UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Program studiów

Wydział:	Wydział Farmaceutyczny
Kierunek:	Drug Discovery and Development
Poziom kształcenia:	drugiego stopnia
Forma kształcenia:	stacjonarne
Rok akademicki:	2023/24

Spis treści

Program

Podstawowe informacje

Klasyfikacja ISCED:	0916
Liczba semestrów:	4
Tytuł zawodowy nadawany absolwentom:	magister

Opis realizacji programu:

Drug Discovery and Development (DDD) to studia koncentrujące się na wszystkich aspektach identyfikacji i opracowywania nowych leków. Celem studiów jest przygotowanie wysokiej klasy specjalistów, posiadających unikalne połączenie zaawansowanej wiedzy teoretycznej z zakresu pracy nad lekiem z umiejętnościami praktycznymi. Student otrzymuje solidną podstawę w zakresie nauk farmaceutycznych, ale także możliwość specjalizacji w konkretnym obszarze odkrywania i rozwoju leków. Pierwszy semestr ma na celu zapewnienie podstawowego zrozumienia procesu odkrywania i opracowywania leków oraz kluczowych aspektów chemicznych, biologicznych i patofizjologicznych istotnych z punktu widzenia prac nad lekiem. Drugi semestr to szerokie i zrównoważone tematycznie szkolenie w dziedzinie nauk farmaceutycznych, które służy za podstawę dalszego, ukierunkowanego rozwoju kwalifikacji zawodowych. Semestry trzeci i czwarty koncentrują się na jednej z trzech dziedzin wiodących, takich jak: Chemia Leków, Farmakologia Eksperymentalna oraz Rozwój Leku Wspierany Modelowaniem Matematycznym.
Absolwenci studiów DDD szczegółowo zapoznają się z procesem poszukiwania nowych leków ich identyfikacji, badania, produkowania i testowania. Kształcenie obejmuje także najważniejsze aspekty prawno-regulacyjne, niezbędne do ich oficjalnej akceptacji jako produktów leczniczych. Ponadto, zdobędą umiejętności zarządzania i kompetencje językowe, wspierające ich przyszłe zatrudnienie w branży pharma-biotech, agencjach rejestracyjnych oraz centrach badań nad lekiem na całym świecie.

Liczba punktów ECTS

konieczna do ukończenia studiów	120
w ramach zajęć prowadzonych z bezpośrednim udziałem nauczycieli akademickich lub innych osób prowadzących zajęcia	73
którą student musi uzyskać w ramach zajęć z zakresu nauki języków obcych	6
którą student musi uzyskać w ramach modułów realizowanych w formie fakultatywnej	41
którą student musi uzyskać w ramach praktyk zawodowych	-
którą student musi uzyskać w ramach zajęć z dziedziny nauk humanistycznych lub nauk społecznych	5

Liczba godzin zajęć

Łączna liczba godzin zajęć: 1841

Praktyki zawodowe

Wymiar, zasady i forma odbywania praktyk zawodowych

nie dotyczy

Ukończenie studiów

Wymogi związane z ukończeniem studiów (praca dyplomowa/egzamin dyplomowy/inne)

Ukończenie studiów wymaga spełnienia łącznie następujących warunków 1) zaliczenia wszystkich przedmiotów obowiązkowych i fakultatywnych określonych w programie studiów 2) zdania egzaminu dyplomowego 3) przygotowania i obrony pracy dyplomowej.

Efekty uczenia się

Wiedza

Kod	Treść	PRK
DDD_KDR_W01	The graduate knows and understands phenomena and interpretations of parameters describing the properties of a drug and its fate in the body	P7S_WG
DDD_KDR_W02	The graduate knows and understands mechanisms of action, application and side effects of drugs most important from the point of view of society and the economy	P7S_WG
DDD_KDR_W03	The graduate knows and understands the process of searching, obtaining and properties of medicinal substances (biologically active)	P7S_WG
DDD_KDR_W04	The graduate knows and understands the specificity of the studies on the pharmacokinetic, pharmacodynamic and toxicological properties of drugs and drug candidates in vitro and in vivo	P7S_WG
DDD_KDR_W05	The graduate knows and understands guidelines for the development, production and evaluation of the properties of the dosage form	P7S_WG
DDD_KDR_W06	The graduate knows and understands application of analytical methods used in drug research	P7S_WG
DDD_KDR_W07	The graduate knows and understands statistical methods, mathematical models and in silico research used in pharmaceutical sciences	P7S_WG
DDD_KDR_W08	The graduate knows and understands principles of functioning of the pharmaceutical sector and main trends and prospects for its development	P7S_WK, P7S_WG
DDD_KDR_W09	The graduate knows and understands requirements and legal and ethical aspects regarding the development and implementation of the drug	P7S_WK
DDD_KDR_W10	The graduate knows and understands issues necessary for independent planning and implementation of research tasks in the area of its specialty	P7S_WG
DDD_KDR_W11	The graduate knows and understands rules of functioning of the equipment and apparatus used at various stages of drug research and development	P7S_WK
DDD_KDR_W12	The graduate knows and understands functioning of equipment and apparatus used at various stages of drug research and development	P7S_WK
DDD_KDR_W13	The graduate knows and understands principles of protection of intellectual and industrial property	P7S_WK
DDD_KDR_W14	The graduate knows and understands principles and methodology of scientific research, development and processing of research results as well as preparation and evaluation of scientific publications	P7S_WK

Umiejętności

Kod	Treść	PRK
DDD_KDR_U01	The graduate can critically analyze information and research results in the field of pharmaceutical sciences and draw correct conclusions based on them	P7S_UW
DDD_KDR_U02	The graduate can plan and carry out specialized research in the field of drug discovery and development by selecting the appropriate methodology and using professional equipment and software	P7S_UK, P7S_UW
DDD_KDR_U03	The graduate can interpret the results of specialist research and draw conclusions, formulate opinions and solve problems related to the search and development of a drug	P7S_UW

Kod	Treść	PRK
DDD_KDR_U04	The graduate can support research with appropriate statistical methods and mathematical models, and with the use of databases and specialized software	P7S_UW
DDD_KDR_U05	The graduate can cooperate and communicate effectively with people with various expertise, experience, and knowledge levels and specialists in various fields of science in order to implement research plans and solve complex problems in the field of drug discovery and development	P7S_UK
DDD_KDR_U06	The graduate can obtain reliable scientific information, use appropriate databases, professional literature and expert opinions	P7S_UW
DDD_KDR_U07	The graduate can present and disseminate knowledge and research results in a professional, understandable and accessible way for various groups of recipients	P7S_UK
DDD_KDR_U08	The graduate can communicate in English at the B2 + level using specialized vocabulary in the field of pharmaceutical sciences	P7S_UK
DDD_KDR_U09	The graduate can effectively work in a group, assuming an advisory, expert or managerial role depending on the needs	P7S_UO, P7S_UK
DDD_KDR_U10	The graduate can identify errors and neglects in the process of drug research and development as well as own work and research	P7S_UW
DDD_KDR_U11	The graduate can take care of the continuous development of knowledge and skills as well as dissemination of professional knowledge in the society	P7S_UU

Kompetencje społeczne

Kod	Treść	PRK
DDD_KDR_K01	The graduate is ready to gain reliable knowledge and critically assess the received content in solving cognitive and practical problems	P7S_KK
DDD_KDR_K02	The graduate is ready to reliably and responsibly fulfill professional duties and comply with the rules of professional ethics	P7S_KR
DDD_KDR_K03	The graduate is ready to take responsibility for their work and for critical self-evaluation	P7S_KR
DDD_KDR_K04	The graduate is ready to assign priorities for the implementation of a chosen goal or other tasks, and if necessary, consult experts	P7S_KK
DDD_KDR_K05	The graduate is ready to act in an entrepreneurial way and for the benefit of society	P7S_KO
DDD_KDR_K06	The graduate is ready to evaluate ethical issues related to human research	P7S_KK
DDD_KDR_K07	The graduate is ready to concern for personal safety, the environment and colleagues	P7U_K

Plany studiów

Semestr 1

Przedmiot	Liczba godzin	Punkty ECTS	Forma weryfikacji		
Legal and Scientific Basics of Drug Discovery and Development	wykład: 35 seminarium: 35	5,0	egzamin pisemny	O	Or
Chemistry in Pharmaceutical Sciences	wykład: 50 ćwiczenia: 75 seminarium: 25	8,0	egzamin pisemny	O	Or
Biology in Pharmaceutical Sciences	wykład: 22 ćwiczenia: 64 seminarium: 8 seminarium e-learning: 6	7,0	egzamin pisemny	O	Or
Diseases States and Pharmacotherapeutic Strategies	ćwiczenia: 30 seminarium: 30 wykłady e-learning: 15	-	-	O	Or
Humanities - Bioethics in Pharmaceutical Sciences	wykład: 15 seminarium: 15	3,0	zaliczenie na ocenę	O	Os
Humanities – Scientific Writing	seminarium e-learning: 18 ćwiczenia e-learning: 12	2,0	zaliczenie na ocenę	O	Os
Introduction to Biostatistics	seminarium e-learning: 30	2,0	zaliczenie na ocenę	O	Or
Foreign Language in Pharmaceutical Sciences	lektorat: 20	-	-	O	Os
BHK	szkolenie BHK: 6	-	zaliczenie	O	Or

Semestr 2

Przedmiot	Liczba godzin	Punkty ECTS	Forma weryfikacji		
Diseases States and Pharmacotherapeutic Strategies	ćwiczenia: 30 seminarium: 30 wykłady e-learning: 15	8,0	egzamin pisemny	O	Or
Principles of Medicinal Chemistry	wykład: 30 seminarium: 60	6,0	egzamin pisemny	O	Or
Molecular ADME and In Vivo Pharmacokinetics	ćwiczenia: 30 seminarium: 20 warsztat: 10	3,0	egzamin pisemny	O	Or
Principles of Pharmaceutical Technology	wykład: 20 ćwiczenia: 20 seminarium: 20	3,0	egzamin pisemny	O	Os
Molecular Screening Systems	wykład: 6 ćwiczenia: 18 seminarium: 6	2,0	zaliczenie na ocenę	O	Os

Przedmiot	Liczba godzin	Punkty ECTS	Forma weryfikacji		
Introduction to Animal Models of Disease States	ćwiczenia: 15 seminarium: 10 wykłady e-learning: 5	2,0	zaliczenie na ocenę	O	Os
Introduction to Drugs Safety and Toxicology	ćwiczenia: 4 seminarium: 10 warsztat: 16	2,0	zaliczenie na ocenę	O	Or
Pharmaceutical Project Management	seminarium: 15	1,0	zaliczenie na ocenę	O	Os
Foreign Language in Pharmaceutical Sciences	lektorat: 25	2,0	zaliczenie	O	Os
Elective courses semester 2				O(G)	Os
Student musi zaliczyć 1 przedmiot z grupy					
Biological Drugs	wykład: 15 ćwiczenia: 25 seminarium: 10	4,0	zaliczenie na ocenę	F	Os
Pharmaceutical Biotechnology	wykład: 15 ćwiczenia: 25 seminarium: 10	4,0	zaliczenie na ocenę	F	Os

Semestr 3

Przedmiot	Liczba godzin	Punkty ECTS	Forma weryfikacji		
Foreign Language in Pharmaceutical Sciences	lektorat: 45	4,0	egzamin	O	Os
Principles of Clinical Trials	wykład: 15 seminarium: 15	2,0	zaliczenie na ocenę	O	Os
Elective courses – pathways semester 3				O(G)	Os
Student musi zaliczyć 1 przedmiot z grupy					
Medicinal Chemistry	wykład: 3 ćwiczenia: 197 seminarium: 170 warsztat: 30	36,0	egzamin pisemny	F	Os
Experimental Pharmacology	ćwiczenia: 350 seminarium: 30 wykłady e-learning: 20	36,0	egzamin pisemny	F	Os
Model Informed Drug Development	ćwiczenia: 200 seminarium: 200	36,0	egzamin pisemny	F	Os
Elective courses semester 3				O(G)	Os
Student musi zaliczyć 1 przedmiot z grupy					
Generic Medicinal Products	seminarium: 15	1,0	zaliczenie	F	Os
Drug Discovery – Case Studies	seminarium: 15	1,0	zaliczenie	F	Os

Semestr 4

Przedmiot	Liczba godzin	Punkty ECTS	Forma weryfikacji		
Master Project	ćwiczenia: 375	17,0	zaliczenie	O	Os

O - obowiązkowy
O(G) - obowiązkowy (grupa)
F - fakultatywny
Or - obowiązkowy do zaliczenia roku
Os - obowiązkowy do zaliczenia w toku studiów

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Legal and Scientific Basics of Drug Discovery and Development

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing a year
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** written examination
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 1	written examination **Activities and hours** lecture: 35 seminar: 35	5.0

Goals

C1	Introducing the student to the subject of drug discovery and development and equipping him with a basic conceptual apparatus, necessary to acquire further, more advanced content. Presentation of basic processes carried out today as part of the discovery and development of medicines, against the background of historical development of this field. To acquaint students with the basic legal and market conditions for the functioning of the pharmaceutical industry, important from the point of view of researching a new drug. Acquainting with the methodology of scientific works, sources of knowledge, principles of statistical inference, structure and scope of regulations regulating the pharmaceutical industry and scientific and laboratory work, including the principles of intellectual property.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	basic terminology in the field of drug discovery and development	DDD_KDR_W01, DDD_KDR_W07	written examination
W2	cycle of drug discovery and development	DDD_KDR_W08, DDD_KDR_W09	written examination
W3	methodological and regulatory milestones in the history of drug discovery and development	DDD_KDR_W08, DDD_KDR_W09	written examination
W4	organizational conditions and trends in the pharmaceutical industry	DDD_KDR_W08	written examination
W5	basic legal acts shaping the activities of the pharmaceutical industry in the three most economically important areas of the world	DDD_KDR_W09	written examination
W6	competences of registration agencies and procedures used in them	DDD_KDR_W09	written examination
W7	issues related to the protection of intellectual property	DDD_KDR_W13	written examination
W8	legal issues related to the organization and conduct of scientific research	DDD_KDR_W09	written examination
W9	sources and methods of obtaining scientific information	DDD_KDR_W14	written examination
W10	principles of planning scientific research	DDD_KDR_W14	written examination
W11	methods of collecting and analyzing scientific data.	DDD_KDR_W14	written examination
Skills – Student can:			
U1	describe the most important legal acts shaping the functioning of the pharmaceutical industry in the world	DDD_KDR_U06	written examination
U2	list the most important legal acts regarding the organization and conduct of scientific research	DDD_KDR_U05	written examination
U3	discuss the process of work on the drug with specialists and non-specialists in this field	DDD_KDR_U05	written examination
U4	identify and use sources of scientific information	DDD_KDR_U06	written examination
U5	plan a simple experiment and indicate the necessary legal requirements that must be met in order to carry it out	DDD_KDR_U02	written examination
U6	analyze and synthesize scientific data	DDD_KDR_U01	written examination
U7	characterize the types of scientific publications	DDD_KDR_U07	written examination
U8	prepare a short speech, poster, e-poster	DDD_KDR_U07	written examination
U9	identify and use sources of patent information	DDD_KDR_U06	written examination
Social competences – Student is ready to:			
K1	recognize the importance of using reliable sources of information	DDD_KDR_K01	written examination
K2	take the responsibility for comprehensive data evaluation	DDD_KDR_K03	written examination

Calculation of ECTS points

Activity form	Activity hours*
lecture	35
seminar	35
preparation for classes	30
preparation for examination	30

Student workload	**Hours** 130
Workload involving teacher	**Hours** 70

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	The most important concepts related to the discovery and development of the drug. The history of the process of drug discovery and development. Contemporary methods used in drug research.	W1, W2, U3	lecture, seminar
2.	Organizational structure of pharmaceutical companies. Structure of the pharmaceutical market. The role of large and small pharmaceutical companies, research contract companies and academic laboratories in the discovery and development of the drug. The evolutionary cycle of the project team. Aspects of financing work on a new drug.	W4	lecture, seminar
3.	Important stages of legal regulations. Sources, scope and structure of legal regulations concerning the pharmaceutical industry.	W3, W5, W6, U1, U2	lecture, seminar
4.	The rules of intellectual property protection. Forms of protection of intellectual property. Patent as a form of intellectual property protection, patent design, patent proceedings schedule. Industrial property law. Discussion of various forms of intellectual property protection. Getting acquainted with various forms of patents, patent database Esp @ cenet (PL / EU), other patent databases. Patent search by: numbers, key words, authors, date of publication.	W7, U9, K1, K2	lecture, seminar

