducing new biotechnological drugs to the market.	
15.	Mandatory literature: • **Materials provided by the instructors.** Recommended literature: • Daan J. A. Crommelin; Robert D. Sindelar; Bernd Meibohm **Pharmaceutical Biotechnology;** Springer (5th edition or newer) • Robert A. Copeland; **Eznymes;** Wiley -VCH; • **Nature Reviews in Drug Discovery.**	
16.	Methods of verification of the assumed learning outcomes: • **Written exam** – 10 open-ended questions	
17.	Conditions and form of credit for individual components of the course: • **Completion of laboratory classes and a passing grade on the final exam**	
18.	Student workload expressed in teaching hours and ECTS credits	number of hours allocated for the course of a given type of classes
	classes (according to the study plan) with the instructor: • **lecture**	**30 h**

	student's own work (including participation in group work) e.g.: • **Reading assigned literature** • **Preparation for classes** • **Preparation for the exam**	**20 h**
	Total number of class hours:	**50 h**
	Number of ECTS credits:	**2 ECTS**