

**Ss. Cyril and Methodius University in Skopje
Faculty of Pharmacy – Skopje**



**ELABORATE
FOR ACCREDITATION OF THE STUDY PROGRAM**

**Master of Pharmacy
First and Second Cycle Integrated Academic Studies
Five-Year Program**

**PROPOSING INSTITUTION:
Ss. Cyril and Methodius University in Skopje
Faculty of Pharmacy – Skopje**

Skopje, 2025

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1. GENERAL INFORMATION ABOUT THE APPLICANT

Institution name

University "Ss. Cyril and Methodius" in Skopje, Faculty of Pharmacy – Skopje

Address, Headquarters

47 Mother Teresa Street, 1000 Skopje

EMC

6462715

Phone

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Registered Entity Number

6462715

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/

web location

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1.1 FOUNDATION OF THE HIGHER EDUCATION INSTITUTION – FOR THE UNIVERSITY

Name of the Founder	Assembly of the Republic of Macedonia

Title of the Act of Establishment	Law on the University of Skopje

Number and Date of the Act of Establishment	No. 4/1949, Official Gazette of the People's Republic of Macedonia

Amendments to the Founding Rights (Name of the Second Founder and Legal Successors of the Founder)	None
Number and Date of the Decision on the Fulfillment of Conditions for Commencement of Operations, Issued by the Ministry of Education and Science of the Republic of North Macedonia	/
Number and Date of the Accreditation Decision of the Higher Education Institution, Issued by the Accreditation and Evaluation Board of Higher Education of the Republic of North Macedonia	/
Number and Date of the Decision on the Registration of the Higher Education Institution in the Central Register	/

1.2 ESTABLISHMENT OF THE HIGHER EDUCATION INSTITUTION – FOR THE UNIT APPLYING FOR ACCREDITATION

Name of the Founder	Assembly of the Republic of Macedonia

Title of the Act of Establishment	Law on the University of Skopje

Number and Date of the Act of Establishment	No. 4/1949, Official Gazette of the People's Republic of Macedonia

Amendments to the Founding Rights	None

(Name of the Second Founder and Legal Successors of the Founder)	
Number and Date of the Decision on the Fulfillment of Conditions for Commencement of Operations, Issued by the Ministry of Education and Science of the Republic of North Macedonia	05/96 from 04.04.1977
Number and Date of the Accreditation Decision of the Higher Education Institution, Issued by the Accreditation and Evaluation Board of Higher Education of the Republic of North Macedonia	Decision of the Accreditation Board No. 1409-208/3 dated 10.05.2019 and Decision of the Ministry of Education and Science No. 14-1162 dated 03.07.2019
Number and Date of the Decision on the Registration of the Higher Education Institution in the Central Register	4066499/17 from 21.11.2013

2. OWNERSHIP STRUCTURE OF THE HIGHER EDUCATION INSTITUTION

State	√	Private	Mixed

3. ACTIVITY OF THE HIGHER EDUCATION INSTITUTION ACCORDING TO THE FRASCATI CLASSIFICATION

a) Scientific Field (First-Level Research Area)	3. Medical Sciences and Health
b) Scientific subfield	3.05.02 Pharmacy
c) Scientific discipline	3.05.02.01 Pharmaceutical Chemistry 3.05.02.02 Pharmacoinformatics 3.05.02.03 Pharmacogenetics 3.05.02.04 Social Pharmacy 3.05.02.05 Immunochemistry 3.05.02.06 History of Pharmacy 3.05.02.07 Drug Analytics 3.05.02.08 Applied Chemistry and Pharmaceutical Instrumental Analyses 3.05.02.09 Pharmaceutical Botany 3.05.02.10 Pharmacognosy 3.05.02.11 Biopharmaceutics 3.05.02.12 Pharmaceutical Biotechnology 3.05.02.13 Pharmaceutical Technology with Industrial Pharmacy and Micro/Nanotechnology 3.05.02.14 Applied Biochemistry 3.05.02.15 Bromatology 3.05.02.16 Pharmaceutical Toxicology

	3.05.02.17 Other

4. GOVERNING BODY OF THE HIGHER EDUCATION INSTITUTION

Full Name and Position

Full Professor Zoran Sterjev, PhD, Dean

Date and Act of Appointment

Decision of the Teaching-Scientific Council of the Faculty of Pharmacy in Skopje on the Election of the Dean for the Mandate Period 2021–2024, No. 02-287/3 dated 12.05.2021, and Decision of the University Senate Confirming the Election of the Dean, No. 02-633/8 dated 25.05.2021

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Full Name

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Date: December 30, 2025



Овластено лице
Декан
Проф. д-р Зоран Стерјев

5. LEGAL FRAMEWORK

Laws:

1. Law on Higher Education (Official Gazette of the Republic of Macedonia No. 82/2018 and Official Gazette of the Republic of North Macedonia No. 178/2021, 58/2024, and 124/2025)
2. Law on Scientific Research Activities (Official Gazette of the Republic of Macedonia No. 46/2008, 103/2008, 24/2011, 80/2012, 24/2013, 147/2013, 41/2014, 145/2015, 154/2015, 30/2016, and 53/2016, and "Official Gazette of the Republic of North Macedonia" No. 257/2020, 163/2021, 64/2024, 235/2024, and 144/2025)
3. Law on the National Qualifications Framework (Official Gazette of the Republic of North Macedonia No. 3/2025)

Secondary Legislation:

4. Regulation on the Definition of Scientific Research Fields at the Third Level (areas), as a supplement to the two levels of the International Frascati Classification (Official Gazette of the Republic of North Macedonia No. 91/2024)
5. Rulebook on standards and norms for establishing higher education institutions and performing higher education activities (Official Gazette of the Republic of North Macedonia No. 245/2022 and No. 4/2023)

6. Rulebook on the methodology, standards, and procedure for accreditation of higher education institutions and for accreditation of study programs (Official Gazette of the Republic of North Macedonia No. 256/2022)
7. Rulebook on standards and procedures for external evaluation and self-assessment (Official Gazette of the Republic of North Macedonia No. 153/2022)
8. Rulebook on standards and norms for establishing scientific institutes and completing scientific research activities (Official Gazette of the Republic of North Macedonia No. 245/2022)
9. Rulebook establishing professional and scientific titles (Official Gazette of the Republic of North Macedonia No. 125/2023 and No. 194/2023)
10. Rulebook on the content of study programs (Official Gazette of the Republic of North Macedonia No. 244/2023)
11. Rulebook on the content and format of the diploma, guidelines for preparing the diploma supplement, and other public documents (Official Gazette of the Republic of North Macedonia No. 67/2025)
12. Rulebook on maintaining records for higher education (Official Gazette of the Republic of Macedonia No. 102/2018)
Other Necessary Documents:
13. Statute of the higher education institution
14. Decision on accreditation of the higher education institution issued by the Accreditation and Evaluation Board for Higher Education of the Republic of North Macedonia
15. Decision on accreditation of a study program issued by the Accreditation Board for Higher Education of the Republic of North Macedonia
16. Decision on the start of work issued by the Ministry of Education and Science of the Republic of North Macedonia or by AKVO (accreditations up to 2018)
17. Decision on the start of work for a third-cycle study program issued by the Government of the Republic of North Macedonia (accreditations after 2018)

6. MAP OF THE HIGHER EDUCATION INSTITUTION (UNIVERSITY, FACULTY, OR HIGHER VOCATIONAL SCHOOL)

6.1. Map of the Higher Education Institution

Name of the Higher Education Institution	In Macedonian Language	Фармацевтски факултет, Универзитет „Св.Кирил и Методиј“ во Скопје
	In English Language	Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje
	In the Language of Instruction	Faculty of Pharmacy, “Ss. Cyril and Methodius” University in Skopje
Headquarters		47 Mother Teresa Street, 1000 Skopje
Website		www.ff.ukim.edu.mk
Type of Higher Education Institution (Public, Private, Public-Private)		Public Higher Education Institution
Information on the Most Recent Accreditation		Information on the Most Recent Accreditations • 2005: Accreditation of the postgraduate study program in Health Management and Pharmacoeconomics – reaccreditation by the Accreditation Board, Decision No. 12-128,129/2 dated 16.10.2013 and Ministry of Education and Science (MES) Decision No. 13-14655/2 dated 11.12.2013. • 2009: Accreditation of the Master of Pharmacy integrated first and second cycle program – Accreditation Board Decision No. 12 of 03.09.2009 and MES Decision No. 12-3737/5 of 29.10.2010. • 2010: Accreditation of the three-year academic program for Bachelor of Laboratory Bioengineering – first cycle: Accreditation Board Decision No. 12-97/2 of 15.01.2010 and MES Decision No. 12-3737/5 of 29.10.2010. • 2011: Accreditation of doctoral studies in the field of Medical Sciences and Health, Pharmacy: Accreditation Board Decision No. 12-66/4 of 05.01.2011 and MES Decision No. 13-547/7 of 23.03.2011. • 2011: Accreditation of specialist studies in Pharmaceutical Regulation – second cycle: Accreditation Board Decision No. 12-121/2 of 29.10.2010 and MES Decision No. 13-55/1 of 05.01.2011. • 2012: Accreditation of Master’s studies in Phytotherapy – second cycle: Accreditation Board Decision No. 12-15/2 of 07.10.2011 and MES Decision No. 13-626/4 of 03.04.2012. • 2012: Accreditation of specialist studies in Phytotherapy – second cycle: Accreditation Board Decision No. 12-14/2 of 07.10.2011 and MES Decision No. 13-3022/1 of 30.03.2012.

	• 2012: Accreditation of Master's studies in Cosmetology – second cycle: Accreditation Board Decision No. 12-20/3 of 24.11.2011 and MES Decision No. 13-3020/1 of 30.03.2012. • 2012: Accreditation of specialist studies in Cosmetology – second cycle: Accreditation Board Decision No. 12-20/2 of 24.11.2011 and MES Decision No. 13-3023/1 of 30.03.2012. • 2012: Accreditation of Master's studies in Industrial Pharmacy – second cycle: Accreditation Board Decision No. 12-232/3 of 01.10.2012 and MES Decision No. 13-63/1 of 02.01.2013. • 2013: Reaccreditation of specialist studies in Pharmacoeconomics and Health Management – second cycle: Accreditation Board Decision No. 12-182/2 of 07.02.2014 and MES Decision No. 13-55/1 of 05.01.2011. • 2014: Accreditation of Master's studies in Laboratory Analysis and Pharmaceutical Engineering – second cycle: Accreditation Board Decision No. 12-182/2 of 07.02.2014 and MES Decision No. 13-1612/4 of 08.04.2014. • 2015: Reaccreditation of integrated first and second cycle studies in Pharmacy: Accreditation Board Decision No. 12-58/2 of 19.05.2015 and MES Decision No. 14-2886 of 07.12.2015. • 2015: Reaccreditation of second cycle specialist studies in Phytotherapy: Accreditation Board Decision No. 12-268/2 of 30.03.2015 and MES Decision No. 14-1771 of 24.09.2015. • 2015: Accreditation of second cycle specialist studies in Homeopathic Medicines: Accreditation Board Decision No. 12-267/2 of 30.03.2015 and MES Decision No. 14-1772 of 07.12.2015. • 2015: Reaccreditation of third cycle doctoral studies in Pharmacy: Accreditation Board Decision No. 12-79/2 of 14.07.2014 and MES Decision No. 14-552 of 04.03.2015. • 2016: Reaccreditation of second cycle specialist studies in Pharmaceutical Regulation: Accreditation Board Decision No. 12-152/2 of 12.02.2016 and MES Decision No. 14-398 of 06.05.2016. • 2018: Second reaccreditation of third cycle doctoral studies in Pharmacy: Accreditation Board Decision No. 1409-27/2/2 of 16.03.2018 and MES Decision No. 14-771 of 08.05.2018. • 2018: Accreditation of first cycle three-year studies in Dietetics and Diet Therapy: Accreditation Board Decision No. 17-152/2 of 02.03.2018 and MES Decision No. 14-710 of 29.03.2018. • 2018: Accreditation of second cycle Master's studies in Dietetics and Diet Therapy: Accreditation Board Decision No. 17-153/2 of 02.03.2018 and MES Decision No. 14-682 of 22.03.2018.

	• 2018: Second reaccreditation of second cycle specialist studies in Phytotherapy – Herbal Medicines and Dietary Supplements: Accreditation Board Decision No. 1409-184/2 of 27.09.2018 and MES Decision No. 14-2853 of 08.02.2019. • 2019: Reaccreditation of three-year academic program for Bachelor of Laboratory Bioengineering – first cycle: Accreditation Board Decision No. 1409-208/3 of 10.05.2019 and MES Decision No. 14-1167 of 03.07.2019. • 2019: Reaccreditation of two-year Master’s studies in Laboratory Analysis and Pharmaceutical Engineering – second cycle: Accreditation Board Decision No. 1409-289/3 of 26.09.2019 and MES Decision No. 14-2749 of 07.11.2019. • 2021: Reaccreditation of integrated first and second cycle studies in Pharmacy: Accreditation Board Decision No. 08-72/4 of 11.02.2021 and Quality Agency Decision No. 08-69/4 of 10.03.2021. • 2021: Reaccreditation of second cycle specialist studies in Pharmaceutical Regulation: Accreditation Board and Quality Agency Decision No. 08-1013/4 of 09.11.2021. • 2021: Reaccreditation of second cycle specialist studies in Homeopathic Medicines: Accreditation Board Decision No. 08-415/5 of 15.04.2021 and Quality Agency Decision No. 08-597/4 of 26.07.2021. • 2021: Reaccreditation of second cycle specialist studies in Pharmacovigilance: Accreditation Board Decision No. 08-107/4 of 11.02.2021 and Quality Agency Decision No. 08-68/4 of 10.03.2021. • 2022: Reaccreditation of second cycle specialist studies in Industrial Pharmacy: Accreditation Board Decision No. 08-596/6 of 17.03.2022 and Quality Agency Decision No. 08-354/4 of 05.04.2022. • 2023: Reaccreditation of first cycle studies in Dietetics and Diet Therapy: Accreditation Board Decision No. 08-21/6 of 30.06.2023 and Quality Agency Decision No. 08-999/4 of 12.07.2023. • 2023: Reaccreditation of second cycle studies in Dietetics and Diet Therapy: Accreditation Board Decision No. 08-22/6 of 30.06.2023 and Quality Agency Decision No. 08-998/4 of 12.07.2023. • 2024: Reaccreditation of three-year academic program for Bachelor of Laboratory Bioengineering – first cycle: Accreditation Board Decision No. 08-112/7 of 30.08.2024 and Quality Agency Decision No. 08-675/4 of 26.09.2024. • 2024: Reaccreditation of second cycle studies in Laboratory Analysis and Pharmaceutical Engineering: Accreditation Board Decision No. 08-369/7 of 19.11.2024 and Quality Agency Decision No. 08-916/4 of 18.12.2024.

Field of Study or Artistic Discipline according to the International Standard Classification of Education (ISCED, UNESCO) and Research Fields (according to the International Frascati Classification, 2015) for which Accreditation has been Granted	Field of Study according to the International Standard Classification of Education (ISCED): 09 Health and Welfare 91 Health 0916 Pharmacy According to the current International Frascati Classification: Domain: Medical Sciences and Health Field: Pharmacy
Information on International Cooperation in Teaching, Research, and Student Mobility	International Cooperation, Research Projects, and Student Mobility – Faculty of Pharmacy, University “St. Cyril and Methodius”, Skopje Partner Universities, Faculties, Institutes, and Departments: • Institute for Medicinal Plant Research "Dr. Josif Pančić", Belgrade, Serbia • University of Belgrade, Faculty of Chemistry, Serbia • University of Belgrade, Faculty of Pharmacy, Serbia • Medical University of Sofia, Faculty of Pharmacy, Bulgaria • Centre for Research and Technology – Hellas (CE.R.T.H.), Institute of Applied Bioscience (IN.A.B.), Thessaloniki, Greece • National Agricultural Research Foundation (NAGREF), A.R.C.N.G, Department of Aromatic and Medicinal Plants, Thermi, Thessaloniki, Greece • University of Ljubljana, Biotechnical Faculty, Slovenia • University of Zagreb, Faculty of Agriculture, Croatia • Agricultural University of Tirana, Albania • University of Prishtina “Hasan Prishtina”, Department of Biology, Kosovo • Medical Faculty – Department of Pharmacy, University of Novi Sad, Serbia • Bulgarian Academy of Sciences, Sofia, Bulgaria • Hacettepe University, Faculty of Pharmacy, Ankara, Turkey • Faculty of Science, University of Stockholm, Sweden • Department of Pharmacy, University of Copenhagen, Denmark • International Centre for Genetic Engineering and Biotechnology, Trieste, Italy • Karolinska Institutet – Medical University, Stockholm, Sweden • Mediterranean Agronomic Institute of Chania (MAICh), CIHEAM, Chania, Greece • University of Veterinary Medicine, Vienna, Austria • Queen’s University, Kingston, Ontario, Canada • Ghent University, Ghent, Belgium

	• Shanghai Institute of Materia Medica, Chinese Academy of Sciences, PR China • Chinese National Compound Library, Shanghai, PR China • Austrian Drug Screening Institute (ADSI), Innsbruck, Austria • Faculty of Chemistry and Pharmacy, University of Innsbruck, Austria • Faculty of Pharmacy, University of Valencia, Spain International Research Projects (Last 5 Years): • Knowledge, attitudes, and practices of healthcare workers regarding seasonal influenza vaccination – collaboration with the Institute of Public Health, Skopje, Macedonia, CDC Atlanta, USA, 2019 • Wearable Smart Patches for Multimodal Wound Healing, funded by NATO SPSS, 2023–2026 • Proteomic profiling of protein corona on nanoparticles in hCMEC/D3 cell media, Joint Research Centre, European Commission, 2022–2023 • CEEPUS – Central European Exchange Program for University Studies, 2017–2023 • Introduction of new wet granulation methods for modern dosage form development, Ministry of Education and Science of RM, 2021–2023 • Enhancement of technical competence in the Center for Pharmaceutical Nanotechnology, Ministry of Education and Science, RM, 2021–2023 • In vitro testing of micro-particulate carriers of bioactive natural compounds for chronic wound treatment, UKIM, 2022 • Development of vibrational spectroscopy methods for rapid monitoring of phytocannabinoids in hemp – bilateral project with Austria, 2022–2023 • Implementation of innovative models for wound treatment product development – bilateral project with Austria, 2022–2023 • Development of vibrational spectroscopy methods coupled with multivariate analysis in pharmaceutical research, UKIM, 2021–2023 • VetaLipoFer – nutritional supplement for preventive treatment of anemia in animals, Innovation and Technology Development Fund, RM, 2022–2024 • Innovative biomimetic carrier systems for chronic wound treatment, Faculty of Pharmacy, UKIM, 2022–2025 • PharmDataBorg – platform for integration and storage of pharmaceutical knowledge, Faculty of Pharmacy, UKIM, 2022–2025

	• Stability analysis of cannabis and its preparations, Ministry of Education and Science, 2022–2023 • Pharmacognostic, phytochemical, and bio-pharmacological studies on various Cannabis spp. and preparations, phase II, UKIM • Studies on natural heritage of Kožuf Mountain, UKIM, 2022–2023 • Population assessment of wild blueberries (Vaccinium spp.) in Kožuf Mountain, Ministry of Environment and Spatial Planning, 2022 • Detection of wild-growing cannabis in Macedonia, Ministry of Environment and Spatial Planning, 2022 • Silybum marianum (milk thistle) – source of bioactive silymarin, USS Project, 2022–2023 • Development of environmentally friendly chromatographic methods in pharmaceutical analysis, UKIM, 2022–2023 • Strengthening laboratory capacity for detection of counterfeit medicines, Ministry of Education and Science, 2021–2023 • Austrian-Macedonian bilateral project (Technical University of Graz): “Spectroscopy and dynamics of water at interfaces”, 2022–2023 • TAVS-TAG project – NI4OS-Europe, 2019–2022 • Upgrading research infrastructure for nanomaterials and characterization methods, Faculty of Natural Sciences, 2019–2022 • Computational capacity expansion for theoretical chemistry and pharmaceutical crystal studies, Faculty of Natural Sciences, 2019–2022 • Low concentration somatic mutation detection using liquid biopsy and dPCR, Ministry of Education and Science, 2022–2024 • Electronic drug information database – INFOLLEK, Faculty of Pharmacy, UKIM, 2022–2023 • Post-marketing surveillance of cannabis-based products, Faculty of Pharmacy, UKIM and Replek, 2020–2022 • Strengthening genomics and proteomics capacities at ICGEB-MASA for personalized medicine, Ministry of Education and Science, 2021–2022 • CBD effect studies on carbohydrate metabolism, collaborative project with REPLEK PHARM, UKIM, 2020–2022 • WHO training modules for pharmacists on vaccination, 2022 • Inherited susceptibility to colorectal cancer studies, COST Action CA-17118, 2018–2022 • Bladder cancer biomarker research, ICGEB, Trieste, Italy, 2020–2022

	• COVID-19 immune response studies, ICGEB, Trieste, Italy, 2020–2022 • Upgrading genomics and proteomics capacities at RCGEB MASA for personalized oncology therapy, Ministry of Education and Science, 2021–2022 • PROMOTING GERIATRIC MEDICINE IN EMERGING COUNTRIES (PROGRAMMING), 2022 • Erasmus+ and European Solidarity Corps projects: “Harmonized and sustainable pharmacy education for open Europe”, 2024 Student Exchange Programs: • EPSA Individual Mobility Project (IMP) • JoinEU-SEE – Coordinator: Ghent University, Belgium • EUROWEB – Coordinator: Mälardalen University, Sweden • ERAWEB – Coordinator: Erasmus University, Netherlands • Erasmus+ Student Mobility Program • BASILEUS – Academic Exchange between EU and Western Balkans • CEEPUS – Central European Exchange Program for University Studies
Information on Facilities Designated for Teaching and Research Activities	Facilities Details for Teaching and Research Activities Total area: 3,000 m² Number of lecture halls: 3 (total capacity: 300 seats) Number of classrooms: 1 (capacity: 50 seats) Number of laboratories: 14 (capacity: 30 students per laboratory) Computer center: 20 student workstations Number of offices for teaching and research staff: 20 Number of rooms for visiting/collaborating staff: 1 (open “ocean” workspace concept)
Equipment Details for Teaching and Research Activities	Equipment for Teaching and Research Activities GC-FID-MS HPLC analytical systems (6 instruments) UV/VIS spectrophotometers (3) AAS instrument UV/VIS chamber for TLC analysis Digital balances up to four decimal places (5) Water baths (6) Ultrasonic baths (3) ERWEKA apparatus for monitoring drug release rates from pharmaceutical products Disintegration testing unit (Desintegration testing unit ERWEKA ZT 72) Centrifuges, microcentrifuge Evaporator, distillers Mills (2)