5.	Basics of scientific methodology and statistical inference in scientific papers. Basic principles of laboratory work. Work with scientific literature databases, search for thematic publications (PubMed, pages of major scientific publications providing Life science literature). Case study: analysis of selected scientific publications.	W10, W11, W8, W9, U4, U5, U6, U7, U8, K1, K2	lecture, seminar

Course advanced

Teaching methods:

seminar, lecture

Activities	Examination methods	Credit conditions
lecture	written examination	Obtaining at least 50% of the points in the written exam
seminar	written examination	Obtaining at least 50% of the points in the written exam

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Chemistry in Pharmaceutical Sciences

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing a year
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** written examination
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 1	written examination **Activities and hours** seminar: 25 lecture: 50 classes: 75	8.0

Goals

C1	Expanding and systematizing knowledge useful in pharmaceutical sciences in the field of general chemistry, organic chemistry, analytical chemistry and physical chemistry
C2	Introduction to chemical and analytical laboratory techniques used in the process of drug discovery and development
C3	Developing the ability to plan and execute tasks based on cooperation in the group

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods

Knowledge – Student knows and understands:			
W1	the most important issues for pharmaceutical sciences in the field of: ◦ general chemistry, chemistry of solutions and physical chemistry, ◦ chemical properties and methods of synthesis of the main classes of organic compounds, ◦ analytical methods used in qualitative and quantitative analysis.	DDD_KDR_W01, DDD_KDR_W03, DDD_KDR_W06, DDD_KDR_W07, DDD_KDR_W12	multiple choice test
W2	principles of good laboratory practice and workplace safety and health in a chemical laboratory	DDD_KDR_W11	classroom observation, project
Skills – Student can:			
U1	correctly interpret chemical formulas, chemical names, stereoisomerism, draw and name compounds according to current IUPAC nomenclature	DDD_KDR_U01, DDD_KDR_U03	multiple choice test
U2	predict simple relationships between the structure of a chemical compound and its physicochemical properties	DDD_KDR_U01, DDD_KDR_U03	project, multiple choice test
U3	recognize the most important for pharmaceutical sciences types of chemical reactions: is able to name them, write the equations and predict their course	DDD_KDR_U01	multiple choice test
U4	perform calculations relevant for the process of drug discovery and development in the field of general chemistry and chemistry of solutions and interpret their results	DDD_KDR_U01, DDD_KDR_U03, DDD_KDR_U04	project, assignment report, multiple choice test
U5	plan and perform simple laboratory operations in the field of organic synthesis, qualitative and quantitative analysis and analysis of physicochemical properties, useful in drug discovery and development process	DDD_KDR_U01, DDD_KDR_U02, DDD_KDR_U03, DDD_KDR_U04	classroom observation, project, assignment report
U6	interpret results of simple chromatographic and spectrometric analyzes	DDD_KDR_U01, DDD_KDR_U03	classroom observation, project, assignment report, multiple choice test
U7	use software and Internet tools to obtain information on chemical compounds, useful for drug discovery and development process	DDD_KDR_U01, DDD_KDR_U04, DDD_KDR_U06	project, multiple choice test
Social competences – Student is ready to:			
K1	cooperate in a group in order to solve complex problems and carry out tasks	DDD_KDR_K04	classroom observation, project
K2	take the responsibility for his/her work and is capable of critical self-appraisal	DDD_KDR_K02, DDD_KDR_K03	classroom observation, project, assignment report

Calculation of ECTS points

Activity form	**Activity hours***
seminar	25
lecture	50
preparation for classes	25

preparation of a project	10
classes	75
preparation for examination	25

Student workload	**Hours** 210
Workload involving teacher	**Hours** 150
Practical workload	**Hours** 75

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	General chemistry (chemical bonds, electronegativity, partial and full charges, intermolecular interactions, kinetics of processes, catalysis, reaction equilibrium)	W1, U1, U2, U4	lecture, seminar
2.	Chemistry of solution (acidity, alkalinity, pH, pKa, electrolyte power, buffers, Henderson-Hasselbalch equation)	W1, U1, U2, U4	lecture, classes, seminar
3.	Basics of physical chemistry (solubility, precipitation, dispersion systems, lipophilicity, surface tension)	W1, U2, U3, U4	lecture, classes, seminar
4.	Qualitative and quantitative analysis (chromatography, spectroscopy, other instrumental methods)	W1, U4, U5, U6, U7	lecture, classes, seminar
5.	Main classes of organic compounds – reactivity and properties (saturated, unsaturated and aromatic hydrocarbons, heterocycles, halogeno-derivatives, alcohols, phenols, aldehydes, ketones, amines, acids and their derivatives)	W1, U1, U2, U3	lecture, seminar
6.	Reactions in organic chemistry and their mechanisms (halogenation, alkylation, acylation, hydrolysis, condensation, oxidation, reduction, mechanisms of substitution, addition and rearrangement reactions)	W1, U1, U3	lecture, seminar
7.	Nomenclature of organic compounds by IUPAC, stereochemistry	W1, U1	lecture, seminar
8.	Basic laboratory operations and unit processes in organic synthesis	W2, U5, U6, U7, K1, K2	lecture, classes, seminar
9.	Qualitative and quantitative pharmaceutical analysis	W1, W2, U4, U5, U6, U7, K1, K2	classes, seminar

Course advanced

Teaching methods:

classes / practicals, computer classes, laboratories (labs), demonstration, discussion, e-learning, educational film, problem

solving method, project method, presentation, computer room, seminar, participation in research, lecture, lecture with multimedia presentation, practical classes

Activities	Examination methods	Credit conditions
seminar	project, multiple choice test	1. Completion of written tests – scoring each test at least 60% 2. Preparation and delivery of a lecture on a given topic 3. Project completion
lecture	multiple choice test	1. Completion of written tests – scoring each test at least 60%
classes	classroom observation, assignment report, multiple choice test	1. Completion of all laboratory tasks

Entry requirements

None

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Biology in Pharmaceutical Sciences

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing a year
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** written examination
ISCED classification 0916 Pharmacy	

Period	**Examination**	**Number of ECTS points**
Semester 1	written examination **Activities and hours** lecture: 22 e-learning seminar: 6 classes: 64 seminar: 8	7.0

Goals

C1	The learning objective within the module is to broaden knowledge, skills and social competences in the field of molecular biology, genetics, biochemistry and microbiology, in the aspects related to drug discovery and development.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	the current development direction for molecular biology, genetics, biochemistry and microbiology, in the level necessary to assimilate basics of drug design and development	DDD_KDR_W01, DDD_KDR_W02, DDD_KDR_W11	written examination, oral examination, test
W2	the theories of molecular biology, genetics, biochemistry and microbiology in the level necessary to assimilate principles of drug design and development	DDD_KDR_W01, DDD_KDR_W02, DDD_KDR_W11	written examination, test
W3	the structure and properties of nucleic acids, proteins, saccharides and lipids in the context of drug action,	DDD_KDR_W01, DDD_KDR_W02, DDD_KDR_W11	written examination, test
Skills – Student can:			
U1	use advanced technical methods and equipment useful in molecular biology, genetics, biochemistry and microbiology, in the level necessary to assimilate principles of drug design and development	DDD_KDR_U07, DDD_KDR_U09	written examination, test
U2	use principles of asepsis, antiseptics and microbiological purity necessary for studies with microorganisms in laboratory practice	DDD_KDR_U01, DDD_KDR_U07	written examination, test
U3	use specialized IT tools for search and collection of data in the field of molecular biology and genetics as well as to analyze and critically evaluate these data	DDD_KDR_U01, DDD_KDR_U04, DDD_KDR_U06, DDD_KDR_U07	oral examination, test
U4	work in planning and carrying out research tasks in the field of molecular biology, genetics, biochemistry and microbiology in the level necessary to assimilate principles of drug design and development	DDD_KDR_U01, DDD_KDR_U04, DDD_KDR_U09	oral examination, test
Social competences – Student is ready to:			
K1	consult with experts in the field of molecular biology, genetics, biochemistry and microbiology, in case of difficulty in solving problem independently	DDD_KDR_K01, DDD_KDR_K04	oral examination
K2	care about safety of her/his own, her/his colleagues and the environment	DDD_KDR_K05, DDD_KDR_K07	oral examination

Calculation of ECTS points

Activity form	**Activity hours***
lecture	22
e-learning seminar	6
preparation for classes	20
preparation for examination	45
preparation of multimedia presentation	15
classes	64
seminar	8

Student workload	**Hours** 180
Workload involving teacher	**Hours** 100
Practical workload	**Hours** 64

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	Principles of molecular biology and genetics, including: 1. Introduction - organisms classification and taxonomy 2. Structure of cells and cell components, in the context of the emergence and therapy of diseases 3. Protein structure - in the context of biological targets - receptors, enzymes (amino acids, peptides, primary-quaternary protein structure), 4. General information on the structure of nucleic acids, saccharides and lipids in the context of drug action, 5. Central Dogma and cell cycle in the context of drug targets 6. Principles of genetics and their relationship to pharmacogenetics,	W1, W2, W3, U1, U3, U4, K1, K2	lecture, classes, seminar
2.	Principles of biochemistry, including: ◦ Main metabolic processes, enzyme characteristics, ◦ Main concepts and relationships in biochemistry: Michaelis-Menten equation, inhibition (reversible, irreversible), and induction.	W1, U1, U4, K1, K2	lecture, classes, e-learning seminar
3.	Principles of microbiology in the context of anti-infectious drugs to understand the selective toxicity, principles of asepsis, antiseptics and microbiological purity studies: ◦ Classification of microorganisms, ◦ General characteristics of bacteria, fungi and viruses, ◦ Growth requirements and breeding of microorganisms, ◦ Antibiotics, antibiotic therapy and bacterial sensitivity to drugs, sterilization and disinfection, ◦ Hospital infections including infections from medicines (definitions), presence of microorganisms in medicines, pharmaceutical raw materials and water.	W1, U1, U2, U4, K1, K2	classes
4.	Pharmacognosy and pharmaceutical botany – general overview in the context of natural drug discovery & development	W1, K1	seminar

Course advanced

Teaching methods:

brainstorm, classes / practicals, computer classes, laboratories (labs), demonstration, discussion, educational film,

presentation, seminar, lecture, lecture with multimedia presentation

Activities	Examination methods	Credit conditions
lecture	written examination	Partial written tests – scoring each test at least 51%. Final examination: written exam (>51%)
e-learning seminar	oral examination, test	positive grade (>3.0) for oral presentation performed by student
classes	test	Full classes attendance, partial written tests – scoring each test at least 51%. Final examination: written exam (>51%)
seminar	oral examination	Full seminars attendance, partial written tests – scoring each test at least 51%. Final examination: written exam (>51%)

Entry requirements

None

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Diseases States and Pharmacotherapeutic Strategies

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing a year
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** written examination
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	Examination	Number of ECTS points
Semester 1	- **Activities and hours** e-learning lecture: 15 seminar: 30 classes: 30	0.0

Period	Examination	Number of ECTS points
Semester 2	written examination **Activities and hours** seminar: 30 classes: 30 e-learning lecture: 15	8.0

Goals

C1	Expanding and systematizing knowledge, in the field of human anatomy and physiology and general pharmacology, necessary to understand the mechanisms of disease formation and their pharmacotherapy.
C2	Understanding the basics of pathophysiology and pharmacotherapy of the most important diseases
C3	Developing the ability to independently expand knowledge basing on reliable sources

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	basics of the structure and functioning of the body, as a basis for understanding the effects of drugs	DDD_KDR_W02	written examination, theoretical colloquiums, oral answer, assignment report, test
W2	pathophysiological changes occurring in the human body, necessary to understand the mechanisms of action of drugs	DDD_KDR_W02	written examination, theoretical colloquiums, oral answer, assignment report, test
W3	routes of drugs administration and their fate in the body	DDD_KDR_W01, DDD_KDR_W02	written examination, theoretical colloquiums, oral answer, assignment report, test
W4	mechanisms of action of drugs and therapeutic strategies	DDD_KDR_W02	written examination, theoretical colloquiums, oral answer, assignment report, test
W5	therapeutic effects and the most important side effects of drugs, as well as the basis for obtaining the selectivity of therapy	DDD_KDR_W02	written examination, theoretical colloquiums, oral answer, assignment report, test
W6	basic indications for the most important drug groups and the most important drug interactions	DDD_KDR_W02	written examination, theoretical colloquiums, oral answer, assignment report, test
Skills – Student can:			
U1	decide which drug groups are suitable for the treatment of specific diseases	DDD_KDR_U01	written examination, theoretical colloquiums, oral answer, assignment report, test
U2	assess what side effects may occur after selected drugs	DDD_KDR_U01	written examination, theoretical colloquiums, oral answer, assignment report, test
U3	estimate the risk of interactions between drug groups	DDD_KDR_U01	written examination, theoretical colloquiums, oral answer, assignment report, test

U4	independently acquire knowledge based on reliable sources and critically evaluate it	DDD_KDR_U01, DDD_KDR_U05, DDD_KDR_U06	assignment report
Social competences – Student is ready to:			
K1	consult with experts in the field of experimental pharmacology in case of facing difficulties in solving certain tasks independently	DDD_KDR_K01	assignment report

Calculation of ECTS points

Semester 1

Activity form	**Activity hours***
e-learning lecture	15
seminar	30
classes	30
preparation for classes	35
Student workload	**Hours** 110
Workload involving teacher	**Hours** 75
Practical workload	**Hours** 30

* hour means 45 minutes

Semester 2

Activity form	**Activity hours***
seminar	30
classes	30
e-learning lecture	15
preparation for classes	35
preparation for examination	20
Student workload	**Hours** 130
Workload involving teacher	**Hours** 75

Practical workload	Hours 30

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	Basics of the structure and functioning of the human body and pathophysiological processes in the context of drug action mechanisms	W1, W2, U4, K1	classes, seminar, e-learning lecture
2.	Basic concepts and definitions in the field of pharmacology - ED50, LD50, therapeutic index, agonism, antagonism	W4, U4, K1	classes, seminar, e-learning lecture
3.	Routes of drug administration and the fate of drugs in the body	W3, U4, K1	classes, seminar, e-learning lecture
4.	Biological targets (enzymes, receptors, ion channels, membrane transporters)	W4, U4, K1	classes, seminar, e-learning lecture
5.	Cellular and molecular mechanisms of drug action (interaction with receptors, ion channels, enzymes, transporters	W4, U4, K1	classes, seminar, e-learning lecture
6.	Pharmacological properties of drugs acting in the central and peripheral nervous system, cardiovascular system, respiratory system, digestive system, endocrine system, immune system, as well as antimicrobial and anticancer drugs	W4, W5, W6, U1, U4, K1	classes, seminar, e-learning lecture
7.	Basic indications for selected groups of drugs	W5, U1, U4, K1	classes, seminar, e-learning lecture
8.	The most important group/drug specific side effects	W5, U2, U4, K1	classes, seminar, e-learning lecture
9.	The most important drug interactions	W6, U3, U4, K1	classes, seminar, e-learning lecture

Course advanced

Semester 1

Teaching methods:

computer classes, discussion, e-learning, educational film, educational game, presentation, group work, seminar, lecture with multimedia presentation

Activities	Examination methods	Credit conditions
e-learning lecture	written examination	-
seminar	written examination	-
classes	assignment report	-

Semester 2

Teaching methods:

computer classes, discussion, e-learning, educational film, educational game, presentation, group work, seminar, lecture with multimedia presentation

Activities	Examination methods	Credit conditions
seminar	written examination, theoretical colloquiums, oral answer, test	1. Presence at over 50% of seminars is mandatory. 2. Progress in seminars will be checked through oral answers to questions or by written assessments. 3. There are 6 mandatory main assessments with a pass mark of 60%, these will be held on the Pegaz platform. The grading scale is as follows: 92-100%: 5.0 84-91%: 4.5 76-83%: 4.0 68-75%: 3.5 60-67%: 3.0 <60%: 2.0 4.The main assessments will cover the material from seminars, classes, and lectures. The questions will be of various types (multiple-choice with only one correct answer per question, ordering, short answer, true-false, calculation, drag and drop etc.). 5. Only one resit is possible for students who want to attempt to amend their grade. The grade obtained in the resit of the main assessment is used to calculate the weighted average. 6. The final grade from the seminars will be a weighted average from the following marks: main assessment - weight 5, oral answer/written test - weight 3, activity during classes/presentation - weight 1. The grading scale is as follows: 4.76-5.0: 5.0 4.26-4.75: 4.5 3.76-4.25: 4.0 3.26-3.75: 3.5 3.0-3.25: 3.0 <3.0: 2.0 7. Entry to the final examination will require passes from all classes (by means of reports) and the grade from seminars at least 3.0. 8. If a student does not meet the criteria allowing them to sit the exam before the 15th June 2023, they will lose the opportunity to complete the first term exam. In such a case, the student still has the opportunity to meet the criteria until the 5th September 2023 and, if successful, they will be permitted to take the second term exam. If the student does not meet the criteria which allows them to sit the exam before the 5th September, they will not pass the course. 9. The final examination will constitute of 60 multiple-choice questions with only one correct answer. The grading scale is as follows: 92-100%: 5.0 84-91%: 4.5 76-83%: 4.0 68-75%: 3.5 60-67%: 3.0 <60%: 2.0 10.The final grade awarded for the course will represent the 40% of the grade from final examination and 60% of the grade from the seminars. However, the grade from the exam must be ≥3.0.
classes	assignment report	1. Presence at over 50% of classes is mandatory. 2. Progress in classes will be checked by way of reports. 3. Entry to the final examination will require passes from all classes (by means of reports) and the grade from seminars at least 3.0. 4. If a student does not meet the criteria allowing them to sit the exam before the 15th June 2023, they will lose the opportunity to complete the first term exam. In such a case, the student still has the opportunity to meet the criteria until the 5th September 2023 and, if successful, they will be permitted to take the second term exam. If the student does not meet the criteria which allows them to sit the exam before the 5th September, they will not pass the course.
e-learning lecture	written examination	1. The final examination will constitute of 60 multiple-choice questions with only one correct answer. The grading scale is as follows: 92-100%: 5.0 84-91%: 4.5 76-83%: 4.0 68-75%: 3.5 60-67%: 3.0 <60%: 2.0 2. The final grade awarded for the course will represent the 40% of the grade from final examination and 60% of the grade from the seminars. However, the grade from the exam must be ≥3.0.

Entry requirements

Mandatory presence at seminars.

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Humanities - Bioethics in pharmaceutical sciences

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** graded credit
ISCED classification 0916 Pharmacy	

Period	**Examination**	**Number of ECTS points**
Semester 1	graded credit **Activities and hours** lecture: 15 seminar: 15	3.0

Goals

C1	Understanding of the essential elements of bioethical issues in pharmaceutical sciences.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	DDD_KDR_W09 The graduate knows Declaration of Helsinki, CIOMS International Ethical Guidelines for Health-related Research Involving Humans and other national and international standards and regulations	DDD_KDR_W09	classroom observation, clinical case presentation
Skills – Student can:			

U1	DDD_KDR_U10 The graduate can identify irregularities, failures and malpractices in the process of drug research and development and own work and research	DDD_KDR_U10	classroom observation, clinical case presentation
Social competences – Student is ready to:			
K1	DDD_KDR_K02 The graduate is ready to act according ethics standards	DDD_KDR_K06	classroom observation

Calculation of ECTS points

Activity form	**Activity hours***
lecture	15
seminar	15
preparation for classes	30
preparation for colloquium	30
Student workload	**Hours** 90
Workload involving teacher	**Hours** 30

* hour means 45 minutes

Study content

No.	**Course content**	**Subject's learning outcomes**	**Activities**
1.	1. Case study: research or treatment, benefits and risk in research	W1, K1	seminar
2.	2. Case study: fair recruitment rules	W1, U1	seminar
3.	3. Case study: informed consent form, relevant information	U1, K1	seminar
4.	4. Case analysis: therapeutic obligation, clinical equipoise	W1, U1, K1	seminar
5.	5. Case study: research involving vulnerable groups	W1, U1	seminar
6.	1. Biomedical research with human subjects – introduction	U1, K1	lecture
7.	2. Risks and benefits in biomedical research	W1, U1, K1	seminar
8.	3. Therapeutic obligation, the principle of clinical equipoise, use of placebo in research	W1, U1	seminar
9.	4. Vulnerable populations in research	W1, U1	seminar
10.	5. Informed consent, assent and dissent in research	U1, K1	seminar

11.	6. Justice in biomedical research: recruitment, post-approval drug access, international research	W1, U1, K1	seminar

Course advanced

Teaching methods:

case study, textual analysis, brainstorm, discussion, case study method, presentation, group work, seminar, lecture, lecture with multimedia presentation

Activities	Examination methods	Credit conditions
lecture	clinical case presentation	Presentation of the case or ethics argumentation suggested by the professor.
seminar	classroom observation	Presence, active involvement into classroom discussions.

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Humanities – Scientific writing

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** graded credit
ISCED classification 0916 Pharmacy	

Period	**Examination**	**Number of ECTS points**
Semester 1	graded credit **Activities and hours** e-learning seminar: 18 e-learning classes: 12	2.0

Goals

C1	Introduction to scientific writing and scientific reading
C2	The format of an original manuscript
C3	Principles of effective writing (organization, crafting better sentences and paragraphs)
C4	Issues in scientific writing: plagiarism, ghostwriting, authorship
C5	Review process

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	principles and methodology of scientific research, development and processing of research results as well as preparation and evaluation of scientific publications	DDD_KDR_W14	practical examination, multiple choice test
Skills – Student can:			
U1	critically analyze information and research results in the field of pharmaceutical and medical (life) sciences and draw correct conclusions based on them	DDD_KDR_U01	practical examination, multiple choice test
U2	communicate with representatives of different areas of life representing different levels of knowledge and specialists in various fields of science in order to implement research plans and solve complex problems in the field of drug discovery and development	DDD_KDR_U05	practical examination, multiple choice test
U3	obtain reliable scientific information, use appropriate databases, professional literature and expert opinions	DDD_KDR_U06	practical examination, multiple choice test
U4	present and disseminate knowledge and research results in a professional, understandable and accessible way for various groups of recipients	DDD_KDR_U07	practical examination, multiple choice test
Social competences – Student is ready to:			
K1	ready to take responsibility for their work and for critical self-evaluation	DDD_KDR_K03	practical examination, multiple choice test

Calculation of ECTS points

Activity form	**Activity hours***
e-learning seminar	18
practice	15
conducting literature research	15
e-learning classes	12

Student workload	**Hours** 60
Workload involving teacher	**Hours** 30
Practical workload	**Hours** 27

* hour means 45 minutes

Study content

No.	**Course content**	**Subject's learning outcomes**	**Activities**
1.	Introduction: effective scientific writing and reading	W1, U1, U2, U3, U4, K1	e-learning seminar, e-learning classes

2.	Organization of writing process	W1, U1, U2, U3, U4, K1	e-learning seminar, e-learning classes
3.	The format of an original manuscript	W1, U1, U2, U3, U4, K1	e-learning seminar, e-learning classes
4.	Plagiarism, ghostwriting, authorship,	W1, U1, U2, U3, U4, K1	e-learning seminar, e-learning classes
5.	Scientific writing: tips and tricks for writing better and faster	W1, U1, U2, U3, U4, K1	e-learning seminar, e-learning classes
6.	Review process	U1, U3	e-learning seminar, e-learning classes

Course advanced

Teaching methods:

textual analysis, computer classes, discussion, educational film, foreign language course, presentation, group work, seminar, workshop, practical classes

Activities	Examination methods	Credit conditions
e-learning seminar	practical examination, multiple choice test	Class attendance
e-learning classes	practical examination	Class attendance

Entry requirements

None

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Introduction to Biostatistics

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing a year
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** graded credit
ISCED classification 0916 Pharmacy	

Period Semester 1	**Examination** graded credit **Activities and hours** e-learning seminar: 30	**Number of ECTS points** 2.0

Goals

C1	Making students aware of the role of statistics in reasoning and inference.
C2	Providing students with basic information and skills in the field of techniques and tools supporting statistical inference.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The student knows and understands the role of statistics in data analysis and the process of verifying hypotheses.	DDD_KDR_W01, DDD_KDR_W10, DDD_KDR_W14	group assessment, assignment report, test
Skills – Student can:			

U1	The student is able to assess the correctness of data, examine their distribution and carry out elementary statistical analysis and reasoning	DDD_KDR_U01, DDD_KDR_U02, DDD_KDR_U03, DDD_KDR_U04	group assessment, assignment report, test
Social competences – Student is ready to:			
K1	The student is able to present data to the group in a legible and clear way and to justify the observations and conclusions resulting from them	DDD_KDR_K01, DDD_KDR_K02	group assessment, assignment report

Calculation of ECTS points

Activity form	**Activity hours***
e-learning seminar	30
preparation for classes	10
practice	20

Student workload	**Hours** 60
Workload involving teacher	**Hours** 30
Practical workload	**Hours** 20

* hour means 45 minutes

Study content

No.	**Course content**	**Subject's learning outcomes**	**Activities**
1.	Introduction to modelling tools and software.	W1	e-learning seminar
2.	Exploratory data analysis.	W1, U1	e-learning seminar
3.	Data storage, sharing and wrangling.	U1, K1	e-learning seminar
4.	Probability and probability distributions.	W1, U1	e-learning seminar
5.	Nonparametric inference.	W1, U1	e-learning seminar
6.	Parametric inference.	W1, U1	e-learning seminar
7.	Parameter estimation, confidence intervals and bootstrapping.	W1, U1	e-learning seminar
8.	Case studies 1	W1, U1, K1	e-learning seminar
9.	Case studies 2	W1, U1, K1	e-learning seminar
10.	Case studies 3	W1, U1, K1	e-learning seminar

Course advanced

Teaching methods:

case study, computer classes, discussion, e-learning

Activities	Examination methods	Credit conditions
e-learning seminar	group assessment, assignment report, test	Homeworks (50% of the grade) In-class assignments (50% of the grade)

Entry requirements

High-school level mathematics.

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Foreign Language in Pharmaceutical Sciences

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24, 2024/25
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** examination
ISCED classification 0231 Language acquisition	

Period Semester 1	**Examination** - **Activities and hours** foreign language course: 20	**Number of ECTS points** 0.0

Period Semester 2	**Examination** credit **Activities and hours** foreign language course: 25	**Number of ECTS points** 2.0

Period Semester 3	**Examination** examination **Activities and hours** foreign language course: 45	**Number of ECTS points** 4.0

Goals

C1	The aim of the course is to prepare the student to use English fluently in speaking and writing for professional, academic and social purposes as well as to understand specialist literature and express opinions on topics related to it at the level of proficiency B2+ of the Common European Framework of Reference for Languages

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	English terminology related to the process of searching, obtaining and properties of medicinal substances	DDD_KDR_W03	written examination, oral examination, test
Skills – Student can:			
U1	take part in a discussion - introduce a point, ask for and express opinions, express pros and cons, express doubts, express disagreement and support, give reasons, draw conclusions, sum up a discussion, talk about his/her field and projects, make a presentation using specialized vocabulary, follow a discussion in a team meeting, argue for and against an idea appropriately, support ideas with evidence, interrupt a meeting appropriately (Speaking)	DDD_KDR_U08	oral examination
U2	summarize a research proposal, fill in an application form, recognize different styles of writing, ask for help using an online forum, describe data for statistical analysis, write a caption for a figure or graph, describe a figure or graph in a paper, take notes at a meeting, write an abstract (Writing)	DDD_KDR_U08	written examination, essay, test
U3	read and understand specialist literature, find necessary information and evaluate its importance, understand arguments in scientific articles (Reading)	DDD_KDR_U08	written examination, test
U4	understand discussions, presentations, papers, telephone conversations (Listening)	DDD_KDR_U08	written examination, test
Social competences – Student is ready to:			
K1	objectively reflect on and critically evaluate his/her own progress and skill development, study on his/her own and constantly expand his/her knowledge and skills	DDD_KDR_K03	written examination, oral examination, test

Calculation of ECTS points

Semester 1

Activity form	Activity hours*
foreign language course	20
preparation for classes	10

Student workload	**Hours** 30
Workload involving teacher	**Hours** 20

* hour means 45 minutes

Semester 2

Activity form	**Activity hours***
foreign language course	25
preparation for classes	15
Student workload	**Hours** 40
Workload involving teacher	**Hours** 25

* hour means 45 minutes

Semester 3

Activity form	**Activity hours***
foreign language course	45
preparation for examination	35
Student workload	**Hours** 80
Workload involving teacher	**Hours** 45

* hour means 45 minutes

Study content

No.	**Course content**	**Subject's learning outcomes**	**Activities**

1.	Professional English: 1. The pharmaceutical company: job profiles, professions and departments. 2. New drug developments and launches. 3. Cultural differences in marketing drugs and medicine. 4. Substance discovery and product development: a new chemical entity, drug dosage forms, categories of drugs. 5. Good pharmaceutical industry practice. 6. Quality assurance audits. 7. Laboratory safety systems. 8. Standard operating procedures. 9. Preclinical and clinical testing, dealing with authorities, experimental drugs on trial. 10. Drug safety and regulatory affairs: pharmacovigilance, regulatory documentation, patient information, counterfeit medicines. 11. Production and packaging of drugs: safety requirements, production processes, packaging challenges.	W1, U1, U2, U3, U4, K1	foreign language course
2.	Academic English: 1. Planning a career in science. 2. Applying for research funding. 3. Applications and application forms. 4. Communicating with scientific communities. 5. Taking part in a meeting. 6. Giving a paper and presenting a poster at a conference. 7. Reading and presenting facts, evidence, data, numbers, statistics, graphs and diagrams. 8. Writing an abstract and a paper to a scientific journal	W1, U1, U2, U3, U4, K1	foreign language course
3.	General English: 1. Introducing oneself, one’s job, projects, interests and hobbies. 2. Taking part in a discussion - discussion phrases. 3. Socializing at a conference. 4. Writing a formal email. 5. Writing a memo. 6. Writing an executive summary.	W1, U1, U2, U4, K1	foreign language course
4.	Grammar: 1. Revision of past, present and future tenses. 2. Conditional sentences (type 0, 1, 2, 3 and mixed) 3. Subjunctive (wish, if only, would rather, as if/though, suppose, it’s high time) 4. Passive Voice 5. Modal Verbs, Modal Verbs + Perfect Infinitives 6. Direct and Indirect Questions 7. Reported Speech 8. Articles	W1, U1, U2, U3, U4, K1	foreign language course

Course advanced

Semester 1

Teaching methods:

e-learning, language conversation classes, foreign language course

Activities	Examination methods	Credit conditions
foreign language course	essay, test	1. attendance at all the classes 2. active participation in classes 3. obtaining pass marks for written tests and essays

Semester 2

Teaching methods:

e-learning, language conversation classes, foreign language course

Activities	Examination methods	Credit conditions
foreign language course	essay, test	1. attendance at all the classes 2. active participation in classes 3. obtaining pass marks for written tests and essays

Semester 3

Teaching methods:

e-learning, language conversation classes, foreign language course

Activities	Examination methods	Credit conditions
foreign language course	written examination, oral examination, test	In order to take the examination, it is necessary to obtain a credit in all semesters. If the first date of the final examination is lost due to a failed pass, the date is not reinstated. A prerequisite for passing the course is attendance at all classes and obtaining positive marks from mid-term tests and oral answers by the end of the retake examination period in a given semester.

Additional info

A student who has not received a credit from the previous part of the course for any reason may participate in the next part of the course and repeat the failed part at the same time. Repeating a semester or course means participation in all classes and tests again. The grading scale (0-100%) applies to all forms of student progress assessment (both oral and written): 0-59% - unsatisfactory (2.0), 60-70% - satisfactory (3.0), 71-75% - satisfactory plus (3.5), 76-85% - good (4.0), 86-90% - good plus (4.5), 91-100 - very good (5.0). Tests and speaking tasks should be scored at a minimum of 60% of the maximum number of points.

Entry requirements

Knowledge of English at the level of proficiency B2 of the Common European Framework of Reference for Languages. Attendance at all the classes is compulsory.