	Refractometer IR spectrometer Benchtop pH meters (10) Polarimeter Light microscopes (20) Binocular microscopes (2) Stereomicroscope Spray dryer Laser particle size analyzer Tablet press, capsule filling machine Water thermostatic baths with stirring (2) Magnetic stirrers (4) Lyophilizers (2) Standard sieves Homogenizer Autoclave Aseptic chamber with UV lamp Stability test chambers (2) Dry sterilizer, oven, vacuum oven Peristaltic pumps (2) Conductivity meter Vortex mixers (2) Potentiometric titrator Incubators Micropipettes Refrigerators at 4 °C and -20 °C Laminar flow cabinet PCR machine Equipment for polyacrylamide and agar gel electrophoresis ELISA reader, ELISA microplate washer, shaker, and incubator Laboratory furniture with fume hoods and necessary installations for operating analytical instruments Standard laboratory glassware (graduated cylinders, beakers, volumetric flasks, measuring cylinders, flasks, glass and plastic test tubes, watch glasses, Graham reflux condenser, reagent storage bottles with ground glass stoppers, ceramic wire triangles, vacuum pumps, pipettes and accessories, drying racks for glassware, sprayers, inks, digital burettes, Eppendorf tube holders, mortars and pestles, Bunsen burners, porcelain balls, separatory funnels) 20 computer workstations with appropriate software for teaching purposes Godox mini photo studio LST60 Remote monitoring system via ETHERNET-RJ45 (Gateway) Centrifuge Z 207A with angle rotor 221.86 V01 for 4×50 ml RB/Falcon or 4×15 ml tubes Diesel generator LCD projector Optoma X371 Compact UPS system Solid-phase extraction system with vacuum control valve FTIR spectrometer (Cary 630 FTIR-ATR) HPLC/UV system (HPLC 1260 Infinity II Quat System with DAD)

	Sartorius analytical balance (4 decimal places) 2 Constant climate chambers with Peltier technology KBF-S ECO 240 ATR 3000 DH portable Raman spectrometer (Optosky, China), 1064 nm laser
Total number of students for whom previous accreditations have been obtained	/
Number of Students (First-Time Enrollees)	Number of Students (First-Time Enrollees) First Cycle: 158 students Second Cycle: 32 students Third Cycle: 2 students Total number of students enrolled at the Faculty of Pharmacy in the 2025/2026 academic year: 192 students
Number of individuals holding teaching-scientific, scientific, and teaching titles	28 full professors / associate professors 13 assistant professors 1 titled associate professor Total: 41
Number of individuals holding associate titles	6 assistants
Teacher-to-student ratio (number of students per teacher)	10 students per instructor per year
Space-to-student ratio (m ² per student)	15 m ² / student
Internal mechanisms for ensuring and controlling the quality of studies	The self-evaluation is conducted by the Self-Evaluation Committee, composed of: Prof. Marija Hiljadnikova Bajro Prof. Zorica Naumovska Prof. Natalija Nakov Prof. Liljana Anastasova Assoc. Prof. Dr. Ivana Cvetkovikj Karanfilova Representative from the student body Representative from the student body Student evaluation of teaching quality and academic staff is carried out through anonymous surveys each semester. The report of the self-evaluation conducted at the Faculty of Pharmacy for the period 2019–2022 is available on the faculty's website.: http://www.ff.ukim.edu.mk/wp-content/uploads/2023/06/%D0%98%D0%B7%D0%B2%D0%B5%D1%88%D1%82%D0%B0%D1%98-%D0%BE%D0%B4-%D1%81%D0%B0%D0%BC%D0%BE%D0%B5%D0%B2%D0%B0%D0%BB%D1%83%D0%B0%D1%86%D0%B8%D1%98%D0%B0-%D0%BD%D0%B0-%D0%A4%D0%A4-2019-2022.pdf

Frequency of the self-evaluation process (annually, every two years, every three years) and the date of the most recent self-evaluation	Self-evaluation is conducted every three years. April 2023 for the period October 2019 – September 2022. Self-evaluation 2023/2024.
Data on the most recent external evaluation of the institution	The report on the external evaluation of Ss. Cyril and Methodius University (UKIM), conducted by the expert team appointed by the European University Association (EUA), composed of Johanna Maria Liljeroos, Tampere, Finland; Borje Lennart Olausson, Åsa, Sweden; Georg Schulz, Salzburg, Austria; Andrée Sursock, N/A; and Janis Vetra, Latvia, was submitted in November 2017. https://www.ukim.edu.mk/dokumenti_m/samo_ev/NE-2018-UKIM-EN.pdf
Other information the institution wishes to present as evidence of its success	- Accredited Laboratory for Drug Testing and Control – the Center for Drug Testing and Control holds a certificate according to MKC EN ISO/IEC 17025:18. - Center for Natural Products – holds a certificate as an accredited laboratory in accordance with MKC EN ISO/IEC 17025:19. - Center for Biomolecular Pharmaceutical Analyses (CBFA) – authorization to perform healthcare activities: granted by the Ministry of Health of the Republic of North Macedonia to conduct diagnostic-laboratory activities based on Article 96, paragraph 1 of the Law on Health Care (Official Gazette of the Republic of North Macedonia, No. 43/12): decision No. 10-6087/2 dated 13.10.2011, Ministry of Health. In 2016, the first agreement was signed between CBFA and the Health Insurance Fund of North Macedonia (HIF) for the provision of healthcare services to insured persons in specialist-consultative care, specifically diagnostic laboratory services in the field of molecular diagnostics: initial agreement No. 10-1695/2 dated 24.02.2016, followed by an extension: No. 10-19938/2 dated 01.01.2019.

7. INFORMATION ABOUT THE UNIT ORGANIZING THE STUDY PROGRAM

1	Unit of the Higher Education Institution (University Unit)	In Macedonian language	Фармацевтски факултет
		In English language	Faculty of Pharmacy

		In the Language of Instruction	Faculty of Pharmacy
2	Headquarters		Mother Teresa 47
3	Study and Research Field in Which the Unit Is Accredited According to the UNESCO International Standard Classification of Education (ISCED).		Type of Studies (Academic or Professional) Offered by the Unit 09 Health and Social Care 091 Health
4	Research Field for Which the Unit Is Accredited According to the Frascati Classification		3. Medical Sciences and Health
5	Type of Studies (Academic or Professional) Offered by the Unit		Academic
6	Study Programs within the Unit		First Cycle Studies – Undergraduate Programs: • Master of Pharmacy, integrated first and second cycle, 300 ECTS • Laboratory Bioengineering, 180 ECTS • Dietetics and Diet Therapy, 180 ECTS Second Cycle Studies – Graduate Programs: • Academic Specialist Studies (60 ECTS) for programs in: 1. Pharmaceutical Regulation 2. Industrial Pharmacy 3. Cosmetology 4. Phytotherapy – Herbal Medicines and Dietary Supplements 5. Homeopathic Medicines 6. Pharmacovigilance • Academic Master's Studies (120 ECTS) for programs in: 1. Laboratory Analysis and Engineering in Pharmacy 2. Dietetics and Diet Therapy Third Cycle (Doctoral) Studies: • Doctoral programs in the field of Pharmacy
7	Cycle of Education (First or Second Cycle Studies, or Integrated First and Second Cycle Studies, and Third Cycle)		• First Cycle Studies • Integrated First and Second Cycle Studies • Second Cycle Studies • Third Cycle Studies

8	Total Number of Students for Whom Previous Accreditations Have Been Granted	320 (for all study programs)
9	Number of Students (First-Time Enrollees)	Number of Students (First-Time Enrollees) First Cycle: 158 students Second Cycle: 32 students Third Cycle: 2 students Total number of students enrolled at the Faculty of Pharmacy in the 2025/2026 academic year: 192 students
10	Number of Personnel in Teaching-Scientific, Scientific, and Teaching Positions	41
11	Number of Staff in Academic-Scientific, Scientific, and Teaching Positions Number of Staff in Associate Positions	6
12	Teacher-Student Ratio (Number of Students per One Teacher)	10 students per professor per year (based on the planned enrollment for all study programs)

Table 7.1. List of Staff Appointed to Academic-Scientific Positions in Full-Time Employment at the Unit (Faculty) Applying for (Re)Accreditation of the Study Program (Article 61 of the Law on Higher Education, “Official Gazette of the Republic of North Macedonia,” No. 82/2018)

	Full name of the teacher	Academic teaching-scientific title
1	Prof. Ljubica Shuturkova	Full professor
2	Prof. Aneta Dimitrovska	Full professor
3	Prof. Aleksandar Dimovski	Full professor
4	Prof. Katerina Gorachinova	Full professor
5	Prof. Renata Slaveska Raicki	Full professor
6	Prof. Biljana Bauer	Full professor
7	Prof. Tatjana Kadifkova Panovska	Full professor
8	Prof. Kristina Mladenovska	Full professor
9	Prof. Rumenka Petkovska	Full professor
10	Prof. Marija Glavash Dodov	Full professor
11	Prof. Gjoshe Stefkov	Full professor
12	Prof. Aleksandra Grozdanova	Full professor
13	Prof. Zoran Sterjev	Full professor
14	Prof. Jasmina Tonikj Ribarska	Full professor
15	Prof. Ana Poceva Panovska	Full professor
16	Prof. Katerina Brezovska	Full professor

17	Prof. Katerina Anchevska Netkovska	Full professor
18	Prof. Marija Hiljadnikova Bajro	Full professor
19	Prof. Maja Simonoska Crcarevska	Full professor
20	Prof. Marija Karapandzova	Full professor
21	Prof. Zorica Naumovska	Full professor
22	Prof. Aleksandra Kapedanovska Nestorovska	Full professor
23	Prof. Jelena Acevska	Full professor
24	Prof. Tanja Petreska Ivanovska	Full professor
25	Prof. Nikola Geshkovski	Full professor
26	Prof Nadica Matevska Geshkovska	Full professor
27	Prof. Natalija Nakov	Full professor
28	Prof. Liljana Anastasova	Full professor
29	Asst. Prof. Ivana Cvetkovikj Karanfilova	Assistant professor
30	Asst. Prof. Ljubica Mihailova	Assistant professor
31	Asst. Prof. Zoran Zivikj	Assistant professor
32	Asst. Prof. Marija Staninova Stojovska	Assistant professor
33	Asst. Prof. Dushko Shalabaliya	Assistant professor
34	Asst. Prof. Elizabeta Krstevska Bozinovikj	Assistant professor
35	Asst. Prof. Veronika Stoilkovska Gjorgievaska	Assistant professor
36	Asst. Prof. Ana Trajkovska	Assistant professor
37	Asst. Prof. Evgenija Mihajloska	Assistant professor
38	Asst. Prof. Olga Gigopolu	Assistant professor
39	Asst. Prof. Kristina Shutevska Achevska	Assistant professor
40	Asst. Prof. Blagoj Achevski	Assistant professor
41	Asst. Prof. Aleksandar Dimkovski	Assistant professor

8. GENERAL INFORMATION ABOUT THE STUDY PROGRAM

1	Title of the Study Program	In Macedonian language	Магистер по фармација
		In English language	Master of Pharmacy
		In the Language of Instruction	Master of Pharmacy
2	Study Fields or Artistic Disciplines at the First, Second, and Third Levels According to the UNESCO International Standard Classification of Education (ISCED). For Interdisciplinary Study Programs, the Relevant Study Fields or Artistic Disciplines at the First, Second, and Third Levels Should Be Specified.	Broad Field	Health and Social Care
		Narrow Field	Health
		Detailed Field	Pharmacy
3	Frascati Classification (for Designation Purposes)	Scientific Field	Medical Sciences and Health
		Scientific Discipline	Subfield: Pharmacy
		Scientific, Professional, or Artistic Area	3.05.02.01 Pharmaceutical Chemistry 3.05.02.02 Pharmacoinformatics 3.05.02.03 Pharmacogenetics 3.05.02.04 Social Pharmacy 3.05.02.05 Immunochemistry 3.05.02.06 History of Pharmacy 3.05.02.07 Drug Analytics 3.05.02.08 Applied Chemistry and Pharmaceutical Instrumental Analysis 3.05.02.09 Pharmaceutical Botany 3.05.02.10 Pharmacognosy 3.05.02.11 Biopharmaceutics 3.05.02.12 Pharmaceutical Biotechnology 3.05.02.13 Pharmaceutical Technology with Industrial Pharmacy and Micro/Nanotechnology 3.05.02.14 Applied Biochemistry 3.05.02.15 Bromatology 3.05.02.16 Pharmaceutical Toxicology

			3.05.02.17 Other
4	National Classification of Occupations	Major Groups	2. Professionals and Scientists
		Subgroups	22. Health Professionals
		Subsidiary groups	226. Other Health Professionals
		Unit Groups	2262. Pharmacists
5	Type of Studies (Academic or Professional)		Academic Studies
6	Cycle of Education (First or Second Cycle Studies, or Integrated First and Second Cycle Studies)		Integrated First and Second Cycle Studies
7	Study Program Workload Expressed in ECTS Credits, Including Any Preparatory Courses if Applicable		300 ECTS
8	ECTS Credit Value of the Final Thesis for Postgraduate Studies		10 ECTS
9	Duration of Studies (in Years and Semesters of the Study Program)		5 years (10 semesters)
10	Information on Whether the Study Program Is Submitted for Accreditation or for Renewal of Previous Accreditation		First accreditation
11	Method of Financing of the Proposed Study Program, and for Private or Private-Public Non-Profit Higher Education and Research Institutions, Proof of Secured Adequate Financial Guarantee for the Study Program		Tuition fee of €5000 per year.
12	Qualification Level or Degree Required for Enrollment According to the National Qualifications Framework		The minimum requirement for entry into this level is the completion of the relevant prior education and passing the Matura (secondary school leaving exam).
13	Enrollment Requirements for the Study Program, Specifically for Full-Time, Part-Time, and International Students, Including Relevant Subjects from the State Matura or Entrance Exam with Clear, Unambiguous, and Precise Content of the Exam, Its Duration, Administration, and Assessment		The conditions and criteria for student enrollment at Ss. Cyril and Methodius University are established by the Rectorate of the University in accordance with legal regulations and the recommendations of the Ministry of Education and Science. Eligibility for enrollment is granted to individuals who have completed the relevant prior education and passed the Matura exam. The specific enrollment requirements are determined through the admission call for first-cycle undergraduate studies at Ss. Cyril and Methodius University – Skopje.
14	Qualification Level or Degree Awarded upon Completion of the Studies According to the National Qualifications Framework		Level VIIA
15	Academic or Professional Title Awarded upon	In Macedonian language	Магистер по фармација

	Completion of the Study Program	In English language	Master of pharmacy
		In the Language of Instruction	Master of Pharmacy
16	Place of Instruction		Faculty of Pharmacy, Skopje
17	Number of Students Planned to Be Enrolled in the Study Program		60
18	Language of Instruction		English language
19	Possibility of Conducting Courses in a Foreign Language (Mobility Windows – Courses That Can Be Taught in English)		All courses in the curricula
20.1	Mode of Study (Full-Time, Part-Time)		Full-Time Study
20.2	Rules, Possibilities, and Conditions for Part-Time Study of the Program		/
21	Information on Continuing Education, Including Study and Research Fields for Second and Third Cycle Study Programs (Academic or Professional), Ensuring Progression for Graduates of the First Cycle Program		Continuation of education in a third-cycle study program in the field of Medical Sciences and Health, subfield Pharmacy
22	Program Academic Year in Which the Implementation of the Study Program Will Begin		2026/2027 year
23	Deadlines for Completion of the Activities Provided in the Study Program		5 years, or at most twice the prescribed duration of study
24	Number and Date of the Decision (if submitted for reaccreditation)	of the most recent accreditation issued by the Board for Accreditation	Re-accreditation of the integrated first and second study cycles (Accreditation Board Decision No. ____ / ____ year)
		for the initiation of the study program issued by the Ministry of Education and Science / Board for Accreditation and Evaluation of Higher Education (MON/AKVO)	Re-accreditation of the integrated first and second study cycles (Ministry of Education and Science Accreditation Decision No. ____ / ____ year)

9. OBJECTIVE AND JUSTIFICATION FOR INTRODUCING THE STUDY PROGRAM

Objective and Justification of the Study Program:

The primary objective of the study program is to educate highly qualified pharmaceutical professionals to meet the needs of society. In accordance with European Directive 2005/36/EC on the recognition of professional qualifications for regulated professions and the declarations of the European Association of Faculties of Pharmacy (EAFP), university studies leading to the academic title of Master of Pharmacy are designed to provide defined knowledge and skills that enable pharmacists to perform appropriate professional activities.

Knowledge and Skills of Pharmacists:

- Knowledge of drugs and the substances commonly used in their production.
- Adequate knowledge of pharmaceutical technology and the physical, chemical, biological, and microbiological testing of drugs.
- Knowledge of drug metabolism, drug effects, toxicity of substances, and appropriate drug use.
- Knowledge to evaluate scientific data related to drugs, allowing the pharmacist to provide accurate information based on this knowledge.
- Adequate knowledge of legal and other requirements associated with pharmaceutical practice.

Professional Activities of Pharmacists and Societal Justification of the Study Program:

Pharmacists' professional activities, which form the societal justification for the study program, are specific to the pharmacy profession and, in accordance with EU Directive 2005/36/EC, include seven main areas of professional practice:

- Preparation of pharmaceutical dosage forms.
- Production and testing of drugs.
- Laboratory testing of drugs.
- Storage, preservation, and wholesale distribution of drugs.
- Preparation, testing, storage, and dispensing of drugs in public pharmacies.
- Preparation, testing, storage, and dispensing of drugs in hospitals.
- Providing information and advice on drugs.

10. ALIGNMENT OF THE STUDY PROGRAM WITH SOCIETAL NEEDS FOR THE GIVEN PROFESSIONAL PROFILE

The academic program for integrated first- and second-cycle studies leading to the academic title of Master of Pharmacy is designed to educate highly qualified pharmaceutical professionals to meet the needs of society. The standard Master of Pharmacy program has a duration of five years and is based on the credit system established under the Bologna Process.

The Faculty of Pharmacy at Ss. Cyril and Methodius University (UKIM), Skopje, is a member of the European Association of Faculties of Pharmacy (EAFP), and pharmacists graduating from the program fully meet all professional requirements defined by EU Directive 2005/36/EC.

During the first two years of study, students build upon knowledge acquired during secondary education and acquire additional fundamental knowledge in natural sciences and medical disciplines, which is essential for mastering the specialized pharmaceutical subjects in the higher years of study. Students are required to attend both theoretical and practical classes, actively participate in the teaching process, attend seminars and workshops, and engage in other forms of learning.

In the final year, students complete a graduation thesis (diploma project), and the program concludes with the defense of the thesis following professional practice in the 10th semester. After graduation, Master of Pharmacy graduates are required to complete a six-month internship according to the program of the Pharmaceutical Chamber of North Macedonia and subsequently pass the final professional (state) exam to obtain a license to practice in the country.

The UKIM Faculty of Pharmacy study program was additionally developed within the TEMPUS project JEP-18016-2003 titled *“Reconstruction of Pharmaceutical Education in the Republic of Macedonia”*, in collaboration with faculty members from the Faculty of Pharmaceutical Sciences at the

University of Copenhagen, Denmark (ranked 26th on the 2019 Shanghai University Ranking) and the University of Stockholm, Sweden (ranked 73rd on the 2019 Shanghai University Ranking).

The program was first accredited in 2009 (accreditation for the integrated first- and second-cycle Master of Pharmacy program: Decision of the Accreditation Board No. 12 of 03.09.2009 and Ministry of Education Decision No. 12-3737/5 of 29.10.2010), and its first re-accreditation was conducted in 2015 (re-accreditation of integrated first- and second-cycle studies in pharmacy: Decision of the Accreditation Board No. 12-58/2 of 19.05.2015 and Ministry of Education Decision No. 14-2886 of 07.12.2015).

To ensure compliance with Article 147 concerning study programs for regulated professions under the Law on Higher Education of the Republic of North Macedonia (Official Gazette of the RSM, No. 82/18), this document does not pertain to a new study program but constitutes a re-accreditation of the undergraduate study program, which must be reaccruited every five years according to Article 48 of the Law on Higher Education. This document is titled *Amendments and Supplements to the Integrated First- and Second-Cycle Study Program in Pharmacy* and contains the components prescribed under Article 140 of the Law on Higher Education.

11. Level within the National Framework of Higher Education Qualifications, Master of Pharmacy study program, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy – Skopje, in accordance with the Regulation on the National Framework of Higher Education Qualifications.

Level within the National Framework of Higher Education Qualifications		Higher education	Level within the European Framework of Higher Education Qualifications
VII	A	Integrated first- and second-cycle academic studies	7

12. Objectives of the study program and learning outcomes indicating successful completion of the integrated first- and second-cycle studies (300 ECTS), awarded to individuals who meet the following qualification descriptors:

12.a. General qualification descriptors for the integrated first- and second-cycle studies (300 ECTS) for the study program submitted for re-accreditation, in accordance with the Regulation on the National Framework of Higher Education Qualifications.

Type of descriptor	Description
Knowledge and understanding	Demonstrates knowledge and understanding in the field of pharmacy, building upon general secondary education and the qualifications for entry into higher education, across the main areas of pharmaceutical practice and science. Applies appropriate methodologies to problem-solving in both systematic and creative ways, providing a foundation or opportunity for originality in the development and/or application of independent ideas in the context of practice and research. Shows knowledge in theoretical, practical, conceptual, comparative, and critical perspectives in the field of pharmacy according to relevant methodologies. Demonstrates understanding in pharmaceutical chemistry, pharmaceutical technology, drug production and testing, laboratory testing of drugs, pharmacognosy, pharmacotherapy, storage, preservation, and wholesale distribution of drugs, preparation, testing, storage, and dispensing of drugs in public pharmacies, preparation, testing, storage, and distribution of drugs in hospitals, and provision of drug information and advice. Demonstrates awareness of current issues related to scientific research and new sources of knowledge in the field of pharmacy. Shows knowledge necessary to practice pharmacy within the legal framework and in accordance with professional standards and ethical principles, to design, formulate, produce, and test medicines, medicinal products, and medical devices, and to ensure appropriate pharmacotherapeutic outcomes at all levels of healthcare. Demonstrates critical understanding of key theories, principles, and methods in pharmaceutical science and practice, with the ability to consolidate knowledge vertically, horizontally, and laterally.
Application of knowledge and understanding	Applies knowledge and understanding based on evidence in the field of pharmaceutical science and in the management of pharmaceutical practice, including the formulation, production, and quality assurance of medicines, medicinal products, and medical devices, as well as in planning, managing, advising, and reviewing general patient pharmaceutical care programs. Demonstrates competencies in identifying, analyzing, and solving problems in relevant areas of pharmaceutical science and practice, using modern technology. Possesses the ability to locate and support arguments, and to adopt an individual and multidisciplinary creative and original approach in new or unfamiliar environments related to the field of study.