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Health and Safety Training

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing a year
Education profile general academic	**Mandatory** obligatory
Disciplines	**Examination** credit
ISCED classification No ISCED cat. found	

Period	**Examination**	**Number of ECTS points**
Semester 1	credit **Activities and hours** Health and Safety training: 6	0.0

Goals

C1	1. Acquainting students and doctoral students starting education in doctoral schools with the provisions and principles of safety and hygiene of education on the basis of selected legal provisions
C2	2. Getting to know the threats to life and health that occur during classes, how to protect against these threats and how to deal with these threats
C3	3. Informing students and doctoral students starting education in doctoral schools about the principles of fire protection and in particular about how to prevent fires, fire detection systems, fire-fighting equipment and conducting evacuation in the event of fire and other local threats
C4	4. Introduction to the general principles of first aid

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Principles of safety and hygiene of education based on selected legal provisions	DDD_KDR_W11	credit
W2	Threats to life and health occurring during classes, ways of protection against these threats and management during these threats	DDD_KDR_W12	credit
W3	Principles of fire protection, in particular methods of fire prevention, fire detection systems, fire-fighting equipment and rules for conducting evacuation in the event of fire and other local threats	DDD_KDR_W12	credit
W4	General rules for first aid	DDD_KDR_W11	credit
Skills – Student can:			
U1	List the principles of safety and hygiene of education using selected legal acts	DDD_KDR_U01	credit
U2	List and analyze threats to life and health that occur during classes, list and choose ways to protect against these threats and is able to behave properly when these threats occur	DDD_KDR_U09	credit
U3	Apply fire protection rules, list the causes of fires and ways of fire prevention, use fire-fighting equipment properly, act properly during evacuation	DDD_KDR_U05	credit
U4	Apply the acquired knowledge of first aid in practice (accident or other threat to life)	DDD_KDR_U06	credit
Social competences – Student is ready to:			
K1	Taking appropriate action during an emergency	DDD_KDR_K01, DDD_KDR_K07	credit

Calculation of ECTS points

Activity form	**Activity hours***
Health and Safety training	6
analysis of the research material	1

Student workload	**Hours** 7
Workload involving teacher	**Hours** 6

* hour means 45 minutes

Study content

No.	**Course content**	**Subject's learning outcomes**	**Activities**

1.	Module I - Selected legal regulations - legal grounds for safety and hygiene of education - rights and obligations of a student and Rector in the field of safety and hygiene of education - basic safety principles applicable to students during classes organized by the University	W1, U1, K1	Health and Safety training
2.	Module I - Conditions of safety and hygiene of education in the University's premises - roads and passages - the University's premises - lighting - heating and ventilation - first aid kit - stand equipped with a screen monitor	W2, U2, K1	Health and Safety training
3.	Module I - Educational environment factors and their threats and prevention - dangerous factors - harmful factors - arduous factors	W2, U2, K1	Health and Safety training
4.	Module I - Accidents to which students may suffer during classes organized by the University - rules of conduct in the event of accidents and in the event of danger and failure	W2, U2, K1	Health and Safety training
5.	Rules of using student houses	W3, W4, U3, U4, K1	Health and Safety training
6.	Module i - Rules for first aid - medical rescue system in Poland - first aid in legal acts - survival chain - lifeguard safety - injured party assessment (ABC) and call for help - safe position - cardiopulmonary resuscitation (CPR) - automatic cardiopulmonary resuscitation AED external defibrillator - emergency procedures	W1, W4, U4, K1	Health and Safety training
7.	Module I - Fire protection - legal bases for fire protection - duties of the University, students and doctoral students in the field of fire protection - definition of fire - fire groups - causes of fires - ways of fire fighting - fire fighting equipment - rules of use and operation - rules of behavior during a fire - rules of behavior during evacuation	W1, W3, U1, U3, K1	Health and Safety training
8.	Module II - 1. Threats of biological agents in the learning environment. 2. Personal protective equipment against biological threats. 3. Problems of environmental protection	W2, U2, K1	Health and Safety training
9.	Module III - 1. Threats of chemical agents in the learning environment. 2. Personal protective equipment against chemical threats. 3. Problems of environmental protection	W2, U2, K1	Health and Safety training

Course advanced

Teaching methods:

e-learning, lecture with multimedia presentation

Activities	Examination methods	Credit conditions
Health and Safety training	credit	watching and listening to the presentation is the basis for recognizing participation in compulsory training

Additional info

The BHK subject must be completed in the winter semester. The training should be started immediately after receiving the individual link to the training platform. Links are sent to a personal mailbox in the student.uj.edu.pl domain
The date of completion of the training on the training platform is considered to be the date of completion.
If it is not possible to complete the training via the remote learning platform, in the first week of the training for a given faculty, contact the employees of the OHS Inspectorate of the Jagiellonian University Medical College via the e-mail address bhk.cm.szkolenia@cm-uj.krakow.pl, or by phone: 12 619 97 12 or 12 619 97 07

Entry requirements

Obligatory for passing in the course of studies

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Principles of Medicinal Chemistry

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing a year
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** written examination
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 2	written examination **Activities and hours** lecture: 30 seminar: 60	6.0

Goals

C1	Introduction to basic issues in the field of medicinal chemistry

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the basic concepts of medicinal chemistry	DDD_KDR_W03	written examination, oral answer, project, test

W2	molecular basis of the mechanisms of drug action	DDD_KDR_W02	written examination, oral answer, project, test
W3	basic physicochemical properties characterizing the molecules and their importance for pharmacological activity	DDD_KDR_W01	written examination, oral answer, project, test
W4	the principles of quantitative structure-activity relationship (QSAR) determination	DDD_KDR_W06, DDD_KDR_W07	written examination, oral answer, project, test
W5	principles and the stages of the drug discovery process	DDD_KDR_W03	written examination, oral answer, project, test
W6	molecular modeling methods and their application in drug design	DDD_KDR_W07	written examination, oral answer, project, test
Skills – Student can:			
U1	use standard software to calculate structural and physicochemical parameters	DDD_KDR_U02, DDD_KDR_U03, DDD_KDR_U04	project, test
U2	assess the drug-like properties of the compound based on structural and physicochemical parameters	DDD_KDR_U02, DDD_KDR_U03, DDD_KDR_U04	written examination, oral answer, project, test
U3	find and explain a relationship between activity and structural and physicochemical parameters	DDD_KDR_U01, DDD_KDR_U03	written examination, oral answer, project, test
U4	use standard software to visualize 3D molecules and to support molecular modeling calculations	DDD_KDR_U02, DDD_KDR_U04, DDD_KDR_U06	project, test
U5	professionally and comprehensively present knowledge and research results	DDD_KDR_U06, DDD_KDR_U07, DDD_KDR_U11	project
Social competences – Student is ready to:			
K1	work in a group in order to implement the project	DDD_KDR_K04	project

Calculation of ECTS points

Activity form	**Activity hours***
lecture	30
seminar	60
preparation for classes	30
preparation for examination	25
case analysis	5

Student workload	**Hours** 150
Workload involving teacher	**Hours** 90
Practical workload	**Hours** 5

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	Basic drug targets (enzymes, receptors, ion channels, transport proteins)	W1, W2, U5	lecture, seminar
2.	biochemical basis of drug action	W1, W2, U5	lecture, seminar
3.	drug-target interactions (van der Waals, hydrogen bonds, electrostatic/ionic bonds)	W1, W2, U3, U5, K1	lecture, seminar
4.	pharmacological activity of drugs (agonists, antagonists, enzyme inhibitors)	W1, W2, U3, U5, K1	lecture, seminar
5.	concept of drug-likeness and methods of its expression; ligand efficiency	W1, W3, U1, U2, U5, K1	lecture, seminar
6.	physicochemical and structural properties important for ADMET	W1, W3, U1, U2, U5, K1	lecture, seminar
7.	rules for defining relationships between structure and structural, physicochemical and pharmacokinetic properties	W1, W3, U2, U5, K1	lecture, seminar
8.	drug design	W1, W3, W5, U1, U2, U3, U4, U5, K1	lecture, seminar
9.	structure-activity relationship (SAR)	W1, W4, W5, U3, K1	lecture, seminar
10.	bioisosteres in drug discovery	W1	lecture, seminar
11.	pharmacophore and privileged structures	W1	lecture, seminar
12.	drug discovery process	W1, W5	lecture, seminar
13.	prodrugs	W1	lecture, seminar
14.	lead structure and methods of its optimization	W1, W6, U4	lecture, seminar
15.	principles of combinatorial and parallel synthesis	W1	lecture, seminar
16.	quantitative structure-activity relationship (QSAR)	W1, W4, U1	lecture, seminar
17.	basic computational methods as a tool for the discovery of bioactive compounds	W6, U4	lecture, seminar
18.	conformational analysis and energy minimization	W1, W6, U4	lecture, seminar
19.	principles of structure- and ligand-based drug design	W1, W6, U4	lecture, seminar
20.	de novo design	W1, W6, U4	lecture, seminar
21.	virtual screening	W1, W6, U4	lecture, seminar

Course advanced

Teaching methods:

case study, textual analysis, brainstorm, computer classes, discussion, project method, case study method, presentation, group work, seminar, lecture

Activities	Examination methods	Credit conditions
lecture	written examination, project	classes attendance (90%) accepted presentation scoring at least 60% on the final exam
seminar	written examination, oral answer, project, test	classes attendance (90%) completion of seminars based on the results of partial tests (at least 60% from each) accepted presentation scoring at least 60% on the final exam

Entry requirements

general chemistry, principles of organic chemistry, principles of biochemistry, principles of physiology and pathophysiology, principles of molecular biology

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Molecular ADME and In Vivo Pharmacokinetics

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing a year
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** written examination
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 2	written examination **Activities and hours** seminar: 20 workshop: 10 classes: 30	3.0

Goals

C1	Structure - physicochemical - biological properties relationships.
C2	ADME parameters necessary for the drug development.
C3	Non-compartmental and compartmental pharmacokinetic analysis.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The basic physicochemical properties of the chemical compounds and the structure – physicochemical properties relationship.	DDD_KDR_W01, DDD_KDR_W04	written credit
W2	The relationship between compound structure and its properties including pharmacokinetic properties: solubility, stability, permeability through biological membranes, distribution, metabolism, excretion, and toxicity.	DDD_KDR_W01, DDD_KDR_W04	written credit
W3	In vitro methods used for drug permeability and metabolism assessment.	DDD_KDR_W01, DDD_KDR_W04	written credit
W4	The biological basis of drug transporters activity.	DDD_KDR_W01, DDD_KDR_W04	written credit
W5	The biological basis of enzymatic induction and inhibition.	DDD_KDR_W01, DDD_KDR_W04	written credit
W6	Drug pharmacokinetic parameters and the methods of their determination in the compartmental and non-compartmental analysis.	DDD_KDR_W01, DDD_KDR_W04	written credit
Skills – Student can:			
U1	To assess the approximate physicochemical properties of the compound on the basis of its structure and to use in practice the biopharmaceutics classification systems.	DDD_KDR_U03, DDD_KDR_U04	assignment report
U2	To identify the applicability of the particular in vitro experiments used in the absorption, distribution, metabolism, and excretion processes screening.	DDD_KDR_U03, DDD_KDR_U04	assignment report
U3	To interpret the results of drug permeability assays, to predict drug’s metabolic clearance with the use of in vitro experiment results.	DDD_KDR_U03, DDD_KDR_U04	assignment report
U4	To calculate and interpret the pharmacokinetic parameters in the compartmental and non-compartmental analysis.	DDD_KDR_U03, DDD_KDR_U04	assignment report

Calculation of ECTS points

Activity form	**Activity hours***
seminar	20
workshop	10
classes	30
preparation for classes	15
preparation for examination	10
participation in examination	1
Student workload	**Hours** 86

Workload involving teacher	Hours 60
Practical workload	Hours 40

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	Chemical compound’s structure, its physicochemical properties, and the processes it undergoes in the body.	W1, W2, U1	seminar
2.	In vitro ADME screening methods.	W3, W4, W5, U2, U3	classes, seminar
3.	In vivo pharmacokinetics.	W6, U4	seminar, workshop
4.	Clinical trials and safety pharmacology.	W4	seminar

Course advanced

Teaching methods:

case study method, seminar, workshop, lecture

Activities	Examination methods	Credit conditions
seminar	written credit	To pass the final exams it is required to score at least 50% points.
workshop	assignment report	Report assignment.
classes	written credit	To pass the final exams it is required to score at least 50% points.

Entry requirements

Legal and Scientific Basics of Drug Discovery and Development module passed

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Principles of Pharmaceutical Technology

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** written examination
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 2	written examination **Activities and hours** lecture: 20 seminar: 20 classes: 20	3.0

Goals

C1	To familiarize the student with selected types of dosage forms, methods of their production and quality control.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	Naming, composition, structure and properties of various dosage forms	DDD_KDR_W05	written examination

W2	Methods for preparing liquid, semi-solid and solid dosage forms on a laboratory and industrial scale; knows and understands the principles of operation of devices for their production,	DDD_KDR_W05, DDD_KDR_W12	written examination
W3	Methods of testing the quality assessment of the selected drug forms	DDD_KDR_W05, DDD_KDR_W06, DDD_KDR_W12	written examination
W4	Requirements for various forms of medicinal products, including pharmacopoeial requirements.	DDD_KDR_W05, DDD_KDR_W09	written examination
Skills – Student can:			
U1	Assess the properties of a medicinal product and present the method of its production in general	DDD_KDR_U01, DDD_KDR_U03	written examination
U2	Plan general production cycle of selected drug forms, taking into account the manufacturing conditions and type of apparatus	DDD_KDR_U02	written examination
U3	Design pharmaceutical availability tests for different drug forms and interpret the results of these tests	DDD_KDR_U01, DDD_KDR_U02, DDD_KDR_U03	written examination
Social competences – Student is ready to:			
K1	Recognize the importance of reliable knowledge and critical assessment of received content in solving cognitive and practical problems	DDD_KDR_K01	written examination

Calculation of ECTS points

Activity form	**Activity hours***
lecture	20
seminar	20
classes	20
analysis of the research material	10
preparation for classes	10
preparation for examination	10

Student workload	**Hours** 90
Workload involving teacher	**Hours** 60
Practical workload	**Hours** 30

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	1. Solid dosage forms, 2. Semi-solid dosage forms, 3. Liquid forms dosage forms 4. Methods for the production and quality control of selected dosage forms, 5. Requirements for various dosage forms, including pharmacopoeial requirements and quality assessment of medicinal products.	W1, W2, W3, W4, K1	lecture, classes, seminar
2.	1. Analysis of pharmacopoeial monographs for selected medicinal products (PhEur., USP), 2. Selection of excipients for various dosage forms.	U2, K1	classes
3.	1. Preparation of solid dosage forms, 2. Assessment of solid dosage forms, including dissolution testing studies, 3. Preparation of liquid and parenteral dosage forms, 4. Quality control of selected dosage forms	U1, U2, U3	classes

Course advanced

Teaching methods:

laboratories (labs), e-learning, seminar, lecture

Activities	Examination methods	Credit conditions
lecture	written examination	Score at least 50% of the exam points
seminar	written examination	Score at least 50% of the exam points
classes	written examination	Score at least 50% of the exam points

Entry requirements

none

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Molecular Screening Systems

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** graded credit
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** lecture: 6 seminar: 6 classes: 18	2.0

Goals

C1	The aim of the module's education is to acquire knowledge, skills and social competences in the field of molecular screening systems in the scope that is necessary to acquire the basics of drug design and development.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The current development direction for molecular screening systems, in the level necessary to assimilate basics of drug design and development Pharmacology in the context of the biological target - expected activity	DDD_KDR_W01, DDD_KDR_W03	written examination
W2	Basic terms of screening in vitro and fundamentals of assay systems and methods of detection in the level necessary to assimilate basics of drug design and development	DDD_KDR_W01	written examination
W3	Pharmacology in the context of the biological target - expected activity	DDD_KDR_W04	written examination
Skills – Student can:			
U1	Is able to calculate the values of the most important descriptors of phamacological activity in vitro based on terms and equations of molecular screening systems in the level necessary to assimilate basics of drug design and development	DDD_KDR_U03	written examination
U2	Is able to assess and compare pharmacological activity of screened compounds on the basis of values of descriptors coming from principal pharmacological assays in vitro	DDD_KDR_U02	written examination
Social competences – Student is ready to:			
K1	Consult with experts in the field of molecular screening systems in case of difficulty in solving problem independently	DDD_KDR_K01	written examination
K2	Show respect for the prestige associated with the profession and properly understood professional solidarity	DDD_KDR_K03	written examination
K3	Care about safety of her/his own, her/his colleagues and the environment	DDD_KDR_K03, DDD_KDR_K07	written examination

Calculation of ECTS points

Activity form	**Activity hours***
lecture	6
seminar	6
classes	18
preparation for classes	20

Student workload	**Hours** 50
Workload involving teacher	**Hours** 30
Practical workload	**Hours** 18

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	1. Basic terms of screening in vitro - concentration response curves and IC50 - dissociation constants (Kd) and inhibition constants (Ki) - efficacy versus binding: EC50 - agonists and partial agonists - antagonists - basal activity and inverse agonists - allosteric modulation - receptor reserve 2. Basic differences between biochemical and cellular assays 3. Fundamentals of assay systems and methods of detection 4. Fundamentals of radioligand assay systems 5. Basics of enzyme-linked immunosorbent assay (elisa) 6. Fundamentals of fluorescence-based assay systems - fluorescence polarization (FP) - fluorescence resonance energy transfer (FRET) - time-resolved fluorescence resonance energy transfer (TRFRET) - amplified luminescent proximity homogeneous assay (AlphaScreen™) - fluorescent detection of calcium flux 7. Theoretical basics of : -reporter gene assays - kinetic fluorescent measurement systems - label-free assay systems	W1, W2, W3, U2, K2	lecture, classes, seminar
2.	1. Basic terms of screening in vitro - concentration response curves and IC50 - dissociation constants (Kd) and inhibition constants (Ki) - efficacy versus binding: EC50 - agonists and partial agonists - antagonists - basal activity and inverse agonists - allosteric modulation - receptor reserve 2. Basic differences between biochemical and cellular assays 3. Fundamentals of assay systems and methods of detection 4. Fundamentals of radioligand assay systems 5. Basics of enzyme-linked immunosorbent assay (elisa) 6. Fundamentals of fluorescence-based assay systems - fluorescence polarization (FP) - fluorescence resonance energy transfer (FRET) - time-resolved fluorescence resonance energy transfer (TRFRET) - amplified luminescent proximity homogeneous assay (AlphaScreen™) - fluorescent detection of calcium flux 7. Theoretical basics of : -reporter gene assays - kinetic fluorescent measurement systems - label-free assay systems	U1, K1, K3	lecture, classes, seminar

Course advanced

Teaching methods:

computer classes, laboratories (labs), demonstration, discussion, e-learning, seminar, workshop, lecture, lecture with multimedia presentation

Activities	Examination methods	Credit conditions
lecture	written examination	Attendance mandatory Partial tests (> 60%)
seminar	written examination	Attendance mandatory Partial tests (> 60%)
classes	written examination	Attendance mandatory Partial tests (> 60%)

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Introduction to Animal Models of Disease States

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** graded credit
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** e-learning lecture: 5 seminar: 10 classes: 15	2.0

Goals

C1	Acquire basic knowledge, skills and social competences in the field of experiments of animals.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the basic ethical and legal aspects of performing experiments on animals	DDD_KDR_W09	written credit

W2	the main sources from which animals can be obtained for experiments	DDD_KDR_W09, DDD_KDR_W10	written credit
W3	various routes of drug administration	DDD_KDR_W10	written credit
W4	the rules for the selection of the appropriate route of administration, dose, group size and species of animals for pharmacological research	DDD_KDR_W10	written credit
W5	selected animal models of diseases used in search for new drugs	DDD_KDR_W10, DDD_KDR_W14	written credit
Skills – Student can:			
U1	choose the appropriate route of administration, dose, size of the group as well as the species of animals for pharmacological experiments	DDD_KDR_U01	assignment report
U2	determine the sources from which animals can be obtained for experiments	DDD_KDR_U02	assignment report
U3	characterize selected animal models of diseases used in research on new drugs with central, circulatory, antimicrobial and antineoplastic activity	DDD_KDR_U01, DDD_KDR_U03	assignment report
Social competences – Student is ready to:			
K1	consult with experts in the field of experimental pharmacology in case of facing difficulties in solving certain tasks independently	DDD_KDR_K01	assignment report
K2	independently acquire knowledge based on reliable sources and critically evaluate it	DDD_KDR_K01	assignment report

Calculation of ECTS points

Activity form	**Activity hours***
e-learning lecture	5
seminar	10
classes	15
preparation for examination	30

Student workload	**Hours** 60
Workload involving teacher	**Hours** 30
Practical workload	**Hours** 15

* hour means 45 minutes

Study content

No.	**Course content**	**Subject's learning outcomes**	**Activities**

1.	Ethical and legal aspects regarding experiments on animals (current regulations on the protection of experimental animals, guidelines on how to write an application for Ethics Committee)	W1, K2	e-learning lecture
2.	Rules for the selection of the appropriate species for testing and the size of the group	W4, U1, K1, K2	e-learning lecture
3.	Various routes of administering compounds	W3, U1, K1, K2	e-learning lecture
4.	Sources from which animals can be obtained for testing	W2, U2, K2	e-learning lecture
5.	Selected animal models of disease states (models of diseases of the central nervous system, cardiovascular system, infectious diseases, models in oncological research)	W5, U3, K1, K2	classes, seminar
6.	Analysis of exemplary pharmacological experiments (forced swim test, elevated plus maze test, novel object recognition test, ECG analysis)	W5, U3, K1, K2	classes

Course advanced

Teaching methods:

computer classes, e-learning, presentation, group work, seminar, lecture with multimedia presentation

Activities	Examination methods	Credit conditions
e-learning lecture	written credit	1. The final assessment will constitute of 30 questions of various types (multiple-choice with only one correct answer per question, ordering, short answer, true-false, calculation, drag and drop etc.). 2. The grade from the final assessment will represent the final grade awarded for the course. The grading scale is as follows: 92-100%: 5.0 84-91%: 4.5 76-83%: 4.0 68-75%: 3.5 60-67%: 3.0 <60%: 2.0
seminar	written credit	1. Presence at over 50% of seminars is mandatory. 2. The final assessment will constitute of 30 questions of various types (multiple-choice with only one correct answer per question, ordering, short answer, true-false, calculation, drag and drop etc.) 3.The grade from the final assessment will represent the final grade awarded for the course. The grading scale is as follows: 92-100%: 5.0 84-91%: 4.5 76-83%: 4.0 68-75%: 3.5 60-67%: 3.0 <60%: 2.0
classes	assignment report	1. Presence at over 50% of seminars is mandatory. 2. Entry to the final examination will require passes from classes by means of reports – at least one passed report from the following topics: Animal models in neuroscience, Animal models of pain, Animal models of cardiovascular disease and Animal models of oncology. 3.If a student does not meet the criteria allowing them to sit the final assessment before the 15th June 2023, they will lose the opportunity to complete the first term final assessment. In such a case the student still has the opportunity to meet the criteria until the 5th September 2023 and, if successful, they will be permitted to take the second term final assessment. If the student does not meet the criteria which allows them to sit the final assessment before the 5th September they will not pass the course. 4. The final assessment will constitute of 30 questions of various types (multiple-choice with only one correct answer per question, ordering, short answer, true-false, calculation, drag and drop etc.). 5.The grade from the final assessment will represent the final grade awarded for the course. The grading scale is as follows: 92-100%: 5.0 84-91%: 4.5 76-83%: 4.0 68-75%: 3.5 60-67%: 3.0 <60%: 2.0

Entry requirements

Knowledge, skills and competences obtained in the I semester of the I year of the DDD course.

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Introduction to Drugs Safety and Toxicology

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing a year
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** graded credit
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** seminar: 10 classes: 4 workshop: 16	2.0

Goals

C1	To deliver knowledge and understanding in the field of drugs safety and toxicity testing. This includes data analysis and in vitro/in vivo study planning.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	The in vitro and in silico studies used for the drugs' safety and toxicity assessment.	DDD_KDR_W01, DDD_KDR_W02, DDD_KDR_W03, DDD_KDR_W04, DDD_KDR_W07	test, gap filling test, written credit
W2	The correlations between physicochemical properties of the chemical compounds and their potential toxicity.	DDD_KDR_W01, DDD_KDR_W02, DDD_KDR_W03, DDD_KDR_W04, DDD_KDR_W07	written credit
W3	The in vivo animal studies used for the drugs' safety and toxicity assessment.	DDD_KDR_W01, DDD_KDR_W02, DDD_KDR_W03, DDD_KDR_W04, DDD_KDR_W07	test, gap filling test, written credit
W4	Most important clinical studies utilized for the drugs' safety assessment.	DDD_KDR_W01, DDD_KDR_W02, DDD_KDR_W03, DDD_KDR_W04, DDD_KDR_W07	written credit
W5	Basic in silico models utilized for the drugs' safety and toxicity screening.	DDD_KDR_W01, DDD_KDR_W02, DDD_KDR_W03, DDD_KDR_W04, DDD_KDR_W07	written credit
W6	Guidelines for the drugs' safety and toxicity assessment (ICH, FDA, EMA).	DDD_KDR_W01, DDD_KDR_W02, DDD_KDR_W03, DDD_KDR_W04, DDD_KDR_W07	assignment report
Skills – Student can:			
U1	To identify the applicability of the particular in vitro experiments used for the drugs' safety and toxicity testing.	DDD_KDR_U01, DDD_KDR_U03, DDD_KDR_U04	written credit
U2	To identify the applicability of the particular in vivo animal models and experiments used for the drugs' safety and toxicity testing.	DDD_KDR_U01, DDD_KDR_U03, DDD_KDR_U04	written credit
U3	To interpret results of the chosen in vitro and in vivo animal experiments towards drugs safety and toxicity assessment.	DDD_KDR_U01, DDD_KDR_U03, DDD_KDR_U04	written credit
U4	To calculate and interpret the toxicokinetic parameters in the compartmental analysis.	DDD_KDR_U01, DDD_KDR_U03, DDD_KDR_U04	written credit

Calculation of ECTS points

Activity form	**Activity hours***
seminar	10
classes	4
workshop	16

preparation for examination	5
preparation for classes	20

Student workload	**Hours** 55
Workload involving teacher	**Hours** 30
Practical workload	**Hours** 20

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	Correlation between the chemicals structure and their toxicity.	W1, W6	classes, seminar
2.	In vitro methods for the drugs toxicity and safety assessment.	W2, U1, U3	classes, seminar
3.	In vivo animal models utilized for the drugs toxicity and safety assessment.	W3, U2, U3	seminar, workshop
4.	Clinical trials and safety pharmacology.	W4	seminar
5.	In silico methods for the drugs toxicity and safety assessment.	W5, U4	classes, seminar

Course advanced

Teaching methods:

case study method, seminar, lecture

Activities	Examination methods	Credit conditions
seminar	test, gap filling test, written credit	To pass the final exams it is required to score at least 60% points.
classes	written credit	To pass the final exams it is required to score at least 60% points.
workshop	assignment report	To pass the final exams it is required to score at least 60% points.

Entry requirements

Module Legal and Scientific Basics of Drug Discovery and Development

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Pharmaceutical Project Management

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** graded credit
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** seminar: 15	1.0

Goals

C1	The aim of education within this subject is to provide the basics of knowledge and skills in the field of project management, especially in relation to pharmaceutical projects. Acquiring these competences aims to enable effective planning and implementation of project tasks, as a part of working in a research group as well as building the basis for further development in the field of pharmaceutical project management.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the life cycle of the project, knows how to plan and implement it	DDD_KDR_W08, DDD_KDR_W09	written credit

W2	what are the tools used to plan and manage a project	DDD_KDR_W07, DDD_KDR_W11	written credit
W3	what are the basic documents of the project throughout the entire life cycle	DDD_KDR_W09	written credit
W4	what are the roles of individual project stakeholders and the role of Project Manager	DDD_KDR_W08	written credit
W5	basic methodologies and their dfferences	DDD_KDR_W08, DDD_KDR_W14	written credit
W6	the importance and principles of communication in the project	DDD_KDR_W08	written credit
W7	the specifics of pharmaceutical projects	DDD_KDR_W08	written credit
Skills – Student can:			
U1	to schedule the project, define the milestones and monitor its implementation	DDD_KDR_U02	written credit
U2	to analyse the influence of the project stakeholders	DDD_KDR_U06	written credit
U3	to estimate the risk of the project and react to its occurrence	DDD_KDR_U01, DDD_KDR_U06	written credit
Social competences – Student is ready to:			
K1	cooperation in a group in order to solve complex problems and carry out tasks	DDD_KDR_K05, DDD_KDR_K07	written credit

Calculation of ECTS points

Activity form	**Activity hours***
seminar	15
preparation for classes	7
preparation for examination	8
Student workload	**Hours** 30
Workload involving teacher	**Hours** 15

* hour means 45 minutes

Study content

No.	**Course content**	**Subject's learning outcomes**	**Activities**

1.	Introduction to Project Management a. What is a project and what its life cycle looks like b. Triple limitation c. Key stakeholders of the project, stakeholders mapping d. Factors affecting the project e. The role of the Project Manager and his duties f. Project team g. Selection of the project and its cost-effectiveness	W1, W3, W4, U1, U2	seminar
2.	Project Planning a. Work breakdown structure b. Defining the scope of the Project c. Project schedule e. Resource planning and balancing g. Estimating the risk in the Project	W2, U1, U3	seminar
3.	The specifics of pharmaceutical projects a. Types of pharmaceutical projects b. Good practices and the most common management errors c. Examples of pharmaceutical projects	W6, W7, K1	seminar
4.	Implementation of the Project a. Monitoring and evaluation of the Project implementation b. Current project management tools c. Reporting the implementation of the Project d. Communication in the project e. Negotiations in the Project f. Change management	W2, W4, U1, K1	seminar
5.	Project Management Methodologies a. Classical methodologies b. Agile methodologies	W5, W7, K1	seminar

Course advanced

Teaching methods:

educational game, case study method, seminar, lecture with multimedia presentation

Activities	Examination methods	Credit conditions
seminar	written credit	At least 50% of the points from the final test

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Biological drugs

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** elective
Disciplines Pharmaceutical science	**Examination** graded credit
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** lecture: 15 seminar: 10 classes: 25	4.0

Goals

C1	The learning objective within the module is to broaden knowledge, skills and social competences in the field of pharma biotechnology in the aspects related to biological drugs

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	basic knowledge in pharmaceutical biotechnology	DDD_KDR_W02, DDD_KDR_W03, DDD_KDR_W08, DDD_KDR_W11	written examination
W2	classification and application of biopharmaceuticals and its mode of action and therapeutic use.	DDD_KDR_W02	written examination
W3	the general principles of biosimilar and innovative biological drugs drugs discovery and development	DDD_KDR_W02, DDD_KDR_W03, DDD_KDR_W08, DDD_KDR_W11	written examination
W4	molecular biology and recombinant DNA techniques related to the production of biological medicine.	DDD_KDR_W03, DDD_KDR_W11	written examination, group assessment
W5	bioprocess design in the bioreactors, types of bioreactor, basic concepts of bioreactor design and selection	DDD_KDR_W03, DDD_KDR_W11	written examination, group assessment
W6	the system validation and optimisation, economics of bioprocesses, scale-up of up-stream and down-stream process.	DDD_KDR_W03, DDD_KDR_W11	written examination, group assessment
W7	the industrial requirements for bioprocessing and biomanufacturing such as Good Laboratory Practice (GLP), Good Manufacturing Practice (GMP), Good Clinical Practise (GCP) and International Organization of Standarization (ISO).	DDD_KDR_W03, DDD_KDR_W11	written examination, group assessment
Skills – Student can:			
U1	differentiate and select appropriate microbial strains or eukaryotic cell lines depending on the produced biological drugs	DDD_KDR_U02, DDD_KDR_U06, DDD_KDR_U07	written examination, group assessment
U2	perform basic laboratory activities in the field of breeding, banking and storing microbiological and eukaryotic organisms	DDD_KDR_U02, DDD_KDR_U06, DDD_KDR_U07	written examination, group assessment
U3	to present and discuss the issues concerning the development of the biological or biosimilar drugs.	DDD_KDR_U02, DDD_KDR_U06, DDD_KDR_U07, DDD_KDR_U09	written examination, group assessment
U4	to use bioinformatic methods in the design of the biological processes, during which recombinant proteins are being obtained	DDD_KDR_U02, DDD_KDR_U06, DDD_KDR_U07	written examination, group assessment
U5	to identify the latest trends in research on innovative biological drugs and the prospects for the introduction of biosimilars into the pharmaceutical market.	DDD_KDR_U02, DDD_KDR_U06, DDD_KDR_U07	written examination, group assessment, project
U6	to perform basic steps in obtaining recombinant protein and its initial analysis.	DDD_KDR_U02	written examination, group assessment
U7	to handle and operate basic laboratory biofermentor and can keep adequate bioprocessing documentation.	DDD_KDR_U02	written examination, group assessment
U8	to communicate with specialists in the field of: bioinformatics, molecular biology, bioprocess engineering on the special topics related to the preparation of recombinant protein	DDD_KDR_U02, DDD_KDR_U05	written examination, group assessment
U9	to design, plan and organize a collaborative research project, focused on obtaining a recombinant biological drug.	DDD_KDR_U02, DDD_KDR_U05	written examination, group assessment, project
Social competences – Student is ready to:			

K1	to consult experts from different areas of biology, biotechnology, pharmacy and ethics if he has difficulty solving the problem	DDD_KDR_K01	written examination
K2	takes care for the safety of biological medicine production in accordance with all safety standards, GLP, GMP, etc	DDD_KDR_K01	written examination

Calculation of ECTS points

Activity form	Activity hours*
lecture	15
seminar	10
classes	25
analysis of the research material	5
preparation for classes	10
preparation for test	15
consultations with lecturer	2
preparation of multimedia presentation	15
case analysis	3

Student workload	**Hours** 100
Workload involving teacher	**Hours** 50
Practical workload	**Hours** 33

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	1. Introduction to Pharmaceutical Biotechnology	W1, W4, U1, U2, U4, U6	lecture, classes, seminar
2.	Biopharmaceuticals	W2, W3, U3, U5	lecture, classes, seminar
3.	Technology of biopharmaceuticals development	W4, W6, W7, U4, U5, U6, U8, U9, K1	lecture, classes, seminar
4.	Bioprocessing technology	W5, W7, U7, K2	lecture, classes, seminar