Ability to apply	Demonstrates the ability to gather, analyze, evaluate, and present information, ideas, and concepts from complete, incomplete, or limited relevant data in the key areas of pharmaceutical practice. Shows competence in evaluating and selecting scientific theories, methodologies, tools, and general skills in the core areas of pharmaceutical science. Exhibits the ability to apply skills in a range of routine and complex situations requiring analysis or comparison of multiple options. Recognizes priorities when solving problems and identifies deviations from standard procedures. Demonstrates the ability to provide objective, evidence-based assessment of theoretical and practical issues in the relevant areas of pharmaceutical science and practice, identifying the underlying causes and selecting appropriate solutions. Shows the ability to follow legal, ethical, professional, and organizational policies/procedures and codes, and, when necessary, to take action based on independent interpretation of the broader scope of professional policies/procedures.
Communication skills	Uses appropriate professional communication to establish collaboration with individual patients, specific patient groups, colleagues, healthcare professionals, and organizational management. Demonstrates the ability to communicate in contexts where the discussion framework, decision criteria, and scope of tasks are either clearly defined or based on judgment. Shows the ability to participate independently in specific, scientific, and interdisciplinary discussions with a professional approach. Accepts consultations for specialist advice and responsibilities within a team. Leads and promotes activities effectively.
Learning skills	Demonstrates the ability to independently identify personal needs and interests for continuous education and professional development, designing strategies and plans to promote personal intellectual growth. Organizes advanced learning activities and critically evaluates the appropriateness of learning methods and their impact on knowledge, skills, competence, and practice. Demonstrates the ability to document learning activities through the creation of an individual portfolio.

12.b. Specific qualification descriptors for the integrated first- and second-cycle studies (300 ECTS) for the study program submitted for re-accreditation, in accordance with the Regulation on the National Framework of Higher Education Qualifications.

Type of descriptor	Description
Knowledge and understanding	Demonstrates a high level of professional competence in the field of pharmacy, possessing knowledge of the fundamental biological and chemical disciplines necessary for the study of pharmaceutical sciences. Shows understanding of drugs and the substances used in their production, the processes of drug manufacturing and other pharmaceutical preparations, preclinical and clinical drug testing, and knowledge of drug formulation and other aspects of pharmaceutical technology. Possesses knowledge of the physicochemical, pharmacokinetic, pharmacodynamic, and biopharmaceutical properties of drugs, including their design, metabolism, and mechanism of action. Demonstrates knowledge of physical, chemical, biological, and microbiological testing of drugs. Has an understanding of the etiology, pathogenesis, and course of the most common disorders and diseases of human organs and systems, as well as the basics of pharmacotherapy. Possesses knowledge of all individual drug groups classified by chemical structure or the anatomical system on which they act, including their clinical application, specifics for therapy individualization, the influence of chemical structure on activity, potential adverse effects, and interactions. Demonstrates knowledge of the fundamental principles of phytotherapy and the role of modern phytotherapy in contemporary medicine and pharmacy, including the mechanisms of action of natural products, their use in the treatment of disorders and diseases, and aspects of their production and quality control. Possesses adequate knowledge for the preparation and evaluation of statistical, biochemical, pharmacoeconomic, pharmacoepidemiological, and other data related to drugs and pharmaceutical products. Demonstrates skills in objective evaluation of professional literature to provide accurate information based on this knowledge. Shows knowledge of applying appropriate communication skills in daily practice, as well as the proper storage, dispensing, and distribution of drugs in accordance with good pharmaceutical practices. Demonstrates adequate knowledge of the legal and other requirements associated with pharmaceutical practice.

Application of Knowledge and Understanding	Possesses the ability to apply knowledge to address issues related to good practices (manufacturing, laboratory, and distribution) in pharmaceutical activities; the design and production of pharmaceutically active chemical substances; formulation of pharmaceutical dosage forms; production of pharmaceutical preparations; physical, chemical, biological, and microbiological testing of drugs; pharmacokinetic, pharmacodynamic, and biopharmaceutical properties of drugs; preclinical and clinical testing of drugs; and the influence of chemical structure on drug activity. Applies knowledge in the therapeutic use of drugs and other pharmaceutical products, preventing potential toxic and other adverse effects, as well as possible drug-drug and drug-food interactions. Demonstrates rational use of medicines based on the principles of Evidence-Based Medicine. Shows professional and scientific preparedness for detecting, defining, and analyzing problems, determining, advising on, and dispensing therapy with pharmaceutical preparations, and monitoring therapy effectiveness. Applies a multidisciplinary, individual, creative, original, and scientific approach in new or unfamiliar environments and, in a multidisciplinary context, in areas related to the field of study.
Ability to apply	Demonstrates the ability to professionally analyze and interpret the fundamental principles of pharmacotherapy and to understand the skills required for its critical evaluation and research. Possesses the ability to assess and evaluate pharmaceutically active chemical compounds, plant and other natural raw materials, their chemical and other characteristics, pharmacological and biological activity, specific features of dosage forms, methods of drug and pharmaceutical product production, their use in prevention, treatment, health promotion, and protection, as well as the efficacy and safety of pharmaceutical products. Demonstrates the ability to evaluate the prescription and administration of drugs and other pharmaceutical preparations, as well as to assess the outcomes of therapy. Shows the ability to follow legal, ethical, professional, and organizational policies/procedures and codes, and, when necessary, to propose actions based on independent interpretation of the broader scope of professional policies and procedures.

Communication Skills	Uses appropriate professional communication to establish collaboration with patients, organizational management, colleagues, and professionals whose training spans natural, biomedical, biotechnological sciences, and practice. Demonstrates the ability to communicate where the context of discussion, decision criteria, and scope of tasks are clearly defined. Shows the ability to participate independently in specific interdisciplinary discussions on practical and scientific aspects of pharmaceutical practice, with a professional approach. Accepts consultations for advice and shared responsibility within a team. Demonstrates the ability for professional communication where the discussion context, decision criteria, and scope of tasks are either clearly defined or based on judgment. Applies appropriate professional communication to establish collaboration and provide education to individual patients, patient groups, colleagues, and other healthcare professionals.
Learning Skills	Takes the initiative to identify needs for acquiring further knowledge and continuous learning with a high degree of independence. Follows current scientific literature and possesses the skills for its appropriate critical evaluation to advance expertise in the specialized field. Designs strategies and plans for promoting personal professional development and participates in learning activities, critically assessing the appropriateness of learning methods and their impact on knowledge, skills, competence, and practice with a high level of independence.

13. Established ratio between compulsory and elective courses, including a list of compulsory courses, a list of elective courses, and a defined method for selecting the courses.

Structure of the Study Program

Table 13.1. Distribution of Courses by Semester and Year of Study for Academic Studies (AS)

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS
				L	E	
1st Year – 1st Semester						
1	FFZP01	FUNDAMENTALS OF PHARMACY	1	2	2	4
2	FFPMF02	MATHEMATICS AND APPLIED STATISTICS IN PHARMACY	1	3	3	5
3	FFMF03	BIOPHYSICS	1	2	2	5
4	FFIPHFA04	INORGANIC CHEMISTRY APPLIED IN PHARMACY	1	3	3	8
5	FFMF05	ANATOMY AND PHYSIOLOGY	1	2	3	8
Total hours (lectures/practical sessions) and ECTS						30

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS
				L	E	
1st Year – 2nd Semester						
6	FFIPHFA06	ORGANIC CHEMISTRY APPLIED IN PHARMACY	2	3	3	8
7	FFIPHFA07	PHYSICAL CHEMISTRY FOR PHARMACISTS	2	3	3	7
8	FFIFG08	PHARMACEUTICAL BOTANY AND BIOLOGY	2	2	5	7
9	FFIFH09	MOLECULAR CELL BIOLOGY AND GENETICS	2	3	3	6
10	FFFK10	SPORT AND HEALTH	2	0	2	2
Total hours (lectures/practical sessions) and ECTS						30

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS
				L	E	
2nd Year – 3th Semester						
11	FFIPHFA11	BIOORGANIC CHEMISTRY	3	3	3	8
12	FFIPHFA12	ANALYTICAL CHEMISTRY APPLIED IN PHARMACY	3	3	4	8
13	FFMF13	PATHOPHYSIOLOGY	3	2	2	6
14	FFMF14	MICROBIOLOGY	3	2	2	5
15	FFIFH15	PHARMACEUTICAL LAW AND ETHICS	3	2	/	3
Total hours (lectures/practical sessions) and ECTS						30

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS
				L	E	
2nd Year – 4th Semester						
16	FFIFH16	PHARMACEUTICAL CHEMISTRY I	4	3	3	7
17	FFIPHFA17	INSTRUMENTAL PHARMACEUTICAL ANALYSES	4	3	3	7
18	FFIFG18	PHYTOCHEMISTRY	4	3	4	7
19	FFIPB19	BIOCHEMISTRY	4	3	3	6
20	FFIFH20	FUNDAMENTALS OF IMMUNOLOGY	4	2	2	3
Total hours (lectures/practical sessions) and ECTS						30

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS
				L	E	
3th Year – 5th Semester						
21	FFIFG21	PHARMACOGNOSY	5	3	4	8
22	FFIFT22	PHARMACEUTICAL TECHNOLOGY I	5	3	/	7
23	FFIFH23	PHARMACEUTICAL CHEMISTRY II	5	2	3	6
24	FFIFH24	FUNDAMENTALS OF PHARMACOLOGY	5	/	/	6
25	FFIFH25	SOCIAL PHARMACY AND PUBLIC HEALTH	5	3	3	3
Total hours (lectures/practical sessions) and ECTS						30

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS
				L	E	
3th Year – 6th Semester						
26	FFIFH26	PHARMACEUTICAL CHEMISTRY III	6	3	4	8
27	FFIFT27	PHARMACEUTICAL TECHNOLOGY II	6	3	3	7
28	FFIFG28	PHYTOTHERAPY	6	2	/	5
29	FFIPB29	BROMATOLOGY	6	3	3	6
30	FFIP L	ELECTIVE COURSE 1	6			4
Total hours (lectures/practical sessions) and ECTS						30

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS
				L	E	
4th Year – 7th Semester						
31	FFIPB30	CLINICAL BIOCHEMISTRY	7	3	3	7
32	FFIFT31	ADVANCED PHARMACEUTICAL TECHNOLOGY	7	3	3	8
33	FFIFH32	PHARMACoinformatics	7	2	2	4
34	FFIFH33	FUNDAMENTALS OF CLINICAL PHARMACY	7	2	3	4
35	FFIFH34	PHARMACEUTICAL CARE	7	3	/	3
36	FFIP_L	ELECTIVE COURSE 2	7			4
Total hours (lectures/practical sessions) and ECTS						30

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS
				L	E	
4th Year – 8th Semester						
37	FFIFH35	CLINICAL PHARMACY AND PHARMACOTHERAPY	8	4	4	8
38	FFIFT36	BIOPHARMACY	8	3	3	7
39	FFIFT37	PHARMACEUTICAL BIOTECHNOLOGY	8	1	/	3
40	FFIFH38	PHARMACOECONOMICS AND PHARMACOEPIDEMIOLOGY	8	3	/	4
41	FFIP-L	ELECTIVE COURSE3	8			4
42	FFIP-Z	ELECTIVE COURSE 4	8			4
Total hours (lectures/practical sessions) and ECTS						30

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS
				L	E	
5th Year – 9th Semester						
43	FFIPB39	TOXICOLOGY	9	2	2	8
44	FFIPHFA40	QUALITY CONTROL OF MEDICINES AND PHARMACEUTICAL LEGISLATION	9	3	5	8
45	FFIFH41	PHARMACOGENETICS, PHARMACOGENOMICS, AND PERSONALIZED THERAPY	9	2	/	3
46	FFIFT42	INDUSTRIAL PHARMACY	9	1	1	3
47	FFIFH35	ELECTIVE COURSE 5	9	4	4	4
48	FFIP_Z	ELECTIVE COURSE 6	9			4
Total hours (lectures/practical sessions) and ECTS						30

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS
				L	E	
5th Year – 10th Semester						
49	FFDR	DIPLOMA THESIS	10			10
50	DDPP	PROFESSIONAL PRACTICE	10			20
Total hours (lectures/practical sessions) and ECTS						30

Table 13.2. Elective Courses within the Study Program

(The list includes elective courses from the study program as well as courses offered by other units of the University, in accordance with Article 139, paragraph 9 of the Law on Higher Education (Official Gazette of the Republic of Macedonia No. 82/18))

Elective Courses from the Group of Pharmaceutical Sciences

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS	Serial number
				L	E		
1	FFIP_L01	Chemistry of Biologically Active Elements	6 / 8	2	0	4	FF
2	FFIP_L02	Green Chemistry in Pharmaceutical Analyses	6 / 8	2	0	4	FF
3	FFIP_L03	Ethnopharmacological Approach in the Development of New Herbal Preparations	6 / 8	2	1	4	FF
4	FFIP_Z04	Bioanalytical Chemistry	7 / 9	2	0	4	FF
5	FFIP_Z05	Nanotechnologies in Pharmaceutical Technology	7 / 9	2	1	4	FF

Elective Courses from the Group of Pharmacy and Clinical Practice

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS	Serial number
				L	E		
1	FFIP_L06	Prevention and Treatment of Poisonings	6 / 8	2	0	4	FF
2	FFIP_L07	Magistral and Galenic Medicines	6 / 8	1	2	4	FF
3	FFIP_Z08	Biochemical Analyses with Specific Clinical Application	7 / 9	2	1	4	FF
4	FFIP_Z09	Food Supplements and Nutrivigilance	7 / 9	2	0	4	FF
5	FFIP_Z10	Rational Use of Herbal Preparations	7 / 9	2	1	4	FF
6	FFIP_Z11	Drug Therapy Monitoring	9	2	1	4	FF

Elective Courses from the **Group of Pharmaceutical Industry**

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS	Serial number
				L	E		
1	FFIP_L12	Quality Management in an Analytical Laboratory	6 / 8	2	1	4	FF
2	FFIP_L13	Pharmaceutical Process Engineering	6 / 8	2	/	4	FF
3	FFIP_L14	Production of Herbal Preparations and Quality Standards	6 / 8	2	1	4	FF
4	FFIP_Z15	Production of Biotechnological Medicines	7 / 9	2	/	4	FF
5	FFIP_Z16	Cosmetology	9	2	/	4	FF

Elective Courses from the **Group of Pharmaceutical Regulation**

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS	Serial number
				L	E		
1	FFIP_Z17	Quality Control of Herbal Preparations	6/8	2	1	4	FF
2	FFIP_Z18	Fundamentals of Patenting and Branding in Pharmacy	7/9	1	1	4	FF
3	FFIP_Z19	Pharmacovigilance	9	2	1	4	FF
4	FFIP_Z20	Regulation for marketing authorisation of medicines and prevention of falsified medicines	9	2	0	4	FF

Elective Courses from the **Additional Group**

Serial number	Course code	Course title	Semester	Weekly teaching hours		ECTS	Serial number
				L	E		
1	FIP_ZL21	Sustainability in Pharmaceutical Practice	6/7/8/9	2	1	4	FF
2	FFIP_L22	Management of Pharmaceutical Waste	6/8	2	0	4	FF
3	FFIP_L23	Biological Medicines and Vaccines	6/8	1	1	4	FF
4	FFIP_Z24	Pharmaceutical Management	7/9	2	0	4	FF

Table 13.3. Mobility Windows – Courses that May Be Delivered in English, in Accordance with Article 139, Paragraph 10 of the Law on Higher Education (“Official Gazette of the Republic of North Macedonia” No. 82/18)

	Course Title	Teacher	Year/Semester	ECTS
1.	/			

Table 13.4. Overview of the Representation of Mandatory and Elective Courses within the Study

Programme			
Semester	Number of Mandatory Courses	Number of Elective Courses	Total Courses
I	5	0	5
II	5	0	5
III	5	0	5
IV	5	0	5
V	5	0	5
VI	4	1	5
VII	5	1	6
VIII	4	2	6
IX	4	2	6
X	2	0	2
Total	44	6	50
%	88	12	100

Table 13.5. Overview of the Percentage Distribution of Mandatory and Elective Courses

Ред бр	Duration of studies (years) / total number of ECTS credits of the study program	Total workload expressed in ECTS		Workload for elective courses expressed in ECTS	
		A Total number of ECTS credits of the study program	A1 Percentage distribution of ECTS credits among the courses of the study program	B Total ECTS credits from elective courses	B1 Percentage of ECTS credits from elective courses in relation to the total ECTS credits of the study program
1.	5 years 300 ECTS	300	100%	24	$(B/A)*100=8\%^*$

* Article 147 of the Law on Higher Education – Study Programs for Regulated Professions

13.6. Rules and Method for Selecting Elective Courses, Including the Option to Choose Courses from Other Accredited Study Programs

Method of Selecting Elective Courses from the Study Program:
The student selects courses from one of the elective course groups according to their personal interests in the field and the semester in which the course is scheduled to be taken.
Method of Selecting Elective Courses from the University List:
/

13.6. Deadlines for Completion of the Scheduled Activities of the Study Program

The scheduled activities of the study program must be completed within 5 years, or at most within a period not exceeding twice the prescribed duration of the studies.

14. List of Teaching Staff with Data Specified in Article 7 (Annex No. 4) of the Rulebook on the Content of Study Programs (“Official Gazette of the Republic of North Macedonia”, No. 79/2023) and Article 61, Paragraph 3 of the Law on Higher Education (“Official Gazette of the Republic of North Macedonia”, No. 82/2018)

Table 14.1. List of Personnel Appointed to Teaching-Scientific, Scientific, and Teaching Positions in Full-Time Employment at the Faculty, Participating in the Implementation of the Study Program

	Prof. name	To be specified		Course title (from Tables 7.1 and 7.2)	Total number	
		<i>The title in which they are appointed and the scientific field</i>	<i>The scientific field of the doctorate</i>		Winter	Summer
	Prof. Ljubica Shuturkova	Full Professor – Pharmaceutical Chemistry	Pharmaceutical Sciences	Pharmaceutical Chemistry II Pharmaceutical Chemistry III Fundamentals of Clinical Pharmacy Clinical Pharmacy and Pharmacotherapy Pharmacoeconomics and Pharmacoepidemiology	1	4
	Prof. Aneta Dimitrovska	Full Professor – Drug Analytics and Instrumental Pharmaceutical Analyses	Pharmaceutical Sciences	Instrumental Pharmaceutical Analyses Drug Analytics Regulation for marketing authorisation of medicines and prevention of falsified medicines Quality Management in an Analytical Laboratory	2	2
	Prof. Aleksandar Dimovski	Full Professor – Fundamentals of Molecular Biology with Genetics, Immunology with Immunochemistry, and Pharmacogenetics	Pharmaceutical Sciences	Molecular Cell Biology and Genetics Fundamentals of Immunology Pharmacogenetics, Pharmacogenomics, and Personalized Therapy	1	2

	Prof. Katerina Gorachinova	Full Professor – Pharmaceutical Technology and Biopharmacy	Pharmaceutical Sciences	Pharmaceutical Technology I Pharmaceutical Technology – Advanced Level Industrial Pharmacy Nanotechnologies in Pharmaceutical Technology (Elective) Pharmaceutical Technology II Biopharmacy Magistral and Galenic Medicines (Elective) Pharmaceutical Process Engineering (Elective))	4	4
	Prof. Renata Slaveska Raicki	Full Professor – Pharmaceutical Technology with Industrial Pharmacy, Biotechnology, and Micro/Nanotechnology	Pharmaceutical Sciences	Pharmaceutical Technology I Industrial Pharmacy Production of Biotechnological Medicines (Elective) Pharmaceutical Technology II Pharmaceutical Biotechnology Magistral and Galenic Medicines (Elective) Pharmaceutical Process Engineering (Elective)	3	4
	Prof. Biljana Bauer	Full Professor – Pharmaceutical Botany and History of Pharmacy	Pharmaceutical Sciences	Pharmaceutical Botany and Biology Ethnopharmacological Approach in the Development of New Herbal Preparations (Elective)	0	2
	Prof. Tatjana Kadifkova Panovska	Full Professor – Pharmaceutical Toxicology, General Biochemistry, and Clinical Biochemistry	Pharmaceutical Sciences	Biochemistry Clinical Biochemistry Toxicology Biochemical Analyses with Specific Clinical Application (Elective) Poisonings Prevention and Treatment of (Elective)	2	3

	Prof. Kristina Mladenovska	Full Professor – Biopharmacy and Pharmaceutical Chemistry	Pharmaceutical Sciences	Fundamentals of Pharmacology Biopharmacy Pharmaceutical Chemistry III Magistral and Galenic Medicines (Elective) Drug Therapy Monitoring	2	3
	Prof. Rumenka Petkovska	Full Professor – Applied Chemistry and Pharmaceutical Instrumental Analyses	Pharmaceutical Sciences	Inorganic Chemistry Applied in Pharmacy Physical Chemistry for Pharmacists Chemistry of Biologically Active Elements	1	2
	Prof. Marija Glavash Dodov	Full Professor – Pharmaceutical Technology with Instrumental Pharmaceutical Analyses and Micro/Nanotechnology	Pharmaceutical Sciences	Pharmaceutical Technology I Pharmaceutical Technology – Advanced Level Industrial Pharmacy Cosmetology (Elective) Pharmaceutical Technology II Magistral and Galenic Medicines (Elective) Pharmaceutical Process Engineering (Elective) Sustainability in Pharmaceutical Practice	4	4
	Prof. Katerina Anchevska Netkovska	Full Professor - Social Pharmacy	Pharmaceutical Sciences	Social Pharmacy and Public Health Pharmaceutical Law Fundamentals of Patenting and Branding in Pharmacy (elective) Sustainability in Pharmaceutical Practice (elective)	3	1
	Prof. Gjoshе Stefkov	Full Professor – Pharmacognosy and	Pharmaceutical Sciences	Pharmaceutical botany and biology Phytochemistry Pharmacognosy Phytotherapy	3	3

		Pharmaceutical Botany		Rational use of herbal preparations Ethnopharmacological approach in the development of new herbal preparations Quality control of herbal products Sustainability in pharmacy practice		
	Prof. Aleksandra Grozdanova	Full Professor –	Pharmaceutical Sciences	Pharmaceutical Chemistry 2 Pharmaceutical Chemistry 3 Social Pharmacy and Public Health Pharmacoeconomics and Pharmacoepidemiology Pharmaceutical Care Clinical Pharmacy and Pharmacotherapy Pharmaceutical Management (Elective) Biological Drugs and Vaccines (Elective)	4	4
	Prof. Zoran Sterjev	Full Professor – Pharmaceutical Chemistry, Immunochemistry, and Social Pharmacy	Pharmaceutical Sciences	Pharmaceutical Chemistry 2 Pharmaceutical Chemistry 3 Drug information Fundamentals of Clinical Pharmacy Pharmacoeconomics and Pharmacoepidemiology Clinical Pharmacy and Pharmacotherapy Therapeutic drug information Pharmaceutical Management (Elective)	4	4
	Prof. Jasmina Tonikj Ribarska	Full Professor	Pharmaceutical Sciences	Analytical Chemistry Applied in Pharmacy Bioorganic Chemistry Bioanalytical Chemistry Green Chemistry in Pharmaceutical Analyses (Elective) Monitoring of Drug Therapy (Elective)	4	1