Course advanced

Teaching methods:

case study, brainstorm, classes / practicals, computer classes, laboratories (labs), demonstration, discussion, problem solving method, project method, case study method, presentation, group work, seminar, workshop, lecture, practical classes

Activities	Examination methods	Credit conditions
lecture	written examination	tests – scoring at least 60%
seminar	written examination, group assessment, project	tests – scoring at least 60%
classes	written examination, group assessment, project	tests – scoring at least 60%

Entry requirements

The presence is mandatory

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Pharmaceutical Biotechnology

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2023/24
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** elective
Disciplines Pharmaceutical science	**Examination** graded credit
ISCED classification 0916 Pharmacy	

Period	**Examination**	**Number of ECTS points**
Semester 2	graded credit **Activities and hours** lecture: 15 seminar: 10 classes: 25	4.0

Goals

C1	The learning objective within the module is to broaden knowledge, skills and social competences in the field of pharma biotechnology

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	Classification and application of biotechnological drugs	DDD_KDR_W01, DDD_KDR_W03	written examination, oral examination, test
W2	Principles and perspectives of gene therapy	DDD_KDR_W02, DDD_KDR_W03	written examination, test

W3	Microbial/enzymatic biotransformations used in the pharma industry	DDD_KDR_W05, DDD_KDR_W12	written examination, test
W4	Bioprocessing technology including bioreactor design and selection, system validation and optimisation, economics of bioprocesses, scale-up of up-stream and down-stream process	DDD_KDR_W05, DDD_KDR_W08, DDD_KDR_W12	written examination, test
Skills – Student can:			
U1	Identifiy and distinguishes research directions and methods used in biotechnology of plants, algae and higher mushrooms important from the pharmaceutical point of view and select molecular biology and recombinant DNA techniques depending on their use in particular areas of pharmaceutical biotechnology	DDD_KDR_U01, DDD_KDR_U02, DDD_KDR_U06	written examination, test
U2	Perform basic laboratory activities with microbiological and eukaryotic organisms, molecular biology and recombinant DNA techniques aswell as microbial/enzymatic reaction of biotransformations including process monitoring and product purification and analysis	DDD_KDR_U02, DDD_KDR_U04	written examination, test
U3	Use bioinformatic methods in the design of the biotechnological processes	DDD_KDR_U01, DDD_KDR_U06	written examination, test
U4	Design, plan and organize a collaborative research project, focused on the use of pharmaceutical biotechnology methods in drug discovery and development	DDD_KDR_U01, DDD_KDR_U02, DDD_KDR_U05	written examination, test
Social competences – Student is ready to:			
K1	Consult experts from different areas of medicinal chemistry, biology, biotechnology and pharmacy if he has difficulty solving the problem.	DDD_KDR_K01	oral examination
K2	Take care for the safety of biological medicine production and the use of molecular biology techniques, recombinant in vitro research models, microbial, plant, algae and mycelial in vitro cultures in accordance with all safety standards, GLP, GMP, etc.	DDD_KDR_K07	oral examination

Calculation of ECTS points

Activity form	**Activity hours***
lecture	15
seminar	10
classes	25
preparation for classes	15
preparation for test	10
preparation for examination	25

Student workload	**Hours** 100
Workload involving teacher	**Hours** 50
Practical workload	**Hours** 25

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	Introduction to Pharmaceutical Biotechnology	W1, W2, U1, K1	lecture
2.	Biopharmaceuticals	W1, W3, W4, U3, K1, K2	lecture, seminar
3.	Technology of biopharmaceuticals development	W1, W3, W4, U3, U4, K1, K2	lecture, classes, seminar
4.	Bioprocessing technology	W3, W4, U2, U3, U4, K1, K2	lecture, classes, seminar

Course advanced

Teaching methods:

classes / practicals, computer classes, laboratories (labs), demonstration, discussion, e-learning, presentation, group work, seminar, lecture, lecture with multimedia presentation, practical classes

Activities	Examination methods	Credit conditions
lecture	written examination	passing the written exam (>51%)
seminar	oral examination	presence obligatory, oral presentation
classes	test	presence obligatory, partial tests (>51%), final written exam

Entry requirements

None

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Principles of Clinical Trials

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2024/25
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** graded credit
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 3	graded credit **Activities and hours** lecture: 15 seminar: 15	2.0

Goals

C1	To familiarize students with the chosen types of clinical trials and their application in various phases of the process of discovering and developing new drugs and development of generic drugs

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	Goals and applications of clinical trials in the process of drug discovery and development	DDD_KDR_W04, DDD_KDR_W05, DDD_KDR_W09	written examination

W2	Various types of clinical trials and methods of their design and analysis of their results	DDD_KDR_W04, DDD_KDR_W07	written examination
W3	Where to find detailed information on the applicable regulations regarding clinical trials	DDD_KDR_W14	written examination
Skills – Student can:			
U1	Interpret parameters analyzed in selected types of clinical trials	DDD_KDR_U01, DDD_KDR_U03, DDD_KDR_U04	written examination
Social competences – Student is ready to:			
K1	Recognize the importance of reliable knowledge and critical assessment of content received in solving cognitive and practical problems	DDD_KDR_K01	written examination

Calculation of ECTS points

Activity form	**Activity hours***
lecture	15
seminar	15
preparation for classes	15
preparation for examination	15

Student workload	**Hours** 60
Workload involving teacher	**Hours** 30

* hour means 45 minutes

Study content

No.	**Course content**	**Subject's learning outcomes**	**Activities**
1.	1. Place of clinical trials in the process of drug discovery and development 2. Phases and types of clinical trials 3. Sources of knowledge about the principles of design and reporting of clinical trials (industrial guidelines, EMA, FDA, ICH) 4. Clinical trials design (place, composition and size of the sample, analyzed variables, randomization and blinding) 5. Analysis and inferences in clinical trials 6. Ethical issues in clinical trials	W1, W2, W3, K1	lecture, seminar
2.	1. Statistical basis of clinical trials 2. Clinical trials protocols (crossed, parallel) 3. Case study: mostly used protocol of clinical trials for demonstration of bioequivalence (2x2x2)	U1, K1	lecture, seminar

Course advanced

Teaching methods:

computer classes, e-learning, seminar, lecture

Activities	Examination methods	Credit conditions
lecture	written examination	Minimum score 50%
seminar	written examination	Minimum score 50%

Entry requirements

None

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Medicinal Chemistry

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2024/25
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** elective
Disciplines Pharmaceutical science	**Examination** written examination
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 3	written examination **Activities and hours** lecture: 3 seminar: 170 classes: 197 workshop: 30	36.0

Goals

C1	Understanding the relationship between drug structure and its activity, pharmacokinetics and toxicity
C2	Understanding the principles of multi-parameter optimization of biologically active compounds, including therapeutic efficacy, pharmacokinetics and safety
C3	Understanding molecular modeling techniques and bioinformatics in order to propose and evaluate candidates for biologically active molecules
C4	Understanding modern methods of mathematical modeling used for making decisions regarding drug development
C5	Understanding modern methods in organic synthesis and analysis used in the preparation of new bioactive compounds
C6	Ability to discuss and effectively cooperate with specialists working in a field of drug development

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	representative examples of drug metabolism	DDD_KDR_W01, DDD_KDR_W02, DDD_KDR_W03	written examination, project, test
W2	goals necessary to achieve at each stage of drug discovery process	DDD_KDR_W01, DDD_KDR_W03, DDD_KDR_W04, DDD_KDR_W05	written examination, project, test
W3	the importance of the chemical structure of a compound for its pharmacodynamic, pharmacokinetic and biopharmaceutical properties	DDD_KDR_W01, DDD_KDR_W02, DDD_KDR_W03	written examination, project, test
W4	principles of design and optimization of pharmacodynamic and drug-like properties	DDD_KDR_W01, DDD_KDR_W03, DDD_KDR_W04	written examination, project, test
W5	methods of determination and prediction of ADME parameters and metabolism	DDD_KDR_W07	written examination, project, test
W6	basics of quantum and molecular mechanics and possibilities of their application in computer-aided drug design	DDD_KDR_W07	written examination, project, test
W7	principles and application of pharmacophore modeling and structure-based modeling (including homology models)	DDD_KDR_W03, DDD_KDR_W07	written examination, project, test
W8	methods for biologically active compounds discovery - de novo design based on atoms and fragments and virtual screening of chemical databases	DDD_KDR_W03, DDD_KDR_W05, DDD_KDR_W07	written examination, project, test
W9	the most important and the most useful synthetic methods in medicinal chemistry	DDD_KDR_W06, DDD_KDR_W11, DDD_KDR_W12	written examination, project, test
W10	analytical techniques used for determination of compound’s structure	DDD_KDR_W06, DDD_KDR_W11, DDD_KDR_W12	written examination, project, test
Skills – Student can:			

U1	use databases with information about drugs' structure and properties	DDD_KDR_U04	group assessment, project, test
U2	analyze and critically evaluate the results of physicochemical, pharmacodynamic, pharmacokinetic, toxicological tests and draw conclusions about the relationship between them and the chemical structure	DDD_KDR_U01, DDD_KDR_U03	written examination, group assessment, project, test
U3	indicate fragments of compound's structure disadvantageous for its drug-like properties and propose appropriate structural modifications leading to their improvement	DDD_KDR_U01, DDD_KDR_U03, DDD_KDR_U06	written examination, group assessment, project, test
U4	propose appropriate methods (and indicate specialists) for the determination of basic physicochemical, pharmacological, pharmacokinetic and toxicological properties	DDD_KDR_U02, DDD_KDR_U05, DDD_KDR_U06	written examination, group assessment, project, test
U5	propose work adequate for a particular stage of drug discovery process	DDD_KDR_U03, DDD_KDR_U06, DDD_KDR_U10	written examination, group assessment, project, test
U6	dock the ligand to the biological target model and evaluate qualitatively and quantitatively ligand-target complex	DDD_KDR_U02, DDD_KDR_U04	group assessment, project, test
U7	perform virtual screening of chemical database	DDD_KDR_U02, DDD_KDR_U04	group assessment, project, test
U8	build pharmacophore and homology model	DDD_KDR_U02, DDD_KDR_U04	group assessment, project, test
U9	interpret the results of the QSAR analysis	DDD_KDR_U01, DDD_KDR_U02, DDD_KDR_U03, DDD_KDR_U04	written examination, group assessment, project, test
U10	properly document the laboratory activity/prepare laboratory documentation	DDD_KDR_U07, DDD_KDR_U08	group assessment, project, test
U11	use the software and databases necessary in the work of organics chemist: programs for drawing of chemical entities, synthetic pathway design, prediction of physicochemical properties, spectral analysis	DDD_KDR_U02, DDD_KDR_U04	written examination, group assessment, project, test
U12	plan and carry out chemical reactions and isolate the desired products using appropriate methods and equipment	DDD_KDR_U02	written examination, group assessment, project, test
U13	use adequate methods to determine structure and purity of compounds	DDD_KDR_U02	written examination, group assessment, project, test
U14	professionally and comprehensively present knowledge and research results	DDD_KDR_U07, DDD_KDR_U11	written examination, group assessment, project, test
Social competences – Student is ready to:			
K1	cooperate in a group to solve complex problems in the field of drug discovery and development	DDD_KDR_K01, DDD_KDR_K02, DDD_KDR_K03	group assessment, project, test
K2	recognize the importance of reliable knowledge and critical assessment of received content in solving cognitive and practical problems	DDD_KDR_K01, DDD_KDR_K02, DDD_KDR_K03	project, test

K3	prioritize tasks to implement specific, self-determined goals or other projects and consult experts, if necessary	DDD_KDR_K04	project, test

Calculation of ECTS points

Activity form	Activity hours*
lecture	3
seminar	170
classes	197
workshop	30
preparation for classes	225
preparation for examination	50
conducting literature research	25
preparation of multimedia presentation	25
preparation of a report	25
preparation of a project	50
preparation for test	50
practice	50

Student workload	**Hours** 900
Workload involving teacher	**Hours** 400
Practical workload	**Hours** 277

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	The effects of physicochemical properties on the pharmacokinetics	W3, W4	lecture, classes, seminar
2.	Relationships between chemical structure and pharmacodynamic, pharmacokinetic properties or toxicity	W2, W3, W4, W5, U1, U14, U2, U3, U5, K1	lecture, classes, seminar

3.	Drug metabolism - basic metabolic pathways, methods of determination of metabolic stability and metabolic pathways	W1, W3, W4, W5, U2, U3, U4, K1	lecture, classes, seminar
4.	Databases and programs allowing to determine physicochemical, pharmacokinetic, toxicological and pharmacological properties	W1, W2, W3, W4, W5, U2, U3, U4, K1, K2, K3	lecture, classes, seminar
5.	Methods used for determination, calculation and prediction of structural (log P, log D, pKa, PSA), physicochemical (solubility, permeability, chemical stability) and biochemical properties of compounds (metabolic stability, protein binding, transport)	W4, W5, U2, U4, U5, K1, K2, K3	lecture, classes, seminar
6.	Methods of structural modifications to optimize the desired properties of the compound	W3, W4, U3, U4, U5, K1, K2, K3	lecture, classes, seminar
7.	Selected reactions for formation of carbon-carbon bond (e.g., Heck, Suzuki, metathesis, aldol, Wittig reactions)	W10, W9, U10, U11, U12, U13	lecture, classes, seminar
8.	Selected reactions for formation of carbon-heteroatom bond	W10, W9, U10, U11, U12, U13	lecture, classes, seminar
9.	Methods for selective reduction and oxidation	W10, W9, U10, U11, U12, U13	lecture, classes, seminar
10.	Protecting groups most commonly used in synthetic chemistry	W10, W9, U10, U11, U12, U13	lecture, classes, seminar
11.	Stereochemistry in organic synthesis	W10, W9, U10, U11, U12, U13	lecture, classes, seminar
12.	Analytical methods for confirming and determining the purity of compounds (NMR, LCMS, IR)	W10, U10, U13, U5	lecture, classes, seminar
13.	Structure and properties of proteins as biological targets (GPCRs, enzymes, ion channels and transporters) and types of interactions with ligands	W6, W7, W8, U7, U8	lecture, classes, seminar, workshop
14.	Assumptions of classical and quantitative structure-activity relationships assessment - SAR, QSAR (classic descriptors, Hansch equation, Craig diagram, Topliss scheme), 3D-QSAR (molecular fields, CoMFA, CoMSIA	W6, U6, U9	lecture, classes, seminar, workshop
15.	Ligand-based (pharmacophore modeling) and structure-based (homology modeling) molecular design methods	W6, W7, W8, U5, U7, U8, K1, K3	lecture, classes, seminar, workshop
16.	Methods of ligand-biological target binding energy assessment (FEP, MM-GBSA)	W6, U7, U8	lecture, classes, seminar, workshop
17.	Principles of de novo design based on atoms and fragments – scoring the molecule's fitness and searching the chemical space	W6, W7, W8, U7, U8	lecture, classes, seminar, workshop
18.	Virtual screening of chemical databases using pharmacophore and structural models	W6, W7, W8, U5, U7, U8	lecture, classes, seminar, workshop
19.	Safety in a chemical laboratory	U10	classes, seminar
20.	Keeping track of laboratory work	U10	classes, seminar
21.	Conducting reactions in various conditions (anhydrous conditions, inert gas atmosphere, low/high temperature)	W10, W9, U10, U11, U12, U13	lecture, classes, seminar
22.	Isolation and purification of compounds (extraction, chromatography, crystallization)	W10, W9, U10, U11, U12, U13	lecture, classes, seminar

23.	Microwave-assisted reactions - theoretical and practical aspects	W10, W9, U10, U11, U12, U13	lecture, classes, seminar

Course advanced

Teaching methods:

case study, brainstorm, classes / practicals, laboratories (labs), demonstration, presentation, group work, computer room, seminar, participation in research, lecture

Activities	Examination methods	Credit conditions
lecture	written examination	1. Completion of seminars based on the results of partial tests (at least 60% from each), 2. Accepted presentation of a project, 3. Completion of laboratory classes. 4. Scoring at least 60% from written final exams for the following units: a. Principles of design and structure optimization of novel drug candidates, b. Principles of Molecular Modeling, c. Contemporary organic synthesis.
seminar	group assessment, project, test	1. Completion of seminars based on the results of partial tests (at least 60% from each), 2. Accepted presentation of a project. 3. Classes attendance - at least 90%
classes	written examination	1. Completion of laboratories based on the results of partial tests (at least 60% from each), 2. Accepted reports, 3. Completion of laboratory classes. 4. Classes attendance - at least 90%
workshop	written examination, project	1. Classes attendance - at least 90% 2. Accepted project presentation. 3. Scoring at least 60% on the written examination.