	Prof. Ana Poceva Panovska	Full Professor – Applied Chemistry and Pharmaceutical Instrumental Analyses	Pharmaceutical Sciences	Organic chemistry applied in pharmacy Bioorganic chemistry Pharmaceutical chemistry 1 Management of pharmaceutical waste Chemistry of biologically active elements Therapeutic drug monitoring Sustainability in pharmacy practice	4	1
	Prof. Katerina Brezovska	Full Professor – Applied Chemistry and Pharmaceutical Instrumental Analyses	Pharmaceutical Sciences	Fundamentals of pharmacy Bioorganic chemistry Instrumental pharmaceutical analyses Quality control of medicines and pharmaceutical legislation Quality management in analytical laboratory Regulation for marketing authorisation of medicines and prevention of falsified medicines	4	2
	Prof. Marija Hiljadnikova Bajro	Full Professor – Applied Biochemistry	Pharmaceutical Sciences	Biochemistry Clinical Biochemistry Biochemical Analyses with Specific Clinical Application (Elective)	1	2
	Prof. Maja Simonoska Crcarevska	Full Professor – Pharmaceutical Technology with Industrial Pharmacy and Micro/Nanotechnology	Pharmaceutical Sciences	Pharmaceutical Technology 1 Pharmaceutical Technology 2 Pharmaceutical Technology – advanced level Industrial Pharmacy Pharmaceutical Care Magistral and Galenic Medicines (Elective) Pharmaceutical Process Engineering (Elective)	4	3

	Prof. Marija Karapandzova	Full Professor Pharmaceutical Botany and Pharmacognosy	Pharmaceutical Sciences	Pharmaceutical botany and biology Phytochemistry Pharmacognosy Phytotherapy Rational use of herbal preparations Manufacturing of herbal preparations and quality standards Quality control of herbal products	3	2
	Prof. Zorica Naumovska	Full Professor Pharmaceutical Chemistry and Pharmacoinformatics	Pharmaceutical Sciences	Pharmaceutical Chemistry 1 Pharmaceutical Chemistry 2 Pharmaceutical Chemistry 3 Pharmacoinformatics Pharmaceutical Care Clinical Pharmacy and Pharmacotherapy Pharmacovigilance (elective)	3	4
	Prof. Aleksandra Kapedanovska Nestorovska	Full Professor Pharmaceutical Chemistry and Pharmacoinformatics	Pharmaceutical Sciences	Pharmaceutical Chemistry 1 Pharmaceutical Chemistry 3 Pharmacoeconomics and Pharmacoepidemiology Pharmaceutical Care Fundamentals of Clinical Pharmacy Clinical Pharmacy and Pharmacotherapy Monitoring of Drug Therapy	3	4

	Prof. Jelena Acevska	Full Professor Drug Analytics, Applied Chemistry, and Pharmaceutical Instrumental Analyses	Pharmaceutical Sciences	Fundamentals of pharmacy Organic chemistry applied in pharmacy Instrumental pharmaceutical analyses Quality control of medicines and pharmaceutical legislation Quality management in analytical laboratory Regulation for marketing authorisation of medicines and prevention of falsified medicines	3	3
	Prof. Tanja Petreska Ivanovska	Full Professor Food and Nutrition and Pharmaceutical Toxicology	Pharmaceutical Sciences	Bromatology Toxicology Food Supplements and Nutrivigilance (elective) Poisonings Prevention and Treatment of (Elective)	2	2
	Prof. Nikola Geshkovski	Full Professor Biopharmacy, Pharmaceutical Technology with Industrial Pharmacy, and Micro/Nanotechnology	Pharmaceutical Sciences	Pharmaceutical Technology 1 Advanced Pharmaceutical Technology Industrial Pharmacy Pharmaceutical Care Pharmaceutical Technology 2 Biopharmacy Magistral and Galenic Drugs (elective) Pharmaceutical Process Engineering (elective)	4	4
	Prof Nadica Matevska Geshkovska	Full Professor Immunochemistry and Pharmacogenetics	Pharmaceutical Sciences	Molecular and Cellular Biology and Genetics Fundamentals of Immunology Fundamentals of Pharmacology	3	2

				Pharmacogenetics, Pharmacogenomics, and Personalized Therapy Monitoring of Drug Therapy		
	Prof. Natalija Nakov	Full Professor Applied Chemistry and Pharmaceutical Instrumental Analyses	Pharmace utical Sciences	Instrumental Pharmaceutical Analyses Physical Chemistry for Pharmacists Bioanalytical Chemistry Green Chemistry in Pharmaceutical Analyses	1	3
	Prof. Liljana Anastasova	Full Professor Applied Chemistry and Pharmaceutical Instrumental Analyses	Pharmace utical Sciences	Inorganic Chemistry Applied in Pharmacy Chemistry of biologically active elements	1	1
	Asst. Prof. Ivana Cvetkovikj Karanfilova	Asst. Prof. Pharmaceutical Botany and Pharmacognosy	Pharmace utical Sciences	Pharmaceutical Botany and Biology Production of Herbal Preparations and Quality Standards (Elective)	0	2
	Asst. Prof. Ljubica Mihailova	Asst. Prof. Pharmaceutical Technology with Industrial Pharmacy, Micro/Nanotec hnology, and Biopharmacy	Pharmace utical Sciences	Pharmaceutical Technology 1 Industrial Pharmacy Pharmaceutical Care Cosmetology (Elective) Pharmaceutical Technology 2 Biopharmacy Magistral and Galenic Drugs (Elective) Pharmaceutical Process Engineering (Elective)	4	4
	Asst. Prof. Zoran Zivikj	Asst. Prof. Food and Nutrition and Pharmaceutical Toxicology	Pharmace utical Sciences	Chromatology Toxicology Dietary Supplements and Nutritional Vigilance (Elective) Poisonings Prevention and Treatment of (Elective)	2	3

				Sustainability in Pharmaceutical Practice		
	Asst. Prof. Marija Staninova Stojovska	Asst. Prof. Pharmacogenetics	Pharmaceutical Sciences	Molecular and Cell Biology and Genetics Fundamentals of Immunology Fundamentals of Pharmacology Pharmacogenetics, Pharmacogenomics, and Personalized Therapy	2	2
	Asst. Prof. Dushko Shalabalija	Assistant Professor /Pharmaceutical Technology with Industrial Pharmacy, Micro/Nanotechnology, and Biopharmacy	Pharmaceutical Sciences	Fundamentals of Pharmacy Pharmaceutical Technology 1 Nanotechnologies in Pharmaceutical Technology (Elective) Production of Biotechnological Drugs (Elective) Pharmaceutical Technology 2 Pharmaceutical Biotechnology Magistral and Galenic Medicines (Elective) Pharmaceutical Process Engineering (Elective)	4	4
	Asst. Prof. Elizabeta Krstevska Bozinovikj	Assistant Professor /Farmacogenetics Immunology	Pharmaceutical Sciences	Fundamentals of pharmacology Molecular and cell biology Fundamentals of immunology	2	1
	Asst. Prof. Veronika Stoilkovska Gjorgievska	Assistant Professor /Pharmaceutical botany Farmacognosy	Pharmaceutical Sciences	Fundamentals of pharmacy Pharmaceutical botany and biology Phytochemistry Pharmacognosy Rational use of herbal preparations Ethnopharmacological approach in the development of new herbal preparations	4	4

				Quality control of herbal products Manufacturing of herbal preparations and quality standards		
	Asst. Prof. Ana Trajkovska	Assistant Professor / Pharmaceutical botany Farmacognosy	Biological Sciences	Fundamentals of pharmacy Pharmaceutical botany and biology Phytochemistry Pharmacognosy Rational use of herbal preparations Ethnopharmacological approach in the development of new herbal preparations Quality control of herbal products Manufacturing of herbal preparations and quality standards	4	4
	Asst. Prof. Evgenija Mihajloska	Assistant Professor / Pharmaceutical chemistry, Immunochemistry Social pharmacy	Pharmaceutical Sciences	Pharmaceutical chemistry II Pharmaceutical chemistry III Pharmaceutical law and ethics Social pharmacy and public health Fundamentals of clinical pharmacy Clinical pharmacy and pharmacotherapy Pharmacoeconomics and pharmacoepidemiology	4	3
	Asst. Prof. Olga Gigopolu	Assistant Professor / Applied Chemistry and Pharmaceutical Instrumental Analyses	Chemical Sciences	Organic chemistry applied in pharmacy Bioorganic chemistry Pharmaceutical chemistry 1 Management of pharmaceutical waste	2	1
	Asst. Prof. Kristina Shutevska Achevska	Assistant Professor /	Pharmaceutical Sciences	Biochemistry Clinical Biochemistry	1	1

		Applied biochemistry				
	Asst. Prof. Blagoj Achevski	Assistant Professor / Applied Chemistry and Pharmaceutical Instrumental Analyses	Chemical Sciences	Physical Chemistry for pharmacists Analytical Chemistry applied in pharmacy Instrumental pharmaceutical analysis „Green“ chemistry in pharmaceutical analysis	1	3
	Asst. Prof. Aleksandar Dimkovski	Assistant Professor / Pharmaceutical chemistry Farmacoinform atics Social pharmacy	Pharmace utical Sciences	Pharmaceutical chemistry I Pharmaceutical chemistry II Pharmaceutical chemistry III Social pharmacy and public health Pharmacoinformatics Fundamentals of clinical pharmacy Pharmacoeconomics and pharmacoepidemiology	4	3
Вкупно					105	100

Table 14.2. List of Personnel Appointed to Teaching-Scientific, Scientific, and Teaching Positions in Full-Time Employment from Other Units of the Higher Education Institution, Engaged in the Unit Where the Study Program Is Implemented

	Prof. name	To be specified			Course title (from Tables 7.1 and 7.2)	Total number of courses taught within the unit and the study programme	
		<i>The title in which they are appointed and the scientific field</i>	<i>The scientific field of the doctorate</i>	<i>unit of employment (permanent employment)</i>		Winter sem.	Summer sem.
	Jana Karshakovska Dimitrioska	Assistant Professor, Social Kinesiology	Social Kinesiology	Faculty of Physical Education, Sport and Health – Skopje	Sport and health	0	1
	Beti Dejanova	Full professor, Physiology	Physiology	Faculty of medicine - Skopje	Physiology	1	0
	Vesela Maleska – Ivanovska	Full professor, Physiology	Physiology	Faculty of medicine - Skopje	Physiology	1	0
	Suncica Petrovska	Full professor, Physiology	Physiology	Faculty of medicine - Skopje	Physiology	1	0
	Lidija Todorovska	Full professor, Physiology	Physiology	Faculty of medicine - Skopje	Physiology	1	0
	Ljudmila Efremovska	Full professor, Physiology	Physiology	Faculty of medicine - Skopje	Physiology	1	0
	Sanja Mancevska	Full professor, Physiology	Physiology	Faculty of medicine - Skopje	Physiology	1	0
	Jasmina Pluncevic Gligoroska	Full professor, Physiology	Physiology	Faculty of medicine - Skopje	Physiology	1	0

	Daniela Pop Gjorcheva	Full professor, Pathophysiology Nuclear Medicine	Pathophysiology Nuclear Medicine Cardiology	Faculty of medicine - Skopje	Patophysiology	1	0
	Venjamin Majstorov	Full professor, Pathophysiology Nuclear Medicine	Pathophysiology Nuclear Medicine Cardiology	Faculty of medicine - Skopje	Patophysiology	1	0
	Ana Ugrinska	Associate Professor Pathophysiology Nuclear Medicine	Pathophysiology Gastroenterology and Hepatology Endocrinology	Faculty of medicine - Skopje	Patophysiology	1	0
	Sinisa Stojanoski	Associate Professor Pathophysiology Nuclear Medicine	Pathophysiology Nuclear Medicine Oncology	Faculty of medicine - Skopje	Patophysiology	1	0
	Tanja Makazlieva	Assistant Professor Pathophysiology Nuclear Medicine	Pathophysiology Nuclear Medicine Oncology	Faculty of medicine - Skopje	Patophysiology	1	0
	Nevena Manevska	Assistant Professor Pathophysiology Nuclear Medicine	Pathophysiology Nuclear Medicine Oncology	Faculty of medicine - Skopje	Patophysiology	1	0
	Gordana Jankoska	Full Professor, Microbiology and Parasitology	Medical Microbiology	Faculty of medicine - Skopje	Microbiology	1	0
	Maja Jurhar Pavlova	Full Professor, Microbiology and Parasitology	Medical Microbiology	Faculty of medicine - Skopje	Microbiology	1	0
	Zaklina Cekovska	Full Professor, Microbiology and Parasitology	Medical Microbiology	Faculty of medicine - Skopje	Microbiology	1	0
	Magdalena Bogdanovska Todorovska	Full Professor, Pathology	Pathology	Faculty of medicine - Skopje	Pathology	1	0

Table 14.4. Number of Required Teaching Staff for the Implementation of Higher Education Activities of the Study Program (Article 28 of the Rulebook on Standards and Norms for the Establishment and Implementation of Higher Education Activities, “Official Gazette of the Republic of North Macedonia”, No. 245/2022)

Serial No	Instructors involved in the implementation of the study program	A	B	C	D	Number of hours per instructor – annually ^[1] (Bx15) x D
		Number of courses	Total number of hours based on courses	Number of students for whom accreditation is requested	Size of the lecture and practical session groups for full-time students ^[2]	
1	Prof. Ljubica Shuturkova	5	10	120	2	150
2	Prof. Aneta Dimitrovska	4	10			150
3	Prof. Aleksandar Dimovski	3	10			150
4	Prof. Katerina Gorachinova	8	10			150
5	Prof. Renata Slaveska Raicki	7	10			150
6	Prof. Biljana Bauer	2	10			150
7	Prof. Tatjana Kadifkova Panovska	5	10			150
8	Prof. Kristina Mladenovska	5	10			150
9	Prof. Rumenka Petkovska	3	10			150
10	Prof. Marija Glavash Dodov	8	10			150
11	Prof. Gjose Stefkov	3	10			150
12	Prof. Aleksandra Grozdanova	6	10			150
13	Prof. Zoran Sterjev	8	10			150
14	Prof. Jasmina Tonikj Ribarska	8	10			150

15	Prof. Ana Poceva Panovska	5	10			150
16	Prof. Katerina Brezovska	7	10			150
17	Prof. Katerina Anchevska Netkovska	6	10			150
18	Prof. Marija Hiljadnikova Bajro	3	10			150
19	Prof. Maja Simonoska Crcarevska	7	10			150
20	Prof. Marija Karapandzova	5	8			120
21	Prof. Zorica Naumovska	7	8			120
22	Prof. Aleksandra Kapedanovska Nestorovska	7	8			120
23	Prof. Jelena Acevska	6	8			120
24	Prof. Tanja Petreska Ivanovska	4	8			120
25	Prof. Nikola Geshkovski	8	8			120
26	Prof Nadica Matevska Geshkovska	5	8			120
27	Prof. Natalija Nakov	4	8			120
28	Prof. Liljana Anastasova	2	8			120
29	Asst. Prof. Ivana Cvetkovikj Karanfilova	2	6			90
30	Asst. Prof. Ljubica Mihailova	8	6			90
31	Asst. Prof. Zoran Zivikj	5	6			90
32	Asst. Prof. Marija Staninova Stojovska	4	6			90

33	Asst. Prof. Dushko Shalabalija	8	6			90
34	Asst. Prof. Elizabeta Krstevska Bozinovikj	3	4			60
35	Asst. Prof. Veronika Stoilkovska Gjorgievska	8	4			60
36	Asst. Prof. Ana Trajkovska	8	4			60
37	Asst. Prof. Evgenija Mihajloska	7	4			60
38	Asst. Prof. Olga Gigopolu	3	4			60
39	Asst. Prof. Kristina Shutevska Achevska	2	4			60
40	Asst. Prof. Blagoj Achevski	4	4			60
41	Asst. Prof. Aleksandar Dimkovski	7	4			60

15. List of Provided Required Non-Teaching Staff, in Accordance with Article 13 of the Rulebook on Standards and Norms for the Establishment and Implementation of Higher Education Activities (“Official Gazette of the Republic of North Macedonia” No. 245/2022)

Table 15.1. Consolidated Overview of Non-Teaching/Administrative Staff by Position and Job Titles at the Higher Education Institution (Faculty or Higher Vocational School)

Serial No.	Job Title	Qualification	Number of Employees
1.	Secretary	University Education (VSS)	1
2.	Head of Administrative Affairs Department	University Education (VSS)	1
3.	Head of Support Department for Application Centers	University Education (VSS)	1
4.	Advisor for Information and Computer Technologies	University Education (VSS)	1
5.	Senior Associate for Student Affairs	University Education (VSS)	1
6.	Independent Clerk – Cash Desk	Secondary Education (SSS)	1

7.	Independent Clerk – Administration	Secondary Education (SSS)	1
8.	Senior Associate for Human Resources	University Education (VSS)	1
9.	Senior Associate for Center Support	University Education (VSS)	1
10.	Associate for Center Support	University Education (VSS)	2
11.		Secondary Education (SSS)	6
12.	Independent Clerks in Laboratory	Secondary Education (SSS)	1
13.	Independent Clerk – Business Operations	Secondary Education (SSS)	1
14.	Janitor / Caretaker	Primary Education (OU)	2

16. Data on the Facilities Allocated for the Implementation of the Master’s Study Program in Health Management and Pharmacoeconomics, Organized at the Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje, in Accordance with Article 20 of the Rulebook on Standards and Norms for the Establishment and Implementation of Higher Education Activities (“Official Gazette of the Republic of North Macedonia” No. 245/2022)

Table 16.1. List of Facilities with Available Area at the Higher Education Institution (Faculty or Higher Vocational School)

No.	Type and purpose of space	Number	Number of seats	Area m ²
1.	Amphitheater	3	300	281
2.	Lecture Halls	1	50	154
	Computer Center	1	20	40
3.	Laboratories for Professional-Applicative and Scientific-Research Work	6	As needed	230
	Laboratories for Conducting Experimental Exercises	8	240	482
4.	Offices for Academic Staff	20	1 or 2	200
5.	Offices for Associate Staff	2	Ocean-style working approach	80
6.	Faculty Buildings and Facilities	3	/	1470
Total				3000

17. List of Equipment and Information–Technical Resources Allocated for the Implementation of the Study Program “Specialist in Health Management and Pharmacoeconomics” at the Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje, in Accordance with Annex 2 of the Rulebook on Standards and Norms for the Establishment and Implementation of Higher Education Activities (“Official Gazette of the Republic of North Macedonia” No. 245/2022)

Table 17.1. List of Equipment and Teaching Aids (by Type, Quantity, and Purpose) for Conducting Activities in Compliance with the Norms and Standards for the Implementation of Higher Education Activities

Serial No.	Equipment and Teaching Tools	Type	Purpose	Quantity
1.	Laboratory furniture with fume hoods and necessary installations for working with measuring instrumental equipment		Practical Training, Professional-Applicative, and Scientific-Research Work	16 laboratories with 20 fume hoods
2.	Auxiliary laboratory equipment and materials <i>сопрема и материјал</i>	Graduated cylinders, large-volume beakers, volumetric flasks, menisci, volumetric flasks with stoppers, flasks, glass test tubes, plastic test tubes, watch glasses, Graham reflux condensers, reagent bottles with ground glass stoppers, ceramic wire triangles, vacuum pumps, pipettors and pipettor accessories, drying racks for glassware, wash bottles, vortex mixers, water baths, long-necked flasks, digital burettes, Eppendorf tube racks, mortars and pestles, hot plates, porcelain balls, separatory funnels.	Practical training, professional-applicative, and scientific-research work	Large number
3.	Apparatus	LC-MS/MS, GC-FID-MS, HPLC analytical systems, preparative-analytical HPLC system, IR spectrometer;	Practical training, professional-applicative, and scientific-research work	

		microscopes; capillary electrophoresis system; UV/VIS spectrophotometers, analytical balance, standard balances, pH meters; water bath, ultrasonic bath, centrifuge, evaporator, distillers, mills, UV/Vis chamber for TLC analysis (Spectroline); disintegration apparatus; dissolution apparatus; drying oven, refractometer; polarimeter; viscometer; Agilent HPLC; light microscopes (20 units), binocular microscopes (2 units); laboratory furniture with fume hoods and necessary installations for working with instrumental equipment; chemicals, standards, and other auxiliary equipment; herbarium with necessary auxiliary equipment.		

Table 17.2. List of **Information–Technical Resources (by Type, Quantity, and Purpose)** for Conducting Activities in Compliance with the Norms and Standards for the Implementation of Higher Education Activities

Serial No.	Information and Technical Resources	Type	Purpose	Quantity
1.	Information Resource	Computers with Internet Access	Theoretical and Practical Teaching	90
2.	Information Resource	Computer Workstations with Appropriate Software for Courses	Theoretical and Practical Teaching	10
3.	Information Resource	Internet Connections	Theoretical and Practical Teaching	2

4.	Information Resource	Wireless Networks	Theoretical and Practical Teaching	8
5.	Technical Resource	LCD Projectors	Theoretical and Practical Teaching	6
6.	Technical Resource	Scanners	Teaching	10
7.	Technical Resource	Printers	Teaching	53
8.	Technical Resource	Electronic Platform for Conducting Exams (exam.net)	Knowledge Evaluation	1

18. Information on the Number of Students (First-Time Enrollees) in the Study Program for the Period Since the Last Accreditation

Table 18.1. Overview of the Number of Students Enrolled (First-Time) in the Study Program During the Period of the Last Accreditation and the Number of Students for Whom Accreditation Was Granted

Academic Year		Number of Students for Whom Accreditation Was Obtained	Number of First-Year Enrolled Students
1.	*		

*First accreditation of the program

Table 18.2. Number of Students for Whom Re-Accreditation Was Granted or Enrolled Students by Study Programs within the University Unit to Which They Belong

Serial No.	Name of Study Program	Number of Students for Whom Accreditation Was Obtained	Number of First-Year Enrolled Students
1	First and Second Cycle Integrated Academic Studies in Pharmacy	120	120
2	First Cycle Undergraduate Studies in Laboratory Bioengineering	60	30
3	First Cycle Undergraduate Studies in Dietetics and Dietotherapy	50	3
4	Doctoral Studies in the Scientific-Research Field of Pharmacy	21	3
5	Specialist Studies in Pharmaceutical Regulation	15	9
6	Specialist Studies in Phytotherapy – Herbal Medicines and Dietary Supplements	15	/
7	Specialist Studies in Cosmetology	15	/

8	Specialist Studies in Homeopathic Medicines	15	/
9	Specialist Studies in Pharmacovigilance	30	7
10	Specialist Studies in Industrial Pharmacy	22	2
11	Master's Studies in Laboratory Analysis and Pharmaceutical Engineering	15	7
12	Master's Studies in Dietetics and Dietotherapy	15	3
	Total	393	187

Table 18.3. Number of Students Requested for Accreditation According to the Net Area Available to the Unit for the Implementation of Study Programs

A	B	C	D
Total Area Available to the Unit in m² (Table 10)	Total Number of Students for Whom Accreditation Was Obtained or Enrolled Students in All Accredited Study Programs (Table 12.2)	Number of Students for Whom Accreditation or Reaccreditation of a New Study Program Is Requested	Net Area in m² per Student ((B + C) / A =)
3000	187	60	12*

* The net area in m² per student at the Faculty of Pharmacy has been calculated as the ratio of the total net area available to the faculty (Table 10) to the total number of enrolled students (Table 12.2), i.e., = A / (B + C). Accordingly, the m² per student meets the requirements set forth in Article 21 of the Rulebook on Norms and Standards for the Establishment of Higher Education Institutions and the Implementation of Higher Education Activities ("Official Gazette of the Republic of North Macedonia" No. 245/2022), where the standard for the required space per full-time student in study programs within the field of medical sciences and healthcare is 9.5 m².

19. Students with Special Needs in Accordance with Article 36 of the Rulebook on Norms and Standards for the Establishment of Higher Education Institutions and the Implementation of Higher Education Activities ("Official Gazette of the Republic of North Macedonia" No. 245/2022)

Table 19.1. Conditions to Be Provided by the Higher Education Institution for Students with Special Needs

	Conditions	Description (if not available, leave blank or indicate planned)
1.	Uninterrupted Access to the Facility	Access Ramp in the Main Building
2	Elevator	Infrastructure Prepared for Elevator in the Main Building
3	Designated Spaces in the Classroom	Provided
4	Electronic Teaching Aids	/

20. Information on Scientific-Research and Publishing Activities in Accordance with Article 18 of the Rulebook on Norms and Standards for the Establishment of Higher Education Institutions and the Implementation of Higher Education Activities (“Official Gazette of the Republic of North Macedonia” No. 245/2022)

The Faculty of Pharmacy continuously develops, prepares, and implements high-quality scientific-research activities through various programs, as well as through national and international projects. The knowledge gained through the conduct of scientific research is integrated into the teaching process. The Faculty of Pharmacy consistently encourages and provides conditions for academic staff to actively engage in research activities and to publish the results of their work.

The Faculty’s publishing activities are carried out in accordance with the Decision on the Procedure and Organization of the Publishing Activities of the Faculty of Pharmacy, Skopje, part of the “St. Cyril and Methodius” University in Skopje, which regulates the specific procedures for publishing textbooks, teaching aids, monographs, studies, collections of exercises, scripts, practical manuals, exercise instructions, student information packages, annual reports/compilations, journals, and other scientific-professional literature, as well as electronic publications within the scope of the Faculty’s activities.

In the field of publishing, the Faculty undertakes: identifying publication needs, adopting an annual publishing plan, printing publications, releasing publications in electronic form (e-publishing), coordinating the Faculty’s publishing activities, securing financial resources for publishing, and performing other activities related to the publishing process.

21. Library and information on provided mandatory and supplementary literature, in accordance with Article 37 of the Rulebook on Norms and Standards for Establishment and Operation of Higher Education Institutions (Official Gazette of the Republic of North Macedonia No. 245/22)

At the Faculty, the literature available in the library is accessible to every student. Upon enrollment, each student receives instructions on how to use the library collection, as well as the informational and technical resources available in the library. Literature is available to students both in printed form, with individual access for each student, and in electronic form. The number of copies of mandatory literature is at least 10%, and for supplementary literature at least 5% of the total number of students currently attending courses within the respective study program.

Table 21.1. List of Mandatory Literature and Number of Copies

No.	Type of literature listed in Appendix 3	Number of copies	Electronic format (PDF, Word, etc.) ¹
	Mandatory literature	Hardcopy	
1	Dzekova-Stojkova, S.A.; Korneti, P.G.; Todorova, B.B.; Trajkovska, S.K. <i>Biochemistry</i> . Ss. Cyril and Methodius University, Skopje.	15	/
2	Denke, D.; Kolman, J.; Fuchs, G.; Gerok, V. <i>Biochemistry and Pathobiochemistry</i> . Miken, Bitola.	15	/
3	Hiljadnikova-Bajro, M.; Kadifkova Panovska, T. <i>Biochemistry Practicum</i> . Faculty of Pharmacy, Ss. Cyril and Methodius University, Skopje.	/	Pdf

4	Kaltejt, T. <i>Food: Chemistry of Food Components</i> . Ars Lamina LLC.	16	/
5	Velíšek, J. <i>The Chemistry of Food</i> . Wiley Blackwell.		Pdf
6	Petrusevska-Tozi, L.; Zivic, Z.; Petreska Ivanovska, T. <i>Fundamentals of Dietotherapy</i> . Faculty of Pharmacy, Skopje.	20	/
7	Trajkovic, J.; Miric, M.; Baras, J.; Siler, S. <i>Food Analysis</i> . Faculty of Technology and Metallurgy, University of Belgrade.	18	/
8	Spasic, S.; Jelic-Ivanovic, Z.; Spasojevic-Kalimanovska, V. <i>Medical Biochemistry</i> .	15	/
9	Straus, B. <i>Medical Biochemistry</i> . Medicinska Naklada, Zagreb.	15	/
10	Kadifkova Panovska, T.; Hiljadnikova-Bajro, M. <i>Manual for Practical Teaching in Clinical Biochemistry</i> . Faculty of Pharmacy, Skopje.	/	Pdf
11	Jokanovic, M. <i>Toxicology</i> . Elit Medica.	20	/
12	Klaassen, C.D.; Watkins, J.B. III. <i>Casarett and Doull's Toxicology: The Basic Science of Poisons</i> .	/	Pdf
13	Barile, F.A. <i>Barile's Clinical Toxicology: Principles and Mechanisms</i> . Taylor & Francis Group.	/	Pdf
14	Dreisbach, R.H.; Robertson, W.O. <i>Handbook of Poisoning</i> . The Parthenon Publishing Group.	17	/
15	Gupta, R.C. <i>Nutraceuticals: Efficacy, Safety and Toxicity</i> . Academic Press (Elsevier).	/	Pdf
16	Berginc, K.; Kreft, S. <i>Dietary Supplements: Safety, Efficacy and Quality</i> . Woodhead Publishing (Elsevier).	/	Pdf
17	Boullata, J.I.; Armenti, V.T. <i>Handbook of Drug-Nutrient Interactions</i> . Humana Press.	/	Pdf
18	Pintauro, S.J. <i>The Regulation of Dietary Supplements</i> . Taylor & Francis Group.	/	Pdf
19	Kellz, W. <i>Pharmacy – What It Is and How It Works</i> . 4th ed., Taylor &	/	Pdf

	Francis Group, USA, 2017 (electronic edition).		
20	Winfield, A.J.; Rees, J.; Smith, I. <i>Pharmaceutical Practice</i> . 4th ed., Churchill Livingstone, Elsevier, 2009 (electronic edition).	/	pdf
21	<i>Pharmaceutical Dosage Forms – Routes of Administration, Contact Packaging – Standard Terms and Definitions</i> . Ministry of Health, 2002.	2	
22	Dimitrovska, A. et al. <i>Evaluation of Chemical Substances for Pharmaceutical Use According to the European Pharmacopoeia</i> . Sofia–Bogdanci, 2020 (electronic).	/	pdf
23	European Pharmacopoeia Commission. <i>European Pharmacopoeia (Ph. Eur.)</i> . EDQM, Council of Europe, Strasbourg, France (current electronic edition).	/	pdf
24	Assembly of the Republic of North Macedonia. <i>National Legislation (Law on Medicines, Rulebooks, Guidelines)</i> . Official Gazette of the Republic of North Macedonia.	/	pdf
25	Nikolovski, B. <i>Contributions to the History of Health Culture in Macedonia</i> . MFD, Skopje, 1995.	2	
26	Crommelin, D.J.A.; Sindelar, R.D.; Meibohm, B. <i>Pharmaceutical Biotechnology: Fundamentals and Applications</i> (translated edition). Ars Lamina, 2017 (hard copy).	10	
27	Ansel, M.; Popovich, N.; Allen, L. <i>Pharmaceutical Dosage Forms and Drug Delivery Systems</i> . 8th ed., Williams & Wilkins, 2004 (electronic edition).	/	pdf
28	Aulton, M. <i>Pharmaceutics: The Science of Dosage Form Design</i> . 2nd ed., Churchill Livingstone, 2002 (electronic edition).	/	pdf
29	<i>Remington: The Science and Practice of Pharmacy</i> . 21st ed., Mack Publishing, 2005 (electronic edition).	/	pdf
30	Shargel, L.; Wu-Pong, S.; Yu, A.B.C. <i>Applied Biopharmaceutics and Pharmacokinetics</i> . McGraw-Hill, 2015.		pdf

31	Washington, N.; Washington, C.; Wilson, C. <i>Physiological Pharmaceutics: Barriers to Drug Absorption</i> . 2nd ed., CRC Press, 2001.		pdf
32	Krishna, R.; Yu, L. <i>Biopharmaceutics Applications in Drug Development</i> . Springer, 2010.		pdf
33	Taylor, K.M.G.; Aulton, M.E. <i>Aulton's Pharmaceutics: The Design and Manufacture of Medicines</i> . 6th ed., Elsevier, 2021 (electronic edition).		pdf
34	Allen, L.V. <i>Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems</i> . 11th ed., Lippincott Williams & Wilkins, 2017 (electronic edition).		pdf
35	Simov, A.; Simova, Z. <i>Pharmaceutical Technology</i> . 2001 (hard copy).		pdf
36	<i>British Pharmacopoeia</i> . Electronic edition.	6	
37	<i>British National Formulary</i> . Electronic edition.		
38	<i>United States Pharmacopeia – Drug Information</i> . Electronic edition.		
39	<i>United States Pharmacopeia</i> . Electronic edition.		
40	Beyadgo, W.G. <i>Foundations of Pharmaceutical Quality Assurance in GxP</i> . 2024 (electronic edition).		
41	Nally, J.D. <i>Good Manufacturing Practices for Pharmaceuticals</i> . 6th ed., Informa Healthcare, 2007 (electronic edition).		pdf
43	Dzekova-Stojkova, S.A.; Korneti, P.G.; Todorova, B.B.; Trajkovska, S.K. <i>Biochemistry</i> . Ss. Cyril and Methodius University, Skopje.		pdf
44	Denke, D.; Kolman, J.; Fuchs, G.; Gerok, V. <i>Biochemistry and Pathobiochemistry</i> . Miken, Bitola.		pdf
45	Hiljadnikova-Bajro, M.; Kadifkova Panovska, T. <i>Biochemistry Practicum</i> . Faculty of Pharmacy, Ss. Cyril and Methodius University, Skopje.	1	
46	Kaltejt, T. <i>Food: Chemistry of Food Components</i> . Ars Lamina LLC.		pdf

47	Velíšek, J. <i>The Chemistry of Food</i> . Wiley Blackwell.		pdf
48	Petrusevska-Tozi, L.; Zivic, Z.; Petreska Ivanovska, T. <i>Fundamentals of Dietotherapy</i> . Faculty of Pharmacy, Skopje.		pdf
49	Trajkovic, J.; Miric, M.; Baras, J.; Siler, S. <i>Food Analysis</i> . Faculty of Technology and Metallurgy, University of Belgrade.		pdf
50	Spasic, S.; Jelic-Ivanovic, Z.; Spasojevic-Kalimanovska, V. <i>Medical Biochemistry</i> .		pdf
51	Straus, B. <i>Medical Biochemistry</i> . Medicinska Naklada, Zagreb.		pdf
52	Kadifkova Panovska, T.; Hiljadnikova-Bajro, M. <i>Manual for Practical Teaching in Clinical Biochemistry</i> . Faculty of Pharmacy, Skopje.		pdf
53	Jokanovic, M. <i>Toxicology</i> . Elit Medica.		pdf
54	Klaassen, C.D.; Watkins, J.B. III. <i>Casarett and Doull's Toxicology: The Basic Science of Poisons</i> .	1	
55	Barile, F.A. <i>Barile's Clinical Toxicology: Principles and Mechanisms</i> . Taylor & Francis Group.		pdf
56	Dreisbach, R.H.; Robertson, W.O. <i>Handbook of Poisoning</i> . The Parthenon Publishing Group.		pdf
57	Gupta, R.C. <i>Nutraceuticals: Efficacy, Safety and Toxicity</i> . Academic Press (Elsevier).		pdf
58	Berginc, K.; Kreft, S. <i>Dietary Supplements: Safety, Efficacy and Quality</i> . Woodhead Publishing (Elsevier).	1	
59	Boullata, J.I.; Armenti, V.T. <i>Handbook of Drug–Nutrient Interactions</i> . Humana Press.	1	
60	Pintauro, S.J. <i>The Regulation of Dietary Supplements</i> . Taylor & Francis Group.	1	
62	Kellz, W. <i>Pharmacy – What It Is and How It Works</i> . 4th ed., Taylor & Francis Group, USA, 2017 (electronic edition).	10	

63	Winfield, A.J.; Rees, J.; Smith, I. <i>Pharmaceutical Practice</i> . 4th ed., Churchill Livingstone, Elsevier, 2009 (electronic edition).	10	
64	<i>Pharmaceutical Dosage Forms – Routes of Administration, Contact Packaging – Standard Terms and Definitions</i> . Ministry of Health, 2002.		pdf
65	Dimitrovska, A. et al. <i>Evaluation of Chemical Substances for Pharmaceutical Use According to the European Pharmacopoeia</i> . Sofia–Bogdanci, 2020 (electronic).		pdf
66	European Pharmacopoeia Commission. <i>European Pharmacopoeia (Ph. Eur.)</i> . EDQM, Council of Europe, Strasbourg, France (current electronic edition).		pdf
67	Assembly of the Republic of North Macedonia. <i>National Legislation (Law on Medicines, Rulebooks, Guidelines)</i> . Official Gazette of the Republic of North Macedonia.		pdf
68	Nikolovski, B. <i>Contributions to the History of Health Culture in Macedonia</i> . MFD, Skopje, 1995.		pdf
69	Crommelin, D.J.A.; Sindelar, R.D.; Meibohm, B. <i>Pharmaceutical Biotechnology: Fundamentals and Applications</i> (translated edition). Ars Lamina, 2017 (hard copy).		pdf
70	Ansel, M.; Popovich, N.; Allen, L. <i>Pharmaceutical Dosage Forms and Drug Delivery Systems</i> . 8th ed., Williams & Wilkins, 2004 (electronic edition).		pdf
71	Aulton, M. <i>Pharmaceutics: The Science of Dosage Form Design</i> . 2nd ed., Churchill Livingstone, 2002 (electronic edition).		pdf
72	<i>Remington: The Science and Practice of Pharmacy</i> . 21st ed., Mack Publishing, 2005 (electronic edition).	1	
73	Shargel, L.; Wu-Pong, S.; Yu, A.B.C. <i>Applied Biopharmaceutics and Pharmacokinetics</i> . McGraw-Hill, 2015.	1	
74	Washington, N.; Washington, C.; Wilson, C. <i>Physiological Pharmaceutics: Barriers to Drug</i>		pdf

	<i>Absorption</i> . 2nd ed., CRC Press, 2001.		
2	Additional Literature		
1	Brownie, K.A.; Kernohan, K.J. <i>Medical Biochemistry</i> . Tabernakul, Skopje.	7	/
2	Murray, J.; Harper. <i>Illustrated Biochemistry</i> . Ars Lamina.	7	/
3	Nelson, D.L.; Cox, M.M. <i>Lehninger: Principles of Biochemistry</i> . Miken, Bitola.	8	/
4	Hiljadnikova-Bajro, M. <i>Collection of Questions in Biochemistry</i> . Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje.	/	Pdf
5	Coulston, A.M.; Boushey, C.J.; Ferruzzi, M.G.; Delahanty, L.M. <i>Nutrition in the Prevention and Treatment of Disease</i> . Academic Press.	/	Pdf
6	Visakh, P.M.; Iturriaga, L.B.; Ribotta, P.; Thomas, S. <i>Advances in Food Science and Nutrition</i> . Scrivener Publishing.	/	Pdf
8	Srilakshmi, B. <i>Dietetics</i> . New Age International (P) Ltd.	9	/
9	Đorđević, B.; Šobajić, S.; Stanković, I.; Đuričić, I.; Vidović, B.; Ivanović, N.; Todorović, V.; Zrnić Ćirić, M.; Baralić, I.; Mazić, S.; Antunović, M.; Panišić-Šekeljić, M. <i>Selected Chapters of Dietetics</i> . University of Belgrade – Faculty of Pharmacy.	7	/
10	Bishop, M.L.; Fody, E.P.; Schoeff, L.E. <i>Clinical Chemistry: Principles, Procedures, Correlations</i> . 5th ed., Prosvetno Delo AD, Skopje.	7	/
11	Laposata, M. <i>Laboratory Medicine: The Diagnosis of Disease in the Clinical Laboratory</i> . McGraw-Hill Medical.	10	/
12	Hodgson, E. <i>A Textbook of Modern Toxicology</i> . John Wiley & Sons.	/	Pdf
13	Hayes, A.W. <i>Principles and Methods of Toxicology</i> . Taylor & Francis Group.	7	/
14	Devlin, T.M. <i>Textbook of Biochemistry with Clinical</i>	10	/

	<i>Correlations</i> . 7th ed., Ars Lamina, Skopje.		
15	Wildman, R.E.C.; Bruno, R.S. <i>Handbook of Nutraceuticals and Functional Foods</i> . Taylor & Francis Group.	/	Pdf
16	Coates, P.M.; Betz, J.M.; Blackman, M.R.; Cragg, G.M.; Levine, M.; Moss, J.; White, J.D. <i>Encyclopedia of Dietary Supplements</i> . Informa Healthcare.	/	Pdf
17	Egbuna, C.; Dable-Tupas, G. <i>Functional Foods and Nutraceuticals</i> . Springer.	/	Pdf
18	Relevant papers in international scientific journals; EMA and FDA websites.		pdf
19	Florence, A.T.; Siepmann, J. <i>Modern Pharmaceutics: Applications and Advances</i> . 5th ed., Informa Healthcare, 2009 (electronic edition).		pdf
20	Adejare, A. <i>Remington: The Science and Practice of Pharmacy</i> . 23rd ed., Elsevier, 2020 (electronic edition).		pdf
21	Nally, J.D. <i>Good Manufacturing Practices for Pharmaceuticals</i> . 6th ed., Informa Healthcare, 2007 (electronic edition).		pdf
22	Huynh-Ba, K. <i>Handbook of Stability Testing in Pharmaceutical Development</i> . Springer, 2009 (electronic edition).		pdf
23	Sandle, T. <i>Sterility, Sterilisation and Sterility Assurance for Pharmaceuticals: Technology, Validation and Current Regulations</i> . Elsevier Science, 2013 (electronic edition).		pdf
24	Alberts, B.; Johnson, A.; Lewis, J.; Raff, M.; Roberts, K.; Walter, P. <i>Molecular Biology of the Cell</i> . 4th ed., Garland Science, 2002 (hard copy).	1	
25	Carp, G. <i>Cell and Molecular Biology: Concepts and Experiments</i> . 4th ed., John Wiley & Sons, 2005 (electronic/hard copy).	1	pdf
26	Group of authors. <i>Flora of the Republic of North Macedonia</i> . Macedonian Academy of Sciences and Arts (MANU) (hard copy).	1	

27	Group of authors. <i>Flora of the Republic of Serbia</i> . Serbian Academy of Sciences and Arts (SANU) (hard copy).	1	
28	Group of authors. <i>Flora of the Republic of Bulgaria</i> . Bulgarian Academy of Sciences (BAS) (hard copy).	1	
29	Bruneton, J. <i>Pharmacognosy, Phytochemistry and Medicinal Plants</i> . 2nd ed., Intercept Ltd., 1999 (hard copy).	1	
30	Evans, W.C. <i>Evans' Pharmacognosy</i> . W.B. Saunders, 2002 (hard copy).	1	
31	Capasso, F.; Gaginella, T.; Grandolini, G.; Izzo, A. <i>Phytotherapy: A Quick Reference to Herbal Medicine</i> . Springer, 2003 (electronic edition).		pdf
32	Mills, S.; Bone, K. <i>Principles and Practice of Phytotherapy</i> . Churchill Livingstone, 2000 (electronic edition).		pdf
33	Wiert, C. <i>Ethnopharmacology of Medicinal Plants: Asia and the Pacific</i> . Humana Press, 2006 (hard copy).	1	
34	Singh, A. <i>Herbalism, Phytochemistry and Ethnopharmacology</i> . Science Publishers, 2011 (electronic edition).		pdf
35	Martin, G.J. <i>Journal of Ethnopharmacology / Frontiers in Pharmacology</i> . Chapman & Hall, 1995 (electronic edition).		pdf
36	EFSA Panel. <i>Guidance on Safety Assessment of Botanicals and Botanical Preparations Intended for Use as Ingredients in Food Supplements</i> . EFSA, 2009 (electronic edition).		pdf
37	Kulevanova, S.; Stefkov, G.; Karapandzova, M.; Cvetkovic Karanfilova, I. <i>Pharmacognosy: Natural Medicinal and Aromatic Raw Materials</i> . Ss. Cyril and Methodius University, 2023 (electronic reviewed textbook).		pdf
38	Kulevanova, S.; Stefkov, G.; Karapandzova, M. <i>Phytochemistry</i> . Ss. Cyril and Methodius University, 2011 (hard copy).	10	pdf

		1%86%D0%B8%D1%98%D0%B0-%D0%A4%D0%A4.pdf
6.	Rules of Procedure of the Teaching-Scientific or Scientific Council	http://www.ff.ukim.edu.mk/wp-content/uploads/2023/12/%D0%94%D0%B5%D0%BB%D0%BE%D0%B2%D0%BD%D0%B8%D0%BA-%D0%A4%D0%A4.pdf
7.	Report and Decision on the Latest Appointment to Academic Rank for Each Teacher and Associate, Published in the Bulletin	http://www.ff.ukim.edu.mk/%d0%bd%d0%b0%d1%81%d1%82%d0%b0%d0%b2%d0%bd%d0%be-%d0%bd%d0%b0%d1%83%d1%87%d0%b5%d0%bd-%d0%b8-%d1%81%d0%be%d1%80%d0%b0%d0%b1%d0%be%d1%82%d0%bd%d0%b8%d1%87%d0%ba%d0%b8-%d0%ba%d0%b0%d0%b4%d0%b0%d1%80/
8.	Work Assignment Schedule	http://www.ff.ukim.edu.mk/wp-content/uploads/2023/04/%D0%9F%D1%80%D0%B0%D0%B2%D0%B8%D0%BB%D0%BD%D0%B8%D1%86%D0%B8-%D0%B2%D0%BD%D0%B0%D1%82%D1%80%D0%B5%D1%88%D0%BD%D0%B0-%D0%BE%D1%80%D0%B3%D0%B0%D0%BD%D0%B8%D0%B7%D0%B0%D1%86%D0%B8%D1%98%D0%B0-%D0%B8-%D1%81%D0%B8%D1%81%D1%82%D0%B5%D0%BC%D0%B0%D1%82%D0%B8%D0%B7%D0%B0%D1%86%D0%B8%D1%98%D0%B0-%D0%A4%D0%A4.pdf
9.	Approved Topics for Master's/Doctoral Theses	http://www.ff.ukim.edu.mk/%d0%bc%d0%b0%d0%b3%d0%b8%d1%81%d1%82%d0%b5%d1%80%d1%81%d0%ba%d0%b8-%d1%81%d0%bf%d0%b5%d1%86%d0%b8%d1%98%d0%b0%d0%bb%d0%b8%d1%81%d1%82%d0%b8%d1%87%d0%ba%d0%b8-%d1%82%d0%b5%d0%bc%d0%b8/
10.	Acts Adopted by the Unit in Accordance with Other Laws	http://www.ff.ukim.edu.mk/%d0%b8%d0%bd%d1%84%d0%be%d1%80%d0%bc%d0%b0%d1%86%d0%b8%d0%b8-%d0%bc%d0%b4-%d1%98%d0%b0%d0%b2%d0%b5%d0%bd-%d0%ba%d0%b0%d1%80%d0%b0%d0%ba%d1%82%d0%b5%d1%80/
11.	Code of Ethics	https://www.ukim.edu.mk/dokumenti_m/248_Eticki_kod_eks.pdf

22. Activities and Mechanisms for Developing and Maintaining Teaching Quality

The improvement and maintenance of teaching quality are carried out through various forms and mechanisms. The Faculty of Pharmacy continuously implements activities to ensure:

- Teaching materials for the preparation and delivery of theoretical and practical instruction,
- Adequate spatial and other conditions for conducting classes,
- Equipment, tools, and apparatus necessary for the delivery of theoretical and practical instruction,
- Electronic access to required information of various kinds, etc.