Entry requirements

Principles of Medicinal Chemistry module passed

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Experimental Pharmacology

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2024/25
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** elective
Disciplines Pharmaceutical science	**Examination** written examination
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 3	written examination **Activities and hours** e-learning lecture: 20 seminar: 30 classes: 350	36.0

Goals

C1	acquire knowledge, skills and social competences in the field of conducting pharmacological research in the process of drug discovery and development, including in vitro and in vivo pharmacodynamic, toxicological and safety pharmacology studies

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	principles of molecular pharmacology significant for current drugs action and discovery of new drugs	DDD_KDR_W02, DDD_KDR_W04	written examination, oral answer, test
W2	assumptions of cell and tissue cultures in the context of their applications in preclinical drug development	DDD_KDR_W03, DDD_KDR_W04	written examination, oral answer, test
W3	concepts, definitions and theoretical assumptions of detection methods and techniques of screening in vitro in the extent useful in drug design and development	DDD_KDR_W03, DDD_KDR_W04	written examination, oral answer, test
W4	concepts, definitions and theoretical assumptions of methods and models of ADME-Tox screening in vitro in the extent useful in the preclinical development of drug candidates	DDD_KDR_W01, DDD_KDR_W04, DDD_KDR_W06	written examination, oral answer, test
W5	the basics of anatomy, physiology and histopathology of laboratory animals	DDD_KDR_W04	written examination, oral answer, test
W6	rules of dealing with laboratory animals and recognizing symptoms of pathological and distress behaviors of animals	DDD_KDR_W14	written examination, oral answer, test
W7	ethical and legal aspects of performing experiments on animals	DDD_KDR_W09, DDD_KDR_W14	written examination, oral answer, test
W8	the requirements for a compound to enter the animal testing phase	DDD_KDR_W14	written examination, oral answer, test
W9	rules of selection of the appropriate route of administration, dose, size of the group, duration of the experiment, as well as animal species for pharmacological research	DDD_KDR_W04	written examination, oral answer, test
W10	selected animal models of disease states	DDD_KDR_W14	written examination, oral answer, test
W11	sources of toxicity, target organs exposed to toxic effects and basic concepts and definitions in the field of toxicology	DDD_KDR_W03, DDD_KDR_W05	written examination, oral answer, test
W12	basic toxicological test sets required by the guidelines for new compounds	DDD_KDR_W05	written examination, oral answer, test
W13	basic sets of tests required by the guidelines, which should be performed within the safety pharmacology studies	DDD_KDR_W04	written examination, oral answer, test
W14	suggested additional tests that can be performed as a part of the safety pharmacology studies	DDD_KDR_W02, DDD_KDR_W04, DDD_KDR_W12	written examination, oral answer, test
W15	specific cases in which safety pharmacology studies are not necessary	DDD_KDR_W05	written examination, oral answer, test
W16	basics of statistical analysis of results	DDD_KDR_W07	written examination, oral answer, test
Skills – Student can:			
U1	conduct routine cell and tissue culture procedures in the extent useful in drug design and development	DDD_KDR_U02	written examination, oral answer, test
U2	calculate pharmacological activity descriptors and ADME parameters on the basis of definitions and equations related to particular in vitro and in vivo screening techniques in the extent useful in drug design and development	DDD_KDR_U02, DDD_KDR_U04	written examination, oral answer, test

U3	prepare and carry out selected in vitro pharmacological and ADME-Tox screening experiments in the extent useful in drug design and development	DDD_KDR_U02	written examination, oral answer, test
U4	locate internal organs and assess the anatomy of these organs in selected laboratory animals	DDD_KDR_U05, DDD_KDR_U07	written examination, oral answer, test
U5	collect and prepare the organs of selected laboratory animals for histopathological assessment and evaluate them using microscopic methods	DDD_KDR_U02	written examination, oral answer, test
U6	determine both normal and pathological conditions of laboratory animals	DDD_KDR_U01	written examination, oral answer, test
U7	choose the appropriate route of administration, dose, size of the group, duration of the experiment, as well as the species of animals for pharmacological research	DDD_KDR_U02	written examination, oral answer, test
U8	administer the compound using various routes of administration	DDD_KDR_U02	written examination, oral answer, test
U9	list the requirements for a compound to enter animal testing phase	DDD_KDR_U02	written examination, oral answer, test
U10	determine from which sources animals for research can be obtained	DDD_KDR_U02	written examination, oral answer, test
U11	select the appropriate battery of tests for new compounds using selected animal models of disease states	DDD_KDR_U02	written examination, oral answer, test
U12	indicate the basic set of tests required by the guidelines, which should be carried out within the safety pharmacology	DDD_KDR_U01, DDD_KDR_U02, DDD_KDR_U05, DDD_KDR_U06, DDD_KDR_U07	written examination, oral answer, test
U13	propose additional safety studies based on the compound’s profile	DDD_KDR_U01, DDD_KDR_U05, DDD_KDR_U06	written examination, oral answer, test
U14	identify sources of toxicity and organs particularly exposed to toxic drugs, as well as explain basic concepts related to toxicity	DDD_KDR_U01, DDD_KDR_U06	written examination, oral answer, test
U15	based on acquired knowledge of the drug development path and available data, indicate when individual tests are performed and plan them in time	DDD_KDR_U02	written examination, oral answer, test
U16	analyze mathematically and statistically research results	DDD_KDR_U04	written examination, oral answer, test
Social competences – Student is ready to:			
K1	consult with experts in the field of experimental pharmacology in case of facing difficulties in solving certain tasks independently	DDD_KDR_K01, DDD_KDR_K02	oral answer
K2	care about safety of her/his own, her/his colleagues and the environment	DDD_KDR_K07	oral answer
K3	independently acquire knowledge based on reliable sources and critically evaluate it	DDD_KDR_K01, DDD_KDR_K02, DDD_KDR_K03	oral answer

Calculation of ECTS points

Activity form	Activity hours*
e-learning lecture	20
seminar	30
classes	350
preparation for classes	450
preparation for examination	50

Student workload	**Hours** 900
Workload involving teacher	**Hours** 400
Practical workload	**Hours** 350

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	Molecular mechanisms of function of receptors, ion channels, membrane transporters and enzymes	W1, K1, K3	classes, seminar, e-learning lecture
2.	Influence of conformational changes of therapeutic protein targets on their activity	W1, K1, K3	classes, seminar
3.	Relationship between receptor protein conformation and the strength of its interaction with ligand or downstream effector proteins	W1, K1, K3	classes, seminar
4.	Constitutive activity of the seven-transmembrane receptors (7TMR)	W1, K1, K3	classes, seminar
5.	Role of receptor ligands binding and dissociation kinetics in evaluation of their biological activity	W1, K1, K3	classes, seminar
6.	Signaling pathways of particular receptor subtypes: differences between individual tissues, cell types and subcellular compartments	W1, K1, K3	classes
7.	Mode of action of allosteric modulators depending on therapeutic target	W1, K1, K3	classes, seminar
8.	Functional selectivity of receptor ligands	W1, K1, K3	classes, e-learning lecture
9.	Measures of pharmacological activity in vitro descriptors: Kd, Ki, Kb, eKm, IC50, EC50, kon, koff, Vmax, Bmax, Emax –meaning and estimation methods	W1, W3, U2, K1, K2, K3	classes
10.	Cell models in preclinical studies	W2, W3, U1, K1, K3	seminar

11.	Main aspects of cultured cell biology	W2, W3, U1, K1, K3	classes, seminar
12.	Cell adhesion, proliferation and differentiation	W2, W3, U1, K1, K3	classes, seminar
13.	Primary versus secondary cell cultures	W2, W3, U1, K1, K3	classes, seminar
14.	Acquisition of cells for culture	W2, W3, U1, K1, K3	seminar
15.	Observation of the culture and determination of culture condition, including potential infections	W2, W3, U1, K1, K3	classes, seminar
16.	Differences between finite and continuous cell lines	W2, W3, U1, K1, K3	classes, seminar
17.	Process of in vitro transformation	W3, K1, K3	classes, seminar
18.	Tissue and organotypic cultures	W2, W3, U1, K1, K3	classes
19.	Passage of suspension and adherent cells	W2, W3, U1, K1, K3	classes
20.	Cell lines representing the phenotype of various tissues	W2, W3, U1, K1, K3	classes
21.	Methods for cell viability assesment	W2, W3, U2, K1, K2, K3	classes
22.	Genetic modification of cells - gene silencing and transgene overexpression	W2, W3, K1, K2, K3	seminar
23.	Assumptions of in vitro pharmacological screening and the importance of appropriate assay throughput	W3, K1, K3	seminar
24.	Phenotypic screening vs. biological target-oriented screening	W3, K1, K3	seminar
25.	Comparison of biochemical and cell-based tests	W3, K1, K3	classes
26.	Saturation and competitive radioligand binding assays	W16, W3, U15, U16, K1, K3	classes
27.	Different types of devices enabling experimental data recording depending on the technology used in biological tests	W16, W3, U15, U16, K1, K3	classes
28.	Spectral characteristics of various fluorophores and technological requirements for their use in biological assays	W16, W3, U15, U16, K1, K3	classes
29.	Application of various imaging techniques in preclinical studies	W3, U15, U16, K1, K3	seminar
30.	Practical use of the HCS platform and flow cytometry in studies on biological activity of compounds	W16, W3, U15, U16, K1, K2, K3	classes
31.	Differences in the setup of electrophysiological experiments taking into consideration voltage gated or ligand-gated ion channels studies	W16, W3, U15, U16, K1, K2, K3	classes
32.	Types of microbiological tests used in the search for antibacterial drugs	W3, K1, K3	seminar
33.	Basics of anatomy, physiology and histopathology of laboratory animals	W5, U4, K1, K2, K3	classes, e-learning lecture
34.	Rules of good practice in the care of laboratory animals (preparing animals for the procedure, rules for handling animals used in procedures adapted to a given species)	W6, U7, K1, K2, K3	classes, seminar
35.	Basic types of animal behavior, recognition of pathological and dystrophic behaviors characteristic of particular species	W5, W6, U6, K1, K2, K3	seminar, e-learning lecture

36.	Ethical and legal aspects regarding the implementation of animal experiments (current regulations on the protection of experimental animals, rules for writing applications for the use of animals for testing)	W7, U10, K1, K2, K3	classes, seminar, e-learning lecture
37.	Sources from which animals can be obtained for testing	W7, U10, K1, K2, K3	seminar
38.	Principles of anesthesia and euthanasia of laboratory animals	W7, K1, K2, K3	classes, seminar
39.	Rules for the selection of the appropriate size of the group and species for testing	W9, U7, K1, K2, K3	classes
40.	Different routes of administering compounds (influence of physicochemical properties of the compound on the choice of the route of administration)	W9, U8, K1, K2, K3	classes
41.	Rules for the collection of biological material, its storage and the basics of biochemical determinations	U5, K1, K2, K3	classes
42.	Requirements that for the compound to enter the animal testing phase	W8, U9, K1, K3	seminar
43.	Principles of the analysis of in vitro results	W16, U16, K1, K3	classes
44.	Selected animal models of disease states (models of diseases of the central nervous system, cardiovascular system, infectious diseases, models in oncological research and others)	W10, U11, K1, K2, K3	classes
45.	Basics of statistical analysis of results	W16, U16, K1, K3	classes
46.	Toxicity sources, target organs exposed to toxic effects	W11, U14, K1, K3	seminar
47.	Basic concepts such as TD50, LD50, LOAEL, NOAEL or therapeutic index	W11, K1, K3	seminar
48.	Rules for the selection of the appropriate animal species for toxicity tests	W13, U15, K1, K2, K3	seminar
49.	Basic toxicological test sets required by the guidelines for new compounds: genotoxicity, immunotoxicity, carcinogenicity, chronic toxicity, reproduction and other	W12, U15, K1, K3	classes, e-learning lecture
50.	Rules for the selection of the appropriate route of administration, dose, group size, duration of the experiment, as well as the species of animals for the study of safety pharmacology	W13, U12, K1, K2, K3	seminar
51.	Basic, required by the guidelines test sets to be performed within the pharmacology of safety - the central nervous system, respiratory system and cardiovascular system and suggested additional tests that can be performed as part of the pharmacology of safety	W13, W14, U12, U13, K1, K2, K3	classes, e-learning lecture
52.	Exceptional cases for which safety pharmacology studies are unnecessary	W15, U13, K1, K2, K3	seminar
53.	Theoretical basics, limitations, advantages and disadvantages of ADME-Tox parameters evaluation in vitro	W4, U2, U3, K1, K2, K3	seminar

54.	Experimental assays for evaluation of drug permeation through biological membranes and drug absorption	W4, U2, U3, K1, K2, K3	classes
55.	Evaluation of drug distribution, including determination of affinity to albumin, acid glycoprotein as well as stability in plasma and other body fluids	W4, U2, U3, K1, K2, K3	classes, seminar
56.	Experimental studies of CYP-independent metabolism	W3, W4, U2, U3, K1, K2, K3	classes
57.	Determining the affinity and impact on CYP isoform activity	W16, W3, W4, U16, U2, U3, K1, K2, K3	classes, seminar
58.	Procedures for the experimental determination of drug elimination parameters, including Clint, t1/2, Vmax i Km	W4, U16, U2, U3, K1, K2, K3	classes
59.	Experimental determination of genotoxicity	W4, U3, K1, K2, K3	classes
60.	Procedures for testing the affinity and inhibition of hERG channels	W4, U16, U3, K1, K2, K3	classes

Course advanced

Teaching methods:

computer classes, educational game, problem solving method, project method, group work, seminar, lecture with multimedia presentation, practical classes

Activities	Examination methods	Credit conditions
e-learning lecture	written examination	1. The final examination will constitute of 30 multiple-choice questions with only one correct answer. The grading scale is as follows: 92-100%: 5.0 84-91%: 4.5 76-83%: 4.0 68-75%: 3.5 60-67%: 3.0 <60%: 2.0 2. The final grade awarded for the course will represent the 40% of the grade from final examination and 60% of the grade from the seminars. However, to pass the course the grade from the exam must be ≥3.0. 3. If a student does not meet the criteria allowing them to sit the exam before the 28th January 2022, they will lose the opportunity to complete the first term exam. In such a case, the student still has the opportunity to meet the criteria until the 22nd February and, if successful, they will be permitted to take the second term exam. If the student does not meet the criteria which allows them to sit the exam before the 22nd February, they will not pass the course.

Activities	Examination methods	Credit conditions
seminar	written examination, oral answer, test	1. Presence at over 50% of seminars in each module is mandatory. 2. The final grade from the seminars will be a weighted average from the following marks: main assessment - weight 5, oral answer - weight 3, activity during classes/presentation - weight 1. The grading scale is as follows: 4.76-5.0: 5.0 4.26-4.75: 4.5 3.76-4.25: 4.0 3.26-3.75: 3.5 3.0-3.25: 3.0 <3.0: 2.0 3. Entry to the final examination will require the grade from seminars 3.0 or more. 4. If a student does not meet the criteria allowing them to sit the exam before the 28th January 2023, they will lose the opportunity to complete the first term exam. In such a case, the student still has the opportunity to meet the criteria until the 22nd February and, if successful, they will be permitted to take the second term exam. If the student does not meet the criteria which allows them to sit the exam before the 22nd February, they will not pass the course. 5. The final examination will constitute of 30 multiple-choice questions with only one correct answer. The grading scale is as follows: 92-100%: 5.0 84-91%: 4.5 76-83%: 4.0 68-75%: 3.5 60-67%: 3.0 <60%: 2.0 6. The final grade awarded for the course will represent the 40% of the grade from final examination and 60% of the grade from the seminars. However, to pass the course the grade from the exam must be ≥3.0.
classes	oral answer	1. Presence at over 50% of classes in each module is mandatory. 2. Entry to the final examination will require passes from all classes (by means of oral answers). 3. If a student does not meet the criteria allowing them to sit the exam before the 28th January 2023, they will lose the opportunity to complete the first term exam. In such a case, the student still has the opportunity to meet the criteria until the 22nd February and, if successful, they will be permitted to take the second term exam. If the student does not meet the criteria which allows them to sit the exam before the 22nd February, they will not pass the course. 4. The final examination will constitute of 30 multiple-choice questions with only one correct answer. The grading scale is as follows: 92-100%: 5.0 84-91%: 4.5 76-83%: 4.0 68-75%: 3.5 60-67%: 3.0 <60%: 2.0 5. The final grade awarded for the course will represent the 40% of the grade from final examination and 60% of the grade from the seminars. However, to pass the course the grade from the exam must be ≥3.0.

Entry requirements

Knowledge, skills and competences obtained in the II semester of the I year of the DDD course. Mandatory presence at over 50% of exercises and seminars.

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Model Informed Drug Development

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2024/25
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** elective
Disciplines Pharmaceutical science	**Examination** written examination
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 3	written examination **Activities and hours** seminar: 200 classes: 200	36.0

Goals

C1	Familiarization with major routes of drugs administration. Quantified approach in dosage form adjustments for a particular route of drug administration.
C2	Acquainting with the systems for quality control and assurance for medicinal products and quantitative assessment of the impact of the production process on quality.
C3	Presentation of software and methods of analysis of clinical data in terms of bioequivalence and biosimilarity.
C4	Acquainting with dissolution methods and mathematical basis of dissolution profiles extrapolation on the results of clinical trials (IVIVC / IVIVR).
C5	Legal regulations of drug development and registration.
C6	Familiarization with computational methods utilized at the drug discovery level.
C7	Acquainting with pharmacometric methods (classical PK, PBPK, PK-PD).
C8	Familiarization with computational methods used for the drugs toxicity and safety assessment.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The results of in vitro and in vivo studies on absorption, distribution, metabolism, and elimination (ADME).	DDD_KDR_W01, DDD_KDR_W03, DDD_KDR_W04, DDD_KDR_W05, DDD_KDR_W07, DDD_KDR_W08, DDD_KDR_W09, DDD_KDR_W10, DDD_KDR_W14	project
W2	The principles of making decisions regarding drugs development based on the results of modeling.	DDD_KDR_W01, DDD_KDR_W03, DDD_KDR_W04, DDD_KDR_W05, DDD_KDR_W07, DDD_KDR_W10, DDD_KDR_W14	project
W3	The principles of search and analysis of publicly available data used to build and parameterize mathematical models; knows the available sources of information.	DDD_KDR_W01, DDD_KDR_W03, DDD_KDR_W04, DDD_KDR_W05, DDD_KDR_W07, DDD_KDR_W10, DDD_KDR_W14	project
W4	Models / approaches to mathematical modeling of drug kinetics: ○ Models of individual ADME processes ○ Classic pharmacokinetic models ○ Non-compartmental analysis ○ Physiological models (PBPK) and their applications ○ Population pharmacokinetic models Toxicokinetic modeling ○ Pharmacodynamic models (PD, PKPD, QSP).	DDD_KDR_W01, DDD_KDR_W03, DDD_KDR_W04, DDD_KDR_W12, DDD_KDR_W14	project

W5	In vitro studies in the evaluation of the safety of the use of medicines.	DDD_KDR_W01, DDD_KDR_W02, DDD_KDR_W04, DDD_KDR_W12, DDD_KDR_W14	project
W6	Methods of assessing organ toxicity of drugs.	DDD_KDR_W01, DDD_KDR_W02, DDD_KDR_W14	project
W7	Problems of scaling up manufacturing processes of a drug and technology transfer, the issues of a campaign based and continuous manufacturing processes, issues of validation of the manufacturing process.	DDD_KDR_W05, DDD_KDR_W06, DDD_KDR_W07, DDD_KDR_W10, DDD_KDR_W11, DDD_KDR_W12, DDD_KDR_W14	project
W8	Conditions for the production of medicinal products and the hygiene of the production space, the problems of GMP, GHP, and related systems HACCP, ISO9001.	DDD_KDR_W03, DDD_KDR_W05, DDD_KDR_W06, DDD_KDR_W07, DDD_KDR_W12, DDD_KDR_W14	project
W9	Modern analytical methods used to study the form of the drug and the principles of their validation, compendial and non-compendial methods of dissolution testing and their importance for demonstrating bioequivalence (BE in vitro and methods for comparing profiles).	DDD_KDR_W05, DDD_KDR_W06, DDD_KDR_W12, DDD_KDR_W14	project
W10	The relationship between modifications of the formulation and bioavailability (extended, modified, controlled release, therapeutic systems), the concept of BCS and its meaning in the registration process (biowaiver), can analyze the dependence of physicochemical properties of API and its bioavailability, also on selected examples of quantitative relationships.	DDD_KDR_W01, DDD_KDR_W04, DDD_KDR_W05, DDD_KDR_W07, DDD_KDR_W14	project
W11	The differences between generic and biosimilar products, the concept of IVIVC / IVIVR and understands its use both in the registration process (biowaiver) and in the post-marketing phase (SUPAC – scale-up and postapproval changes), the physiological and pathophysiological conditions of different routes of drugs administration and the basic principles of the formulation of selected forms of drugs to be administered via different routes.	DDD_KDR_W01, DDD_KDR_W06, DDD_KDR_W07, DDD_KDR_W08, DDD_KDR_W09, DDD_KDR_W10, DDD_KDR_W11, DDD_KDR_W12, DDD_KDR_W14	project
W12	The structure of CTD and the content of individual modules necessary to submit marketing authorization application for a generic product, legal differences in regulations for various markets (EU vs. USA), the issues related to borderline products.	DDD_KDR_W05, DDD_KDR_W06, DDD_KDR_W09, DDD_KDR_W10, DDD_KDR_W11, DDD_KDR_W13, DDD_KDR_W14	project
Skills – Student can:			
U1	Mathematically analyze the results of ADME studies and draw conclusions.	DDD_KDR_U01, DDD_KDR_U03, DDD_KDR_U04	essay

U2	To analyze and interpret simulation results carried on to solve a certain problem, connect with the existing information, and based on them decide about further studies and their directions. To find proper literature data to develop a mathematical model. Critically assess the quality of data, define uncertainties and propose solutions. Defines and use in practice models describing ADME processes including: ◦ Classical PK models, ◦ NCA, ◦ PBPK models, ◦ Toxicokinetic models, ◦ PD, PKPD, QSP models. to solve real life problems.	DDD_KDR_U02, DDD_KDR_U05, DDD_KDR_U07, DDD_KDR_U10, DDD_KDR_U11	essay
U3	Indicate the differences between the laboratory, pilot and production series, to identify potential threats related to the change of production scale and to list the benefits and threats resulting from continuous production, plan the validation of selected manufacturing process based on statistical assumptions, determine sample size, indicate sampling methods and use descriptive statistics methods to analyze and present the obtained results, characterize the classes of cleanrooms used for manufacturing, determine the assumptions of individual quality assurance systems, indicate their purpose and specify the basic documents necessary to create the system.	DDD_KDR_U02, DDD_KDR_U05, DDD_KDR_U07, DDD_KDR_U10, DDD_KDR_U11	project
U4	Design dissolution tests for different drug forms and interpret the results of these tests with particular emphasis on comparing release profiles, calculate and interpret pharmacokinetic parameters of the drug using pharmacokinetic models or a noncompartmental analysis, assign a therapeutic substance to the appropriate BCS class and assess the chances of applying for biowaiver, create a basic level A IVIVC model, find and use sources of knowledge in the regulatory field (EMA / FDA / ICH guidelines, pharmacopoeias, local regulations).	DDD_KDR_U01, DDD_KDR_U02, DDD_KDR_U03, DDD_KDR_U06, DDD_KDR_U10	project
Social competences – Student is ready to:			
K1	To participate effectively in interdisciplinary scientific meetings, representing a team responsible for mathematical modeling.	DDD_KDR_K01, DDD_KDR_K02, DDD_KDR_K03, DDD_KDR_K04	project
K2	Cooperates with other students in conducting the experiment, analyzing results and building mathematical models, presents and defends the results of his/her work.	DDD_KDR_K05, DDD_KDR_K06, DDD_KDR_K07	project

Calculation of ECTS points

Activity form	**Activity hours***
seminar	200
classes	200
preparation of a project	40

preparation for examination	20
preparation of a report	3
participation in examination	2
preparation for classes	375
conducting literature research	60

Student workload	**Hours** 900
Workload involving teacher	**Hours** 400
Practical workload	**Hours** 200

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	Advanced PK/ADME & Biopharmaceutics.	W1, W10, W11, W2, U1, U2, K1, K2	classes, seminar
2.	Pharmaceutical Manufacturing & Quality Control.	W12, W7, W8, W9, U3, U4, K1, K2	seminar
3.	Principles of ADME/Tox and IVIVE.	W2, W3, W4, W5, W6, U1, U2, K1, K2	classes, seminar
4.	Clinical Trials – Scientific Background and Regulatory Requirements.	W1, W12, U4, K1, K2	seminar

Course advanced

Teaching methods:

case study, classes / practicals, computer classes, problem solving method, seminar, lecture

Activities	Examination methods	Credit conditions
seminar	project	Project defense.
classes	essay	Practical exercises report.

Entry requirements

Principles of Pharmaceutical Technology and Knowledge Based Drug Development modules passed

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Generic Medicinal Products

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2024/25
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** elective
Disciplines Pharmaceutical science	**Examination** credit
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 3	credit **Activities and hours** seminar: 15	1.0

Goals

C1	To familiarize students with scientific and regulatory principles of introduction of generic drugs to the market.
C2	To provide knowledge about specific requirements for generic drugs regarding both pharmaceutical development and clinical trials

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			

W1	Prerequisites of scientific and legal nature to market a generic drug	DDD_KDR_W04, DDD_KDR_W05, DDD_KDR_W08, DDD_KDR_W09, DDD_KDR_W13	multiple choice test
W2	Selected excerpts of CTD Module 3 specific for generic drugs	DDD_KDR_W09	multiple choice test
W3	Principles of average bioequivalence and other bioequivalence systems	DDD_KDR_W04, DDD_KDR_W05	multiple choice test
W4	Methods for dissolution profiles comparison and their relevance to the generic product application	DDD_KDR_W04, DDD_KDR_W05, DDD_KDR_W06	multiple choice test
Skills – Student can:			
U1	Carry on simple analysis of dissolution profiles similarity and interpret results of bioequivalence clinical trial	DDD_KDR_U03	multiple choice test
U2	Judge potential for biowaiver given the detailed specification of a developed product	DDD_KDR_U01, DDD_KDR_U03	multiple choice test
Social competences – Student is ready to:			
K1	Assess ethical principles of bioequivalence studies	DDD_KDR_K06	multiple choice test

Calculation of ECTS points

Activity form	**Activity hours***
seminar	15
preparation for classes	10
preparation for test	5
Student workload	**Hours** 30
Workload involving teacher	**Hours** 15

* hour means 45 minutes

Study content

No.	**Course content**	**Subject's learning outcomes**	**Activities**
1.	Introduction to basic principles and regulations for generic drugs	W1	seminar
2.	Pharmaceeutical equivalence or pharmaceutical alternatives and bioequivalence as major points to consider for introduction of generic drug to the market	W1	seminar
3.	Bioequivalence: average, population and individual. Defintions, scope, statistical and ethical principles.	W1, W3, K1	seminar

4.	Module 3 pharmaceutical development for generic drugs. Development of quality control dissolution test method and comparison of dissolution profiles	W2, W4, U1	seminar
5.	Biowaiver in generic product application	W1, U1, U2	seminar

Course advanced

Teaching methods:

seminar

Activities	Examination methods	Credit conditions
seminar	multiple choice test	Above 50% of maximum points

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Drug Discovery – Case Studies

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2024/25
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** elective
Disciplines Pharmaceutical science	**Examination** credit
ISCED classification 0916 Pharmacy	

Period	**Examination**	**Number of ECTS points**
Semester 3	credit **Activities and hours** seminar: 15	1.0

Goals

C1	Aims to develop understanding and appreciation of the team-work role in all stages of drug discovery process, from target identification, through active compound identification to target validation at the end of preclinical phase. Students will get familiar with potential challenges of drug discovery process based on the analysis of marketed drugs case studies.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	The graduate knows and understands the process of searching, obtaining and properties of medicinal substances (biologically active)	DDD_KDR_W03	oral answer, project

W2	The graduate knows and understands the specificity of the studies on the pharmacokinetic, pharmacodynamic and toxicological properties of drugs and drug candidates in vitro and in vivo	DDD_KDR_W04	oral answer, project
Skills – Student can:			
U1	The graduate can interpret the results of specialist research and draw conclusions, formulate opinions and solve problems related to the search and development of a drug	DDD_KDR_U03	oral answer, project
U2	The graduate can effectively work in a group, assuming an advisory, expert or managerial role depending on the needs	DDD_KDR_U09	oral answer, project
Social competences – Student is ready to:			
K1	The graduate is ready to gain reliable knowledge and critically assess the received content in solving cognitive and practical problems	DDD_KDR_K01	oral answer, project
K2	The graduate is ready to assign priorities for the implementation of a chosen goal or other tasks, and if necessary, consult experts	DDD_KDR_K04	oral answer, project

Calculation of ECTS points

Activity form	**Activity hours***
seminar	15
preparation of a project	10

Student workload	**Hours** 25
Workload involving teacher	**Hours** 15

* hour means 45 minutes

Study content

No.	**Course content**	**Subject's learning outcomes**	**Activities**
1.	An overview and the discussion of the discovery and development process for drugs currently on the market or soon to be introduced. Topics will include new drugs from various therapeutic groups.	W1, W2, U1, K1	seminar
2.	Analysis of key elements for successful DDD process.	W1, U2, K1	seminar
3.	Planning of individual stages of work on the drug - costs, time, potential problems and obstacles.	W2, U2, K1, K2	seminar
4.	Problem-solving for key-challenges in drug target identification and validation process using real-life data from drug development projects	W1, U1, U2, K1, K2	seminar

Course advanced

Teaching methods:

case study, brainstorm, discussion, problem solving method, project method, case study method, presentation, group work, seminar

Activities	Examination methods	Credit conditions
seminar	oral answer, project	completion of the assigned project, presentation of team work results

Entry requirements

Knowledge, skills and competences obtained within the 1st and 2nd semester of DDD course.

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM

Master Project

Educational subject description sheet

Basic information

Department Faculty of Pharmacy	**Didactic cycle** 2023/24
Field of study Drug Discovery and Development	**Realization year** 2024/25
Study level second-cycle program	**Lecture languages** English
Study form full-time	**Block** obligatory for passing in the course of studies
Education profile general academic	**Mandatory** obligatory
Disciplines Pharmaceutical science	**Examination** credit
ISCED classification 0916 Pharmacy	
Subject related to scientific research Yes	

Period	**Examination**	**Number of ECTS points**
Semester 4	credit **Activities and hours** classes: 375	17.0

Goals

C1	The aim of the seminars and master project is to prepare the scientific content for the master's thesis and to prepare the student to write a thesis and the present the thesis at the diploma exam

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the research areas covered by master project	DDD_KDR_W10, DDD_KDR_W11, DDD_KDR_W12, DDD_KDR_W14	oral examination, project

W2	the results of recent research published in the scientific literature related to the topic of master project	DDD_KDR_W09, DDD_KDR_W10, DDD_KDR_W11, DDD_KDR_W14	oral examination, project
W3	the research areas of other participants of the course	DDD_KDR_W14	oral examination, project
Skills – Student can:			
U1	collect and compile literature data relevant to master project topic	DDD_KDR_U01, DDD_KDR_U02, DDD_KDR_U03, DDD_KDR_U04	oral examination, project
U2	collect and interpret the results of conducted research	DDD_KDR_U01, DDD_KDR_U02, DDD_KDR_U03, DDD_KDR_U04	oral examination, project
U3	plan the structure of the master's thesis and prepare its text	DDD_KDR_U07, DDD_KDR_U08, DDD_KDR_U11	oral examination, project
U4	prepare and give a multimedia presentation on the purpose, scope, methodology, and results of research project	DDD_KDR_U06, DDD_KDR_U07, DDD_KDR_U11	oral examination, project
Social competences – Student is ready to:			
K1	Objectively evaluate the research tools used in the research (own and others' participants of the course),	DDD_KDR_K03, DDD_KDR_K04	oral examination, project
K2	Critically analyzes the results of the research	DDD_KDR_K02, DDD_KDR_K04	oral examination, project
K3	Cares for the safety at the workplace	DDD_KDR_K07	oral examination, project

Calculation of ECTS points

Activity form	**Activity hours***
classes	375
preparation of multimedia presentation	15
preparation of a project	30
preparation of thesis	30
preparation for examination	30

Student workload	**Hours** 480
Workload involving teacher	**Hours** 375
Practical workload	**Hours** 375

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	Discussions with the supervisor regarding the merits of the project	W1, W2, U1, U2, U3, K1, K3	classes
2.	Discussions with the supervisor on statistical issues and related to the proper preparation of the manuscript	W1, U1, U2, K2	classes
3.	Oral presentations given by each of the course participants on various issues related to DDD covered by their individual research projects	W3, U4, K1	classes

Course advanced

Teaching methods:

brainstorm, discussion, project method, presentation, seminar, participation in research

Activities	Examination methods	Credit conditions
classes	oral examination, project	Passing the master's exam and defending the master's thesis

Entry requirements

Completed all modules from the first two semesters of studies.