Another mechanism for enhancing and maintaining teaching quality includes regular student surveys and reports on evaluation and self-evaluation.

23. Results from the Conducted Self-Evaluation

The self-evaluation was carried out in accordance with the Guidelines on the Unified Basis for Evaluation and Evaluation Procedures of Universities, adopted by the Agency for Higher Education Evaluation in the Republic of Macedonia and the Interuniversity Conference of the Republic of Macedonia (Skopje–Bitola, September 2002).

The self-evaluation was conducted by the Self-Evaluation Committee composed of: Prof. Dr. Marija Hiljadnikova Bajro, Prof. Dr. Zorica Naumovska, Prof. Dr. Natalija Nakov, Prof. Dr. Liljana Anastasova, Assoc. Prof. Dr. Ivana Cvetkovikj Karanfilova, and two student representatives. The Self-Evaluation Report of the Faculty of Pharmacy – Skopje was prepared in April 2023 and covers the period from October 2019 to September 2022. The report of the conducted self-evaluation has been published on the Faculty's website: (<http://www.ff.ukim.edu.mk/samoevaluacija/>).

The most recent self-evaluation report was prepared in September 2024 and covers the academic year 2023/2024. The report of the conducted self-evaluation is available on the Faculty's website: <http://www.ff.ukim.edu.mk/wp-content/uploads/2024/10/Izvestaj-za-samoevaluacija-Farmaceutski-fakultet-2023-24-WEB.pdf>.

24. Alignment of the structure and content of the study cycle with the general and specific descriptors

Type of descriptor	Description

Application of knowledge and understanding	Demonstrates knowledge and understanding in the field of pharmacy, building upon general secondary education and the qualifications required for entry into higher education, across the main areas of pharmaceutical practice and science. Applies appropriate methodologies for problem-solving in both a systematic and creative manner, providing a foundation or opportunity for originality in the development and/or application of autonomous ideas within the context of practice and research. Possesses knowledge in theoretical, practical, conceptual, comparative, and critical perspectives within the field of pharmacy, according to appropriate methodology. Demonstrates understanding in pharmaceutical chemistry, pharmaceutical technology, drug production and testing, laboratory analysis of medicines, pharmacognosy, pharmacotherapy, wholesale storage, handling, and distribution of medicines, preparation, testing, storage, and dispensing of medicines in community pharmacies, preparation, testing, storage, and distribution of medicines in hospitals, as well as providing information and advice regarding medicines. Shows awareness of current issues related to scientific research and emerging sources of knowledge in pharmacy. Demonstrates the knowledge required to practice pharmacy within the framework of legislation and according to professional standards and ethical principles, to design, formulate, produce, and test medicines, medicinal products, and medical devices, and to ensure appropriate outcomes from pharmacotherapy at all levels of healthcare. Exhibits critical understanding of key theories, principles, and methods in pharmaceutical science and practice, with the ability to consolidate knowledge vertically, horizontally, and laterally.
Applies knowledge and understanding	Applies knowledge and understanding based on evidence in the field of pharmaceutical science and the management of pharmaceutical practice, including the formulation, production, and quality assurance of medicines, medicinal products, and medical devices, as well as in planning, managing, advising, and reviewing general patient care programs. Demonstrates competence in identifying, analyzing, and solving problems within relevant areas of pharmaceutical science and practice, utilizing modern technology. Possesses the ability to construct and support arguments and to adopt an individual, multidisciplinary, creative, and original approach in new or unfamiliar contexts related to the field of study.
Ability to Evaluate	Demonstrates the ability to gather, analyze, evaluate, and present information, ideas, and concepts from complete, incomplete, or limited relevant data in key areas of pharmaceutical practice. Shows the ability to assess and select scientific theories, methodologies, tools, and general skills in the core areas of pharmaceutical science. Demonstrates the ability to apply skills in a range of routine and complex situations requiring analysis or comparison of multiple options. Recognizes priorities when solving problems and identifies deviations from standard approaches. Demonstrates the ability to conduct objective, evidence-based evaluation of theoretical and practical issues in relevant areas of pharmaceutical science and practice, identifies the underlying causes of the issues, and selects appropriate solutions. Shows the ability to follow legal, ethical, professional, and organizational policies/procedures and codes, and, when necessary, to take actions based on personal interpretation of the broader scope of professional policies/procedures.

Communication Skills	Uses appropriate professional communication to establish collaboration with individual patients, specific patient groups, colleagues, healthcare professionals, and organizational management. Demonstrates the ability to communicate in contexts where the discussion framework, decision-making criteria, and scope of tasks are either clearly defined or based on professional judgment. Shows capability for independent participation in specific, scientific, and interdisciplinary discussions with a professional approach. Accepts and seeks specialist advice and shared responsibility within a team. Leads and encourages activities.
Learning Skills	Demonstrates the ability to independently identify personal needs and interests for continuous education and professional development, to design strategies and plans for promoting personal intellectual growth, to organize advanced learning activities, and to critically evaluate the appropriateness of learning methods and their impact on knowledge, skills, competence, and professional practice. Exhibits the ability to document learning activities through the creation of an individual portfolio.

23.a. Specific Qualification Descriptors for First and Second Cycle Integrated Studies with 300 ECTS for the Study Program Submitted for Re-accreditation, in Accordance with the Regulation on the National Framework of Higher Education Qualifications

Type of descriptor	Description
Application of knowledge and understanding	Demonstrates a high level of professional competence in the field of pharmacy, possessing knowledge of the fundamental biological and chemical disciplines necessary for the study of pharmaceutical sciences; knowledge of drugs and substances used in drug production; processes for manufacturing drugs and other pharmaceutical preparations; preclinical and clinical testing of drugs; and expertise in drug formulation and other aspects related to pharmaceutical technology. Demonstrates knowledge of the physicochemical, pharmacokinetic, pharmacodynamic, and biopharmaceutical properties of drugs, the procedures and methods of drug design, their metabolism, and mechanisms of action. Possesses knowledge in the physical, chemical, biological, and microbiological testing of drugs. Has understanding of the etiology, pathogenesis, and course of common disorders/diseases of human organs and systems, the fundamentals of pharmacotherapy, and comprehensive knowledge of all individual drug classes based on their chemical structure or anatomical system of action, their clinical application, specifics of therapy individualization, the influence of chemical structure on drug activity, and potential adverse effects and interactions. Demonstrates knowledge of the fundamental principles of phytotherapy and the role of modern phytotherapy in contemporary medicine and pharmacy, mechanisms of action of natural products, and their use in the treatment of disorders and diseases of human organs and systems, including aspects of production and quality control. Possesses adequate knowledge for the preparation and evaluation of statistical, biochemical, pharmacoeconomic, pharmacoepidemiological, and other data relevant to drugs and pharmaceutical products, as well as skills for the objective evaluation of professional literature to provide accurate information based on such knowledge. Possesses knowledge of the application of appropriate communication skills in daily practice, as well as the proper storage, dispensing, and distribution of drugs in accordance with good practices in pharmaceutical activity. Demonstrates adequate knowledge of the legal and other requirements associated with the pharmaceutical profession.

Applies knowledge and understanding	Possesses the ability to apply knowledge in addressing issues related to: good practices (manufacturing, laboratory, and distribution) in pharmaceutical activity; design and production of pharmaceutically active chemical substances; formulation of pharmaceutical dosage forms; manufacturing of pharmaceutical preparations; physical, chemical, biological, and microbiological testing of drugs; pharmacokinetic, pharmacodynamic, and biopharmaceutical properties of drugs; preclinical and clinical testing of drugs; the influence of chemical structure on drug activity; application of drugs and other pharmaceutical products in therapy; prevention of potential toxic and other adverse effects of drug use; and possible drug–drug and drug–food interactions during administration of drugs and other pharmaceutical products. Demonstrates competence in the rational use of drugs based on the principles of Evidence-Based Medicine. Shows professional and scientific readiness to detect, define, and analyze problems; determine, advise, and prescribe therapy with pharmaceutical preparations; and monitor the success of therapy, employing a multidisciplinary, individual, creative, original, and scientific approach in new or unfamiliar environments, and within a multidisciplinary context related to the field of study.
Ability to Evaluate	Demonstrates the ability for professional analysis and interpretation of the fundamental principles of pharmacotherapy and an understanding of the skills required for its critical evaluation and research. Possesses the capability to assess and evaluate pharmaceutically active chemical compounds as well as plant-based and other natural raw materials, their chemical and other characteristics, pharmacological and biological activity, specific properties of dosage pharmaceutical forms, the production processes of medicines and other pharmaceutical products, their use in prevention and treatment, health promotion and protection, the efficacy and safety of pharmaceutical products, and the specific requirements and complexity of quality control methods. Demonstrates the ability to evaluate the prescribing and administration of therapy with medicines and other pharmaceutical products, as well as to assess the outcomes of such therapy. Shows the capability to adhere to legal, ethical, professional, and organizational policies, procedures, and codes and, when necessary, to undertake actions based on independent interpretation of the broader scope of professional policies and procedures.
Communication Skills	Uses appropriate professional communication to establish collaboration with patients, organizational management, colleagues, and professionals whose training widely varies across the fields of natural, biomedical, and biotechnological sciences and practice. Demonstrates the ability to communicate where the context of the discussion, decision-making criteria, and scope of tasks are clearly defined. Shows the capacity for independent participation in specific interdisciplinary discussions on practical and scientific aspects of pharmaceutical practice, with a professional approach. Accepts consultations for advice and shared responsibility within the team. Demonstrates the ability for professional communication where the context of discussion, decision-making criteria, and scope of tasks are either clearly defined or based on judgment. Utilizes appropriate professional communication to establish both collaboration and education with individual patients, patient groups, colleagues, and other healthcare professionals.

Learning Skills	Takes initiative to identify needs for acquiring further knowledge and for continuous learning with a high degree of independence. Follows current scientific literature and possesses the skills for its appropriate critical evaluation in order to improve expertise within the specialized field. Designs strategies and plans for promoting personal professional development and participates in learning activities, critically assessing the appropriateness of learning methods and their impact on knowledge, skills, competence, and practice with a high degree of independence.

23. Alignment of Theoretical and Practical Teaching with the Objectives of the Study Program

Table 24.1. List of institutions with which the higher education institution has concluded agreements for the implementation of practical training in the study field of the study program for which accreditation is sought

Serial No.	Name of Institution	Method of Conducting Practical Training	Scheduled Duration for Conducting Practical Training
1.	/	/	/

25. Alignment of the Study Program with the European Higher Education Area and Comparability with Programs at European Higher Education Institutions

Table 25.1 Institutions or study programs through which the alignment of the study program with the European Higher Education Area and its comparability with programs at European higher education institutions is confirmed

Serial No.	Name of Institution	Name of Study Program Ensuring Comparability	Link to the Study Program
1.	Faculty of Pharmacy, University of Belgrade, Serbia	Study Program in Pharmacy	https://www.pharmacy.bg.ac.rs/en/studies/143/integrated-academic-studies/
2.	Faculty of Pharmacy, University of Valencia		https://www.uv.es/uvweb/undergraduate-degree-pharmacy/en/what-can-study-/degree-programme/degree-programme/degree-pharmacy-1285929278509/Titulacio.html?id=1285847331709&plantilla=GRAU_Farmacia/Page/TPGDetail&p2=2

26. Rules Governing the Preparation of Written Exams, Assignments, Essays, Seminar Papers, Projects, Theses, Master's Theses, and Other Written Activities, Covering at a Minimum the Required Content, Scope, Writing Method, and Other Relevant Requirements

Link to Guidelines Governing the Preparation of Seminar Papers, Bachelor Theses, and Master Theses:
<http://www.ff.ukim.edu.mk/upatstva/>

27. Information on Secured Financial Guarantee for the Study Program ¹

Table 27.1. Value of the Financial Guarantee

Value of the Submitted Bank Guarantee	Tuition Fee Paid by the Student upon Enrollment in the Study Program	Total Number of Students Enrolled at the Higher Education Institution (University or College)	Number of Students for Whom Accreditation Is Requested
/	/	/	/

¹ To be completed by private higher education institutions and colleges

28. DOCUMENTS

1. Предлог Одлука за усвојување на студиската програма од Наставно-научниот совет на факултетот, наставничкиот совет на високата стручна школа или научниот совет на научниот институт член 110 и член 145 од Законот за високо образование („Службен весник на Република Македонија“ бр.82/2018)

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ
Бр. ак-347/31
29.12.2025
СКОПЈЕ


Универзитет „Св. Кирил и Методиј“ Скопје
ФАРМАЦЕВТСКИ ФАКУЛТЕТ Скопје

Врз основа на член 110 од Законот за високото образование (Службен весник на Република Македонија бр.82/2018 и Службен весник на Република Северна Македонија бр.178/2021, бр.58/2024 и бр.124/2025) член 55, став 1, точка 6 од Статутот на Фармацевтски факултет-Скопје во состав на Универзитетот „Св.Кирил и Методиј“ во Скопје (Универзитетски гласник бр.459/2019 и бр.626/2022) согласно Одлуката за именување на членови на Комисија за подготовка на Елаборатот за студиската програма магистер по фармација - интегрирани студии од прв и втор циклус (03-443/2 од 03.10.2025 година) како и врз основа на поднесениот предлог Елаборат за акредитација на студиската програма магистер по фармација - интегрирани студии од прв и втор циклус на англиски јазик, од страна на Комисијата за подготвување на Елаборатот, Наставно-научниот совет на Фармацевтски факултет во Скопје на XIV-та редовна седница на 29.12.2025 година ја донесе следнава

ПРЕДЛОГ ОДЛУКА
за усвојување на студиската програма магистер по фармација - интегрирани студии од прв и втор циклус на англиски јазик

член 1

Се усвојува елаборатот на студиската програма магистер по фармација - интегрирани студии од прв и втор циклус на англиски јазик во рамките на Фармацевтски факултет во Скопје во состав на Универзитетот „Св.Кирил и Методиј“ во Скопје.

член 2

Наставата од студиската програма магистер по фармација - интегрирани студии од прв и втор циклус на англиски јазик ќе започне да се изведува по добивањето согласност од Одборот за акредитација на високообразовните установи и по добивањето на согласност за исполнетост на условите за почеток со работа на студиската програма од страна на Агенцијата за квалитет на Република Северна Македонија.

член 3

Одлуката да се достави до Ректорска управа/Универзитетски Сенат на Универзитетот „Св.Кирил и Методиј“ во Скопје за усвојување на студиската програма магистер по фармација - интегрирани студии од прв и втор циклус на англиски јазик во рамките на Фармацевтски факултет во Скопје.

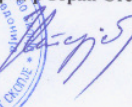
член 4

Составен дел на оваа одлука е елаборатот на студиската програма магистер по фармација - интегрирани студии од прв и втор циклус на англиски јазик.

член 5

Одлуката влегува во сила со денот на нејзиното донесување.

Декан
Проф. д-р Зоран Стерјев



Изготвил: Д.Анческа 
Одобрил: проф.д-р А.П.Пановска 



2. Одлука за усвојување на студиската програма од Универзитетскиот сенат, односно Советот на научната установа; член 94 и член 145 од Законот за високото образование (Службен весник на Република Македонија бр.82/2018)



Универзитет „Св. Кирил и Методиј“ Скопје
Ss. Cyril and Methodius University in Skopje

Одлука од УС
Ознака: ОВ 5.5/13
Страна: 1 од 1

Бр. 02-142/4
30.1.2026 година
Скопје

Врз основа на член 94, став (1), точка 3 од Законот за високото образование (Службен весник на Република Македонија бр. 82/2018 и Службен весник на Република Северна Македонија бр. 178/2021, бр. 58/2024 и бр. 124/2025) и член 157, став 1, точка 8 од Статутот на Универзитетот „Св. Кирил и Методиј“ во Скопје (Универзитетски гласник бр. 425/2019), по предлог на Наставно-научниот совет на Фармацевтскиот факултет, Универзитетскиот сенат на Универзитетот „Св. Кирил и Методиј“ во Скопје, на 27. седница одржана на 30.1.2026 година, донесе

ОДЛУКА

за усвојување на Елаборатот за студиската програма од интегрирани прв и втор циклус студии, на англиски јазик - Pharmacy на Фармацевтскиот факултет во Скопје

Член 1

Се усвојува Елаборатот за студиската програма од интегрирани прв и втор циклус студии, на англиски јазик - Pharmacy на Фармацевтскиот факултет во Скопје.

Член 2

Наставата од студиската програма од интегрирани прв и втор циклус студии на англиски јазик - Pharmacy, ќе започне да се изведува по добивањето согласност од Одборот за акредитација на високото образование и по добивањето согласност за исполнување на условите за почеток со работа на студиската програма од страна на Агенцијата за квалитет на високото образование на Република Северна Македонија.

Член 3

Одлуката се доставува до предлагачот и до Одборот за акредитација на високото образование на натамошна постапка за акредитација на студиската програма.

Член 4

Оваа Одлука стапува во сила со нејзиното донесување и ќе се објави во Универзитетскиот гласник.



Претседател на Универзитетскиот сенат

Проф. д-р Драги Димитриевски

3. Мислење од Одборот за соработка и доверба со јавноста



Универзитет „Св. Кирил и Методиј“ Скопје
ФАРМАЦЕВТСКИ ФАКУЛТЕТ

Република Северна Македонија
Универзитет „Св. Кирил и Методиј“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ

Бр. 01-950/2
29.12.2025 год.
СКОПЈЕ

Врз основа на член 122 од Законот за високото образование (Службен весник на Република Македонија бр. 82/18, и Службен весник на Република Северна Македонија бр. 178/2021, бр.58/2024 и бр.124/2025), Одборот за соработка и доверба со јавноста на Фармацевтскиот факултет во Скопје во состав на Универзитетот „Св. Кирил и Методиј“ во Скопје, на својата седница одржана на ден 29.12.2025 година го донесе следново:

МИСЛЕЊЕ

Се дава позитивно мислење за елаборат за акредитација за студиската програма магистер по фармација прв и втор циклус интегрирани студии на англиски јазик.

Образложение

Одборот за соработка и доверба со јавноста на Фармацевтскиот факултет во Скопје во состав на Универзитет „Св. Кирил и Методиј“ во Скопје го разгледа елаборатот за акредитација за студиската програма магистер по фармација прв и втор циклус интегрирани студии на англиски јазик и донесе заклучок дека предложената студиска програма ги исполнува условите за акредитација.

Поради сето тоа Одборот за соработка и доверба со јавноста на Фармацевтскиот факултет во Скопје го даде своето позитивно мислење.



Одбор за соработка со јавноста
Претседател

Проф. д-р Катерина Анчевска Нетковска

Доставено до:

- Архивата на Факултетот
- Ректорска управа на Универзитет „Св. Кирил и Методиј“ во Скопје

4. Statement by the teaching staff member giving consent to participate in the teaching for specific courses within the study programme

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Катерина Брезовска, избрана во звање редовен професор и вработена на Фармацевтскиот факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Fundamentals of pharmacy (4 ECTS)
2. Bioorganic chemistry (8 ECTS)
3. Instrumental pharmaceutical analysis (7 ECTS)
4. Quality control of medicines and pharmaceutical legislation (8 ECTS)
5. Quality management in analytical laboratory (4 ECTS)
6. Regulation for marketing authorisation of medicines and prevention of falsified medicines (4 ECTS)

Скопје

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Приклучо:	30-12-2025		
Орг. Единица:	Број:	Потпис:	Вредност:
03	972/1		

Подносител на изјава



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Елизабета Крстевска Божиновиќ, избран/а во звање редовен професор и вработен/а на доцент Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

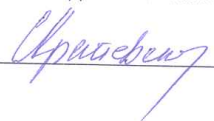
1. FUNDAMENTALS OF PHARMACOLOGY (6 ECTS)
2. MOLECULAR AND CELL BIOLOGY AND GENETICS (6 ECTS)
3. FUNDAMENTALS OF IMMUNOLOGY (3 ECTS)

Скопје

Подносител на изјава

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Едини.	Бр. на	Пр. лог.	Вредност
03	972/2		



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Гоше Стефков, избран/а во звање редовен професор и вработен/а на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Pharmaceutical botany and biology (7 ECTS credits)
2. Phytochemistry (7 ECTS credits)
3. Pharmacognosy (8 ECTS credits)
4. Phytotherapy (5 ECTS credits)
5. Rational use of herbal preparations (4 ECTS credits)
6. Ethnopharmacological approach in the development of new herbal preparations (4 ECTS credits)
7. Quality control of herbal products (4 ECTS credits)
8. Sustainability in pharmacy practice (4 ECTS credits)

Скопје

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Едини.	Број:	Примено:	Вредност:
03	972/3		

Подносител на изјава



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

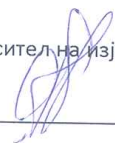
Јас Олга Гигопулу, избран/а во звање редовен професор и вработен/а на доцент Фармацевски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. ORGANIC CHEMISTRY APPLIED IN PHARMACY (8 ECTS)
2. BIOORGANIC CHEMISTRY (8 ECTS)
3. MANAGEMENT OF PHARMACEUTICAL WASTE (4 ECTS)

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
Скопје
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:			
Орг. Единица:	Бр.:	Датум:	Вредност:
C3	972/4	30-12-2025	

Подносител на изјава



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас проф д-р Билјана Бауер
избран/а во звање редовен професор и вработен/а на фармацевтски
факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во
изведување на настава од студиската програма магистер по фармација (интегриран прв и
втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Fundamentals of pharmacy (_4_ ECTS)
2. Pharmaceutical Botany and Biology (_7_ ECTS)
3. Ethnopharmacological Approach in the Development of New Herbal Preparations (Elective) (4__ ECTS)
4. Manufacturing of herbal preparations and quality standards (Elective) (_4_ ECTS)

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
Скопје
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Приложено:	30-12-2025		
Орг. Едини.	Број:	Прилог:	Вредност:
03	972/5		

Подносител на изјава

B. Baeva

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас **Ана Поцева Пановска**, избран/а во звање редовен професор и вработен/а на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. ORGANIC CHEMISTRY APPLIED IN PHARMACY (8 ECTS)
2. BIOORGANIC CHEMISTRY (8 ECTS)
3. PHARMACEUTICAL CHEMISTRY 1 (7 ECTS)
4. MANAGEMENT OF PHARMACEUTICAL WASTE (elective) (4 ECTS)
5. CHEMISTRY OF BIOLOGICALLY ACTIVE ELEMENTS (elective) (4 ECTS)
6. THERAPEUTIC DRUG MONITORING (elective) (4 ECTS)
7. SUSTAINABILITY IN PHARMACY PRACTICE (elective) (4 ECTS)

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Скопје

Применот:	30-12-2025		
Огн. Ел. бр.:	Збор:	Прв. огн. бр.:	Вредност:
03	972/18		

Подносител на изјава



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведуваче на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Кристина Шутевска Ачевска, избран/а во звање доцент и вработен/а на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведуваче на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Biochemistry (6 ECTS)
2. Clinical Biochemistry (7 ECTS)

Република Северна Македонија
Скопје
Универзитет „Св. Кирил и Методиј“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено: 30-12-2025			
Орг. Единица	Број	Период	Вредност
03	972/7		

Подносител на изјава

K. A.

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Благој Ачевски, избран/а во звање доцент и вработен/а на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Physical chemistry for pharmacists
2. Analytical chemistry applied in pharmacy
3. Instrumental pharmaceutical analysis
4. "Green" chemistry in pharmaceutical analysis

Република Северна Македонија
Универзитет "СВ. КИРИЛ И МЕТОДИЈ"
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Единица:	Број:	Примено:	Вредност:
03	972/8		

Подносител на изјава

JB

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Евгенија Михајлоска, избран/а во звање доцент и вработен/а на Фармацевтскиот факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Pharmaceutical chemistry II _____ (6 ECTS)
(предметот да се напише на англиски јазик)
2. Pharmaceutical chemistry III _____ (8 ECTS)
(предметот да се напише на англиски јазик)
3. Pharmaceutical law and ethics _____ (3 ECTS)
(предметот да се напише на англиски јазик)
4. Social pharmacy and public health _____ (3 ECTS)
(предметот да се напише на англиски јазик)
5. Fundamentals of clinical pharmacy _____ (4 ECTS)
(предметот да се напише на англиски јазик)
6. Clinical pharmacy and pharmacotherapy _____ (8 ECTS)
(предметот да се напише на англиски јазик)
7. Pharmacoeconomics and pharmacoepidemiology _____ (4 ECTS)
(предметот да се напише на англиски јазик)

Република Северна Македонија
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ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено: 30-12-2025			
Орг. Едини	Број	Помест	Вредност
03	972/5		

Подносител на изјава



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Ана Трајковска, избран/а во звање доцент и вработен/а на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Fundamentals of pharmacy (4 ECTS credits)
2. Pharmaceutical botany and biology (7 ECTS credits)
3. Phytochemistry (7 ECTS credits)
4. Pharmacognosy (8 ECTS credits)
5. Rational use of herbal preparations (4 ECTS credits)
6. Ethnopharmacological approach in the development of new herbal preparations (4 ECTS credits)
7. Quality control of herbal products (4 ECTS credits)
8. Manufacturing of herbal preparations and quality standards (4 ECTS credits)

Скопје

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено: 30-12-2025			
Орг. Едини.	Број:	Датум:	Вредност:
03	972/10		

Подносител на изјава



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Вероника Стоилковска Ѓоргиевска, избран/а во звање доцент и вработен/а на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Fundamentals of pharmacy (4 ECTS credits)
2. Pharmaceutical botany and biology (7 ECTS credits)
3. Phytochemistry (7 ECTS credits)
4. Pharmacognosy (8 ECTS credits)
5. Rational use of herbal preparations (4 ECTS credits)
6. Ethnopharmacological approach in the development of new herbal preparations (4 ECTS credits)
7. Quality control of herbal products (4 ECTS credits)
8. Manufacturing of herbal preparations and quality standards (4 ECTS credits)

Република Северна Македонија
Скопје
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено: 30-12-2025			
Орг. Единица	Број	Сл. Лог	Вредност
03	972/19		

Подносител на изјава

V. Stal

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Ивана Цветковиќ Каранфилова, избран/а во звање доцент и вработен/а на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. PHARMACEUTICAL BOTANY AND BIOLOGY (7 ECTS)
2. RATIONAL USE OF HERBAL PREPARATIONS (4 ECTS)
3. MANUFACTURING OF HERBAL PREPARATIONS AND QUALITY STANDARDS (4 ECTS)
4. QUALITY CONTROL OF HERBAL PRODUCTS (4 ECTS)

Скопје

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025
Орг. бр.:	03
Датум:	972/12
Вредност:	

Подносител на изјава

Доц. д-р Ивана Цветковиќ Каранфилова



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас **проф. д-р Лилјана Анастасова**, избрана во звање редовен професор и вработена на Фармацевтскиот факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Inorganic Chemistry Applied in Pharmacy (8 ECTS)
2. Chemistry of biologically active elements (4 ECTS)

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
Скопје ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Принт: 30-12-2025			
Орг. Единиц.	Број	Потпис	Вредност
03	972/13		

Подносител на изјава

L. Anastasova

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас д-р Зоран Живиќ, избран во звање доцент и вработен на Фармацевтскиот факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Bromatology (6 ECTS)
2. Toxicology (8 ECTS)
3. Food Supplements and Nutrivigilance (elective course, 4 ECTS)
4. Poisoning: Prevention and Treatment (elective course, 4 ECTS)
5. Sustainability in Pharmaceutical Practice (elective course, 4 ECTS)

Скопје Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Пријато:	30-12-2025		
Орг. Бр.:	Број:	Потпис:	Вредност:
03	972/14		

Подносител на изјава

Доц. д-р Зоран Живиќ

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Наталија Наков, избрана во звање редовен професор и вработена на Фармацевтскиот факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Instrumental pharmaceutical analysis (7 ECTS)
2. Physical chemistry for pharmacists (7 ECTS)
3. Green chemistry in pharmaceutical analysis (4 ECTS)
4. Bioanalytical chemistry (4 ECTS)

Скопје

Подносител на изјава

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Приемно:	30-12-2025		
Орг. бр.:	Бр.бр.	Прием.	Вредност:
03	972/5		



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Анета Димитровска, избрана во звање редовен професор и вработена на Фармацевтскиот факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Instrumental pharmaceutical analysis (7 ECTS)
2. Quality control of medicines and pharmaceutical legislation (8 ECTS)
3. Quality management in analytical laboratory (4 ECTS)
4. Regulation for marketing authorisation of medicines and prevention of falsified medicines (4 ECTS)

Скопје
Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Единица	ФФФР	Место	Вредност:
03	972/18		

Подносител на изјава

А. Димитровска

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Катерина Анчевска Нетковска, избран/а во звање редовен професор и вработен/а на Фармацевтски факултет – Скопје на Универзитетот „Св. Кирил и Методиј“ - Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставните предмети:

1. Social Pharmacy and Public Health 3 ECTS
2. Pharmacist's Law and Ethics 3 ECTS
3. Fundamentals of Patenting and Branding in Pharmacy (elective) 4 ECTS
4. Sustainability in Pharmaceutical Practice (elective) 4 ECTS

Скопје

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Единиц.	Број:	Година:	Вредност:
03	992/17		

Подносител на изјава

Проф. д-р Катерина Анчевска Нетковска

K. Anchevska

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Маја Симоноска Црцаревска, избран/а во звање редовен професор и вработен/а на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Pharmaceutical Technology 1 (7 ECTS)
2. Pharmaceutical Technology 2 (7 ECTS)
3. Pharmaceutical Technology – Advanced Level (8 ECTS)
4. Industrial Pharmacy (3 ECTS)
5. Pharmaceutical Care (3 ECTS)
6. Magistral and Galenic Medicines (Elective) (4 ECTS)
7. Pharmaceutical Process Engineering (Elective) (4 ECTS)

Скопје, Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Применено:	30-12-2025		
Орг. Единица:	Догој:	Прилог:	Вредност:
03	972/18		

Подносител на изјава



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Тања Петреска Ивановска, избран/а во звање редовен професор и вработена на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Bromatology (6 ECTS)
2. Toxicology (8 ECTS)
3. Food Supplements and Nutrivigilance (elective course, 4 ECTS)
4. Poisoning: Prevention and Treatment (elective course, 4 ECTS)

Скопје

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено: 30-12-2025			
Орг. В. и. и.	Број:	Под. оп.	Вредност:
03	972/19		

Подносител на изјава

Проф. д-р Тања Петреска Ивановска

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Марија Хиљадникова-Бајро, избрана во звање редовен професор и вработена на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставните предмети:

1. Biochemistry (6 ECTS)
2. Clinical Biochemistry (7 ECTS)
3. Biochemical analyses with specific clinical applications (4 ECTS)

Скопје

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Прикрито:	30-12-2025		
Орг. Едини.	Прој.	Предлог	Вредност:
03	92/20		

Подносител на изјава

М. Хиљадникова-Бајро

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас, Јасмина Тониќ Рибарска, избран/а во звање редовен професор и вработен/а на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ во Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

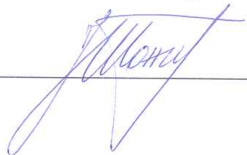
1. ANALYTICAL CHEMISTRY APPLIED IN PHARMACY (8 ECTS)
2. BIOORGANIC CHEMISTRY (8 ECTS)
3. BIOANALYTICAL CHEMISTRY (4 ECTS)
4. THERAPEUTIC DRUG MONITORING (TDM) (4 ECTS)
5. "GREEN" CHEMISTRY IN PHARMACEUTICAL ANALYSIS (4 ECTS)

Скопје

Подносител на изјава

Република Македонија
Универзитет „Св. Кирил и Методиј“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено: 30-12-2025			
Орг. Едини.	Проф.	Период:	Вредност:
03	972/21		



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

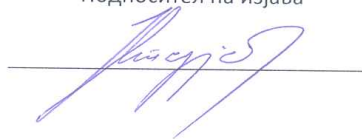
Јас Проф. д-р Зоран Стерјев избран/а во звање редовен професор и вработен/а на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. PHARMACEUTICAL CHEMISTRY II (6 ECTS)
2. PHARMACEUTICAL CHEMISTRY III (8 ECTS)
3. DRUG INFORMATION (4 ECTS)
4. FUNDAMENTALS OF CLINICAL PHARMACY (4 ECTS)
5. CLINICAL PHARMACY AND PHARMACOTHERAPY (8 ECTS)
6. PHARMACOECONOMICS AND PHARMACOEPIDEMIOLOGY (6 ECTS)
7. THERAPEUTIC DRUG MONITORING (TDM) (4 ECTS) – elective course
8. PHARMACEUTICAL MANAGEMENT (4 ECTS) – elective course

Скопје, Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Б. н.:	Број:	П. н.:	Вредност:
03	972/22		

Подносител на изјава



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас **Руменка Петковска**, избрана во звање редовен професор и вработена на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Inorganic Chemistry Applied in Pharmacy (8 ECTS)
2. Physical Chemistry for Pharmacists (7 ECTS)
3. Chemistry of Biologically Active Elements (4 ECTS)

Скопје,

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено: 30-12-2025			
Орг. Ед.	Проф.	Потпиш.	Вредност:
03	992/23		

Подносител на изјава



Проф.д-р Руменка Петковска

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Кристина Младеновска, избрана во звање редовен професор и вработена на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Fundamentals of Pharmacology (6 ECTS)
2. Biopharmacy (7 ECTS)
3. Pharmaceutical Chemistry III (8 ECTS)
4. Magistral and Galenic Medicines (4 ECTS)
5. Drug Therapy Monitoring (4 ECTS)

Скопје
Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Едини.	Служба	Орг.	Вредност:
СЗ	972/25		

Подносител на изјава



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Татјана Кадифкова Пановска, избран/а во звање редовен професор и вработена на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Biochemistry (6 ECTS)
2. Clinical Biochemistry (7 ECTS)
3. Toxicology (8 ECTS)
4. Biochemical Analyses with Specific Clinical Application (elective course, 4 ECTS)
5. Poisoning: Prevention and Treatment (elective course, 4 ECTS)

Скопје
Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Едини.	Број:	Курс:	Вредност:
03	972	РФ	

Подносител на изјава

Проф. д-р Татјана Кадифкова Пановска

Татјана Кадифкова Пановска

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

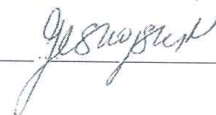
Јас Никола Гешковски, избран/а во звање редовен професор и вработен/а на редовен професор Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. PHARMACEUTICAL TECHNOLOGY I (7 ECTS)
2. BIOPHARMACY (7 ECTS)
3. PHARMACEUTICAL TECHNOLOGY II (7 ECTS)
4. ADVANCED PHARMACEUTICAL TECHNOLOGY (8 ECTS)
5. PHARMACEUTICAL CARE (3 ECTS)
6. INDUSTRIAL PHARMACY (3 ECTS)
7. MAGISTRAL AND GALENICAL MEDICINAL PRODUCTS (4 ECTS)
8. PHARMACEUTICAL PROCESS ENGINEERING (4 ECTS)

Скопје
Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Едини.	Број:	Пр. ред:	Вредност:
03	972/28		

Подносител на изјава



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Јелена Ацевска, избран/а во звање редовен професор и вработен/а на редовен професор Фармацевски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. FUNDAMENTALS OF PHARMACY (4 ECTS)
2. ORGANIC CHEMISTRY APPLIED IN PHARMACY (8 ECTS)
3. INSTRUMENTAL PHARMACEUTICAL ANALYSES (7 ECTS)
4. QUALITY CONTROL OF MEDICINES AND PHARMACEUTICAL LEGISLATION (8 ECTS)
5. QUALITY MANAGEMENT IN ANALYTICAL LABORATORY (4 ECTS)
6. REGULATION FOR MARKETING AUTHORISATION OF MEDICINES AND PREVENTION OF FALSIFIED MEDICINES (4 ECTS)

Република Северна Македонија
Скопје Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30.12.2025		
Орг. Едини.	Број:	Потпис:	Вредност:
03	972/29		

Подносител на изјава

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас _____ Катерина Горачинова _____, избран/а во звање редовен професор и вработен/а на __Фармацевтски__ факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Biopharmacy (FFIFT36) (7 ECTS)
2. Advanced Pharmaceutical Technology (FFIFT31) (8 ECTS)
3. Industrial Pharmacy (FFIFT42) (3ECTS)
4. Pharmaceutical Technology II (FFIFT27) (7 ECTS)
5. Pharmaceutical Technology I (FFIFT22) (7 ECTS)
 - Nanotechnologies in Pharmaceutical technology (FFIP_Z05) (4 ECTS)
 - Pharmaceutical Process Engineering (FFIP_L13) (4 ECTS)
 - Magistral and Galenic Medicines (FFIP_L07) (4 ECTS)

Скопје

Република Македонија
Универзитет „Св. Кирил и Методиј“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Едини.	308	Вредност:	
03	972/30		

Подносител на изјава
проф. Катерина Горачинова



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас АЛЕКСАНДАР ДИМОВСИ, избран/а во звање редовен професор и вработен/а на УКИМ - ФАРМАЦЕВТСКИ факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Molecular and cell biology and genetics (6 ECTS)
2. Basic immunology (3 ECTS)
3. Pharmacogenetics, pharmacogenomics and individualized therapy (5 ECTS)

Скопје

Република Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Единиц.	Број:	Примено:	Вредност:
03	972/31		

Подносител на изјава

A. Dimitrova

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

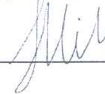
Јас Љубица Михаилова, избрана во звање доцент и вработена на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Pharmaceutical Technology I (7 ECTS)
2. Pharmaceutical Technology II (7 ECTS)
3. Pharmaceutical Care (3 ECTS)
4. Biopharmacy (7 ECTS)
5. Industrial Pharmacy (3 ECTS)
6. Magistral and galenical medicinal products (4 ECTS)
7. Pharmaceutical Process Engineering (4 ECTS)
8. Cosmetology (4 ECTS)

Скопје Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено.	30-12-2025		
Орг. Едини.	Број:	Примено:	Вредност:
03	972/33		

Подносител на изјава



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Рената Славеска Раички, избрана во звање редовен професор и вработена на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Pharmaceutical Technology I (7 ECTS)
2. Pharmaceutical Technology II (7 ECTS)
3. Industrial Pharmacy (3 ECTS)
4. Pharmaceutical Biotechnology (3 ECTS)
5. Production of Biotechnological Medicines (4 ECTS)
6. Magistral and galenical medicinal products (4 ECTS)
7. Pharmaceutical Process Engineering (4 ECTS)

Скопје
Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Един.	Врст:	Прилог:	Вредност:
03	97236		

Подносител на изјава

V. Rami

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

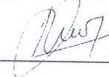
Јас Душко Шалабалија, избран во звање доцент и вработен на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Fundamentals to Pharmacy (4 ECTS)
2. Pharmaceutical Technology I (7 ECTS)
3. Pharmaceutical Technology II (7 ECTS)
4. Pharmaceutical Biotechnology (3 ECTS)
5. Nanotechnologies in Pharmaceutical Technology (3 ECTS)
6. Magistral and Galenical Medicinal Products (4 ECTS)
7. Pharmaceutical Process Engineering (4 ECTS)
8. Manufacturing of Biotechnologicals (4 ECTS)

Република Северна Македонија
Скопје
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Един.	Број	Период	Вредност
09	872	35	

Подносител на изјава



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Марија Главаш Додов, избрана во звање редовен професор и вработена на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

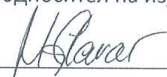
1. Pharmaceutical Technology I (7 ECTS)
2. Pharmaceutical Technology II (7 ECTS)
3. Advanced Pharmaceutical Technology (8 ECTS)
4. Industrial Pharmacy (3 ECTS)
5. Magistral and galenical medicinal products (4 ECTS)
6. Pharmaceutical Process Engineering (4 ECTS)
7. Cosmetology (4 ECTS)
8. Sustainability in Pharmacy Practice (4 ECTS)

Скопје

Подносител на изјава

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено: 30-12-2025			
Орг. Едини:	Број:	Примено:	Вредност:
03	972/36		



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Александра Капедановска Несторовска, избран/а во звање редовен професор и вработен/а на Фармацевтскиот факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Pharmaceutical chemistry II (7 ECTS)
(предметот да се напише на англиски јазик)
2. Pharmaceutical chemistry III (8 ECTS)
(предметот да се напише на англиски јазик)
3. Pharmacoeconomics and pharmacoepidemiology (4 ECTS)
(предметот да се напише на англиски јазик)
4. Pharmaceutical care (3 ECTS)
(предметот да се напише на англиски јазик)
5. Fundamentals of clinical pharmacy (4 ECTS)
(предметот да се напише на англиски јазик)
6. Clinical pharmacy and therapeutics (8 ECTS)
(предметот да се напише на англиски јазик)
7. Therapeutic drug monitoring (4 ECTS)
(предметот да се напише на англиски јазик)

Скопје:

Подносител на изјава

Александра Капедановска

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Единица:	ИДБ	Орг. Бредност:	
03 572/37			

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Александра Грозданова, избран/а во звање редовен професор и вработен/а на Фармацевтскиот факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Pharmaceutical chemistry II (6ECTS)
(предметот да се напише на англиски јазик)
2. Pharmaceutical chemistry III (10 ECTS)
(предметот да се напише на англиски јазик)
3. Social pharmacy and public health (3 ECTS)
(предметот да се напише на англиски јазик)
4. Clinical pharmacy and pharmacotherapy (4 ECTS)
(предметот да се напише на англиски јазик)
5. Pharmacoeconomics and pharmacoepidemiology (4 ECTS)
(предметот да се напише на англиски јазик)
6. Pharmaceutical care (3ECTS)
(предметот да се напише на англиски јазик)
7. Pharmaceutical management (4 ECTS)
(предметот да се напише на англиски јазик)
8. Biological medicines and vaccines (4 ECTS)
(предметот да се напише на англиски јазик)

Скопје

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Единица:	Проф:	Помошник:	Вредност:
03	972/38		

Подносител на изјава

Александра Грозданова

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Љубица Шутуркова, избран/а во звање редовен професор и вработен/а на Фармацевтскиот факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Pharmaceutical chemistry II (7 ECTS)
(предметот да се напише на англиски јазик)
2. Pharmaceutical chemistry III (8 ECTS)
(предметот да се напише на англиски јазик)
3. Pharmacoeconomics and pharmacoepidemiology (4 ECTS)
(предметот да се напише на англиски јазик)
4. Fundamentals of clinical pharmacy (4 ECTS)
(предметот да се напише на англиски јазик)
5. Clinical pharmacy and therapeutics (8 ECTS)
(предметот да се напише на англиски јазик)

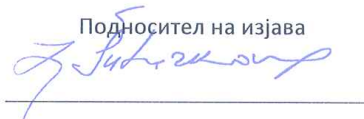
Скопје:

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

30-12-2025

Примено:			
Орг. Едини.	Број:	Примено:	Вредност:
03	972/39		

Подносител на изјава



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Матевска Гешковска Надица, избран/а во звање редовен професор и вработен/а на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. MOLECULAR CELL BIOLOGY AND GENETICS (6 ECTS)
2. FUNDAMENTALS OF IMMUNOLOGY (3 ECTS)
3. FUNDAMENTALS OF PHARMACOLOGY (6 ECTS)
4. PHARMACOGENETICS, PHARMACOGENOMICS AND PERSONALIZED THERAPY (3 ECTS)
5. DRUG THERAPY MONITORING (4 ECTS)

Скопје

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено: 30-12-2025			
Орг. Ед. №:	Орг.	Матрица:	Вредност:
03	972/40		

Подносител на изјава

Матевска

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Станинова Стојовска Марија, избран/а во звање доцент и вработен/а на Фармацевтски факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

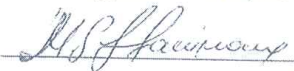
1. MOLECULAR CELL BIOLOGY AND GENETICS (6 ECTS)
2. FUNDAMENTALS OF IMMUNOLOGY (3 ECTS)
3. FUNDAMENTALS OF PHARMACOLOGY (6 ECTS)
4. PHARMACOGENETICS, PHARMACOGENOMICS AND PERSONALIZED THERAPY (3 ECTS)

Скопје

Подносител на изјава

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:	30-12-2025		
Орг. Единица:	Број:	Примено:	Вредност:
03	942/41		



Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Зорица Наумовска, избран/а во звање редовен професор и вработен/а на Фармацевтскиот факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Pharmaceutical chemistry I (7 ECTS)
(предметот да се напише на англиски јазик)
2. Pharmaceutical chemistry II (6 ECTS)
(предметот да се напише на англиски јазик)
3. Pharmaceutical chemistry III (8 ECTS)
(предметот да се напише на англиски јазик)
4. Drug information (4 ECTS)
(предметот да се напише на англиски јазик)
5. Pharmaceutical care (3 ECTS)
(предметот да се напише на англиски јазик)
6. Pharmacovigilance (4 ECTS)
(предметот да се напише на англиски јазик)
7. Clinical pharmacy and therapeutics (8 ECTS)
(предметот да се напише на англиски јазик)

Скопје:

Подносител на изјава

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено: 30-12-2025			
Орг. Едини.	Број:	Потпис:	Вредност:
03	972/42		

Врз основа на член 61 став 1 точка 4 од Законот за високо образование (Службен весник на Република Македонија, бр. 82/2018 и Службен весник на Република Македонија, бр. 178/2018, бр.58/2024 и бр.124/2025) ја давам следната

ИЗЈАВА

за давање согласност за учество во изведување на настава по одредените предмети од студиската програма интегриран прв и втор циклус студии по фармација на англиски јазик

Јас Александар Димковски, избран/а во звање доцент и вработен/а на Фармацевтскиот факултет на Универзитетот „Св. Кирил и Методиј“ – Скопје давам согласност за учество во изведување на настава од студиската програма магистер по фармација (интегриран прв и втор циклус студии) на англиски јазик на Фармацевтски факултет, по наставниот предмет:

1. Pharmaceutical chemistry I (7 ECTS)
(предметот да се напише на англиски јазик)
2. Pharmaceutical chemistry II (6 ECTS)
(предметот да се напише на англиски јазик)
3. Pharmaceutical chemistry III (10 ECTS)
(предметот да се напише на англиски јазик)
4. Social pharmacy and public health (3 ECTS)
(предметот да се напише на англиски јазик)
5. Drug information (4 ECTS)
(предметот да се напише на англиски јазик)
6. Fundamentals of clinical pharmacy (4 ECTS)
(предметот да се напише на англиски јазик)
7. Pharmacoeconomics and pharmacoepidemiology (4 ECTS)
(предметот да се напише на англиски јазик)

Скопје

Република Северна Македонија
Универзитет „СВ. КИРИЛ И МЕТОДИЈ“
ФАРМАЦЕВТСКИ ФАКУЛТЕТ - Скопје

Примено:			
30-12-2025			
Орг. Единица:	Број:	Пратено:	Вредност:
03	992/43		

Подносител на изјава

А. Димковски

5. Approval of the University Senate / the Scientific Council for the participation of a teaching staff member in the implementation of a study programme at an organisational unit of another university (Article 179 of the Law on Higher Education, Official Gazette of the Republic of North Macedonia, No. 82/2018)

ANNEX NO. 3

Course syllabi with information in accordance with Article 4 of the Rulebook on the Content of Study Programs (“Official Gazette of the Republic of Macedonia”, No. 79/2023)

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	FUNDAMENTALS OF PHARMACY			
2	Code	FFZP01			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmaceutical Technology Institute of Applied Chemistry and Pharmaceutical Analysis Institute of Pharmacognosy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	1	Semester:	I
7	Workload expressed in ECTS credits	4 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Asst. Prof. Dr. Dushko Shalabalija (course coordinator from the Institute of Pharmaceutical Technology) Prof. Dr. Jelena Acevska Prof. Dr. Biljana Bauer Prof. Dr. Katerina Brezovska Asst. Prof. Dr. Ljubica Mihailova Asst. M.Sc. Teodora Tasevska Asst. M.Sc. Hrisanta Godzo Asst. Prof. Dr. Veronika Stoilkovska Gjorgievska Asst. Prof. Dr. Ana Trajkovska			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: / Examination requirements: /			
11	Course Aims (Competencies) and Learning Outcomes	The aim of this course is to introduce students to the aspects of the pharmaceutical profession and the place and role of the modern pharmacist in the healthcare system, as well as to the basic pharmaceutical concepts and terminology. Students will obtain a detailed overview of the role and profiles of the pharmacist and his duties and responsibilities through organized lectures by experts from practice, as well as through visits to several pharmaceutical companies in North Macedonia. Additionally, students will become familiar with good practices in pharmacy in accordance with legal regulations relating to ensuring the quality, efficacy, and safety of medicines, as well as with various associations that work to develop and promote the pharmaceutical profession through continuous learning and pharmacist training. Special emphasis will be placed on understanding the structure, content, and importance of the European Pharmacopoeia as a fundamental document ensuring			

		the quality of medicines. This course familiarizes students with the study program, its aims and learning outcomes, compared with European Union directives, the guidelines of the Association of Faculties of Pharmacy in Europe (EAFP), and other relevant study programs from the region and beyond. Learning outcomes (knowledge, individual skills, professional skills) Upon completion of the course, students will be able to: • Understand the multiple aspects and opportunities of the pharmacy profession, with emphasis on its perspectives and professional profiles. • Acquire knowledge of basic pharmaceutical concepts and basic terminology (e.g. medicine and types of medicines, medical devices, routes of administration, pharmaceutical dosage forms, etc.) • Gain fundamental knowledge of pharmaceutical practice and understand the importance of the European Pharmacopoeia as a global standard for quality. • Recognize and interpret good practices in pharmaceutical activities and their application in practice in terms of quality, efficacy, and safety of medicines, as well as identify ways to advance the pharmaceutical profession through continuous learning.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: Subject of pharmacy and the profession of pharmacist – historical overview of pharmacy as a healthcare field and its scientific disciplines, as well as the role, duties, and responsibilities of the pharmacist in the healthcare system and in the industrial sector. Pharmaceutical ethics. Introduction to laboratory safety with focus on the harmful effects of the professional environment, emphasizing chemical hazards. Within the course, each student will be required to independently prepare short project assignments related to the above-mentioned topics. The project assignment will be evaluated as part of the written component of the final assessment. Learning outcomes: Students will be introduced to the field of pharmacy with emphasis on its potential and the latest global achievements, as well as the concept of the pharmacy. Additionally, students will gain a detailed understanding of the pharmacist's role and responsibilities (community pharmacist, industrial pharmacist, clinical pharmacist) through guest lectures by professionals from practice. Students will also gain insight into the basic principles of functioning of the pharmaceutical industry and wholesale distributors through organized visits to various pharmaceutical companies in North Macedonia, where they will become acquainted with the basic principles of drug manufacturing, regulatory aspects, and wholesale operations (storage, distribution, and trade of medicines). Chapter 2: Basic pharmaceutical concepts and basic terminology – definitions of medicine and types of medicines, medical devices, routes of administration, pharmaceutical dosage forms. Learning outcomes: Students will acquire fundamental knowledge about medicines and types of medicines, medical devices, as well as various routes of administration, with a brief overview of their advantages and disadvantages. Additionally, students will become familiar with different pharmaceutical dosage forms and the LADME

		concept, gaining a comprehensive understanding of the fate of drugs after in vivo administration and the main factors affecting their safety and efficacy. Chapter 3: European Pharmacopoeia – Concept (definition, historical development and importance) of the European Pharmacopoeia; Structure and content of the European Pharmacopoeia; European Pharmacopoeia and regulatory framework; Cooperation with other pharmacopoeias (United States and Japanese Pharmacopoeia) and international bodies. Learning outcomes: Students will be able to explain the significance and application of the European Pharmacopoeia in pharmacy, identify its main components and structure, and explain the connection between the European Pharmacopoeia and regulatory requirements. Chapter 4: Good practices in pharmacy – fundamental knowledge about good practices in pharmacy related to pharmaceutical activities, with emphasis on their application in everyday practice. Learning outcomes: Students will become familiar with the role and competences of national and international regulatory bodies in the pharmaceutical sector. In this thematic unit, students will also learn about the concepts of continuous professional development and advancement of the pharmaceutical profession. Additionally, they will become familiar with good practices in pharmaceutical activities, in accordance with existing legal regulations. Particular importance will be placed on applying these practices in daily work and acquiring appropriate knowledge and practical skills.		
13	Interrelation with Other Courses	1. Prior knowledge from other courses / 2. Knowledge from this course is required as a prerequisite for following the teaching content in subsequent studies		
14	Teaching and Working Methods	Teaching methods used in the course: 1. Lectures 2. Visits to various sectors in pharmaceutical companies 3. Laboratory exercises Working methods: 1. Conducting experiments (students work independently and in groups to acquire basic skills for performing laboratory experiments)		
15	Total Available Contact Hours			
		16.1.	Lectures – theoretical classes: hours	Number of working weeks (15) × 2 hours per week = 30 hours
16	Forms of Teaching Activities	16.2.	Exercises (laboratory, classroom) : hours	Number of working weeks (15) × 2 hours per week = 30 hours
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours	3 Students work individually or in

				teams to investigate specific problems and propose solutions related to the topic			
		17.2.	Independent learning: hours		Preparation for theoretical classes: 30 hours Preparation for practical classes: 12 hours Students independently research, study, and solve tasks to deepen their acquired knowledge.		
		17.3.	Exam preparation		15 hours Review of material, systematization of knowledge before the exam		
18	Requirements for Signature	At least 30 points from the planned activities (16.1, 16.2, 17.1)					
19	Assessment Method						
	19.1	Final exam: points (if colloquia are not taken)		25–50			
	19.2	Colloquium: points		Colloquium 1: 13–25 points Colloquium 2: 13–25 points			
	19.3	Practical exam: points		/			
	19.4	Seminar paper/project, written and oral presentation: points		6–10			
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)					
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.					
22	Literature						
	22.1	Required literature					
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)	
		1.	William Kellz CRC	Pharmacy – What it is and how it works	Taylor and Francis Group, USA	4th ed. 2017 (electronic edition)	

		2.	Arthur J. Winfield, Judith Rees, Ian Smith	Pharmaceutical Practice	Churchill Livingstone, Elsevier	4th ed. 2009 (electronic edition)
		3.		Pharmaceutical Dosage Forms – Methods of Use, Contact Packaging – Standard Terms and Definitions	Ministry of Health	2002
		4.	Dimitrovska A. et al.	Evaluation of Chemical Substances for Pharmaceutical Use According to the European Pharmacopoeia	SOFIJA – Bogdanci	2020 (electronic)
		5.	European Pharmacopoeia Commission	European Pharmacopoeia (Ph. Eur.)	European Directorate for the Quality of Medicines & HealthCare (EDQM), Council of Europe, Strasbourg, France	Current edition (electronic)
		6.	Assembly of the Republic of Macedonia	National Regulation (Law on Medicinal Products, Rulebooks, Guidelines)	Official Gazette of the Republic of Macedonia	Current edition
		Additional literature				
	22.2	No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)
		1.		Relevant papers in international scientific journals		Electronic edition
		2.		Current and updated guidelines/regulations from websites of regulatory bodies, associations, and commissions		Electronic edition
		3.	Boro Nikolovski	Contributions from the History of Health Culture in Macedonia	MFD – Skopje	1995

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	MATHEMATICS AND APPLIED STATISTICS IN PHARMACY			
2	Code	FFPMF02			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	1	Semester:	I
7	Workload expressed in ECTS credits	5 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Petar Sokoloski (course coordinator)			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: / Examination requirements: /			
11	Course Aims (Competencies) and Learning Outcomes	- To familiarize students with basic mathematical concepts and methods (fundamentals of linear algebra, differential and integral calculus) necessary for their further professional development in pharmacy. - To introduce selected methods of applied mathematics. - To develop and improve students' abilities for abstract thinking and independent logical reasoning toward creative problem-solving. - To apply mathematical models in chemical and pharmaceutical processes and interpret theoretical results in practice. - To introduce students to the basic concepts of statistics, statistical terminology, and methodology, and their applications in pharmacy. - To train students to handle statistical data and interpret results. - To enable students to use applications and statistical software packages for data processing. After completing the course, students are expected to be able to solve mathematical problems from the studied areas, to recognize mathematical models (laws) and concepts applied in chemistry, biology and in some parts of pharmacy, to understand and to be able to follow the contents related to them. Students will be able to recognize the applications of concepts such as limits, continuous processes, derivatives (as measures of rate of change) and integrals			

		as a means of calculating areas and volumes. Also, students are expected to understand the basic statistical concepts, to master the statistical terminology and methodology and to be able to apply them in solving specific pharmaceutical problems, to know how to collect, organize and process data, to present them with appropriate diagrams and biostatistical tables, to choose an appropriate method (statistical test) for testing a hypothesis, to calculate the appropriate test statistic and correctly interpret the obtained results, to know how to check whether certain phenomena are correlated and to what extent, to be able to use applications and statistical packages for data processing.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Sets, mappings and binary operations. Number sets. Extended set of real numbers. Intervals and neighborhood. Mathematical induction and binomial formula. Linear algebra: Determinants. Matrices and operations with matrices. Systems of linear equations and methods for their solution. Ratio, proportion and percentage and some of their applications in chemical problems (mixing of solutions, concentration and dilution of solutions, percentage composition of a compound). Sequences of real numbers: definition, some basic concepts and some theorems for convergent sequences. Arithmetic, geometric and natural sequences. Real functions of one real independent variable. Overview of elementary functions: linear, quadratic, power, exponential, logarithmic, trigonometric and cyclometric functions. Limit value of a function and some important limits. Continuity of a function. Asymptotes of a function. Differential calculus: Definition of the derivative of a function and its geometric, physical and chemical interpretation. Derivative of elementary functions and operational rules for derivatives. First differential of a function and higher order derivatives and differentials. Intervals of monotonicity of a function. Local extrema and Fermat's theorem. Theorems of Rolle, Lagrange and Cauchy. Indeterminate forms and L'Hôpital's rules. Examination of the course and construction of a graph of a function. Short review of real functions of two real independent variables: definition, first and second order partial derivatives, total differential and local extrema. Integral calculus: Concept of indefinite integral and its properties. Change of variable and partial integration. Integrals containing a quadratic trinomial and integration of rational functions. Integrals of mono-, bi- and polymolecular reactions. Newton-Leibniz theorem and the problem of the area of a curvilinear trapezoid. Application of integral calculus for calculating the area of plane figures, volume and surface area of solids of revolution and length of the arc of a plane curve. Differential equations: First order differential equations with separable variables, linear differential equation.
13	Interrelation with Other Courses	1. The prerequisites from other courses required/related to the subject – none. 2. The knowledge from this course is required for following the course content of (subjects in higher semesters).
14	Teaching and Working Methods	Teaching methods used in the course: 1. Lectures 2. Interactive classes including discussions on specific tasks, cases, and problems

		Working methods: 1. Problem solving (students work independently/in groups to solve specific problems in order to encourage research and analytical skills, teamwork, and application of theoretical knowledge)				
15	Total Available Contact Hours	150 hours				
	Forms of Teaching	16.1.	Lectures – theoretical classes:		45 hours	
16	Activities	16.2.	Exercises (auditorium):		60 hours	
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours		/	
		17.2.	Independent study: hours		Preparation for theoretical classes: 15 hours Preparation for practical classes: 30 hours	
		17.3.	Exam preparation (Review of material, systematization of knowledge before the exam):		15 hours	
18	Requirements for Signature	At least 30 points from the planned activities (16.1, 16.2, 17.1)				
19	Assessment Method					
	19.1	Final exam: points (if colloquia are not taken)		30–70		
	19.2	Colloquium: points		Colloquium 1: 15–35 points Colloquium 2: 15–35 points		
	19.3	Practical exam: points		/		
	19.4	Seminar paper/project, written and oral presentation: points		/		
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)				
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.				
22	Literature					
		Required literature				
	22.1	No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)

		1.	Borko Ilievski	Mathematics 1 – for Chemists and Pharmacists (textbook)	UKIM, Skopje	2011 (hard copy)
		2.	Borko Ilievski, Petar Sokoloski	Applied Statistics	(internal script for pharmacists)	(hard copy)
		3.	Marija Orovchanec, Biljana Krsteska	Collection of solved problems in mathematic	UKIM	2018 (electronic edition)
		Additional literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)
		1.	Erich Steiner	The Chemistry Maths Book	Oxford University Press	2008 (hard copy)
		2.	Kečkić J., Nikčević S.	Mathematics. One-year course (in Serbian)	Naučna knjiga, Belgrade	2005 (hard copy)
		3.	Bolton S., Bon C.	Pharmaceutical Statistics, Practical and Clinical Applications (4th ed.)	CRC Press	2009 (hard copy)

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	BIOPHYSICS			
2	Code	FFMF03			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	1	Semester:	I
7	Workload expressed in ECTS credits	5 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Assoc. Prof. Dr. Duško Lukarski (course coordinator) Prof. Dr. Tomislav Stankovski University 'Ss. Cyril and Methodius' – Skopje, Faculty of Medicine			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: / Examination requirements: /			
11	Course Aims (Competencies) and Learning Outcomes	Course Objectives (Competencies): • To teach the basic physical laws applied in medicine and pharmacy; • To understand processes in living organisms that can be described with biophysical models; • To learn the basic physical principles underlying many diagnostic methods in medicine and methods used in pharmacy; • To learn the basic physical principles underlying certain therapeutic methods. Expected Learning Outcomes: Upon mastering the material in Biophysics, students are expected to become familiar with the basic principles of physics that relate to or form the basis of specific biological, medical, and pharmaceutical systems and processes. The Biophysics course, which includes oral lectures, auditorial exercises with analytical problem-solving, and experimental exercises, aims to enrich students with analytical and experimental skills and knowledge.			
12	Detailed Course Content by Chapters and	Course Content:			

	Units, with Learning Outcomes for Each Chapter	• Foundations of Biophysics: Division of biophysics. Systems theory. Management. Key theories. • Foundations of Biomechanics: Lever. Locomotor levers. Human locomotor system. Work and power of the human body. Ergometry. Mechanical work of the heart. Elasticity. Mechanical properties of biological tissues. Bone elasticity. Bone fracture. • Fluids and Their Properties: Viscosity of liquids. Viscometry. Hydrodynamics of ideal fluids. Physical model of the circulatory system. Surface tension. Laplace pressure. Gas embolism. Atmospheric pressure. Measurement. Mechanics of breathing. • Bioacoustics: Sound waves. Physical and subjective characteristics. Physical principles of speech and hearing systems. Ultrasound. Effects of ultrasound on biological systems. Application of sound in medicine. • Basic Laws in Optics: Optical lenses. Optical instruments: magnifying glass, microscope. Eye as an optical instrument. Physical optics. Infrared light. NIRS – near-infrared spectroscopy. Thermography. Ultraviolet radiation. Fundamentals of quantum optics. Photoelectric effect. Luminescence. Lasers and their applications in medicine. • X-ray Radiation: X-ray spectra. Absorption of X-rays in materials. Applications of X-rays in medicine. Nuclear physics and nuclear reactions. Nuclear medicine. SPECT and PET methods. Hybrid SPECT/CT methods. • Thermodynamic Processes: Thermometry and calorimetry. Heat transfer processes. Physiological effects of heat. Air humidity as a biophysical factor. • Electric Phenomena: Work and power of electric current. Contact potential difference. Thermoelements. Aeroions. Aeroion therapy. Electric current through liquids. Electrolysis. Electrokinetic processes. Physiological effects of electricity. Electro-stimulation. Active electrodiagnostics. Biopotentials, physical fundamentals. Resting biopotentials. Action potential. Electrophysiology. • Electromagnetism: Electromagnetic induction. Current flow through the human body. Magnetic resonance.
13	Interrelation with Other Courses	The knowledge from this course is required as a prerequisite for following the course content in higher semesters.
14	Teaching and Working Methods	Teaching Methods Used in the Course: 1. Lectures 2. Interactive sessions including discussions on specific exercises, cases, and problems Working Methods: 1. Laboratory exercises (practical skills training) 2. Problem solving (students work individually or in groups to solve specific problems, aiming to develop research and analytical skills, teamwork, and application of theoretical knowledge)

		3. Project work (preparation of a project involving research on a given topic to develop independent research skills and presentation abilities in front of an audience)				
15	Total Available Contact Hours	150 hours				
	Forms of Teaching	16.1.	Lectures – theoretical classes:	30 hours		
16	Activities	16.2.	Exercises (laboratory, auditorium):	30 hours		
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours	/		
		17.2.	Independent study: hours	Preparation for theoretical classes: 50 hours Preparation for practical classes: 15 hours		
		17.3.	Exam preparation:	25 hours		
18	Requirements for Signature	At least 30 points from the planned activities (16.1, 16.2, 17.1)				
19	Assessment Method					
	19.1	Final exam: points (if colloquia are not taken)	90			
	19.2	Colloquium: points	/			
	19.3	Practical exam: points	/			
	19.4	Seminar paper/project, written and oral presentation: points	10			
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)				
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.				
22	Literature					
	22.1	Required literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)
		1.	T. Stankovski	Biophysics – Internal script	Faculty of Medicine	2015 (electronic)
	22.2	Additional literature				

		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)
		1.	N. Andonovska	Biophysics – Book	Ss. Cyril and Methodius University, Skopje	2005 (hard copy)
		2.	D. Gershanovski	Biophysics – Script	Institute of Physics	2006 (hard copy)

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	INORGANIC CHEMISTRY APPLIED IN PHARMACY			
2	Code	FFIPHFA04			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Applied Chemistry and Pharmaceutical Analysis			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	1	Semester:	I
7	Workload expressed in ECTS credits	8 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Rumenka Petkovska (course coordinator) Prof. Dr. Liljana Anastasova			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: / Examination requirements: /			
11	Course Aims (Competencies) and Learning Outcomes	Course Objectives (Competencies) The objective of the course is for students to acquire knowledge of the basic concepts and fundamental laws of chemistry, the structure of atoms of chemical elements, chemical bonding, reactivity, changes occurring during chemical reactions, as well as the properties of chemical elements with a special focus on elements essential for the function of living organisms. Learning Outcomes Upon successful completion of the course, students will gain skills in analytical thinking and problem-solving using chemical arithmetic. Students will acquire in-depth knowledge of essential chemical elements and inorganic compounds relevant to pharmacy and medicine.			
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Detailed Course Content General Chemistry • Basic chemical concepts and laws; structure of matter • Atomic structure, chemical bonds, and molecular structure; relationship between structure and reactivity of simple molecules			

		• Thermochemistry and heat effects of chemical reactions • Dispersed systems, solutions, and colligative properties; expression of solution properties • Introduction to chemical kinetics, types of chemical reactions, reaction mechanisms, chemical equilibrium • Electrolyte dissociation; chemical equilibria in aqueous solutions: acid-base reactions, ion product of water and pH, hydrolysis, buffer solutions, redox reactions, and complex formation reactions Students will gain knowledge of basic chemical laws and their application in pharmaceutical sciences. Chemical Arithmetic (Stoichiometry) • Structural stoichiometry (quantitative ratios of elements in compounds) • Reaction stoichiometry (quantitative ratios of substances in chemical reactions) Students will develop the ability to perform chemical calculations, applying these skills for quantitative calculations in synthesis, production, and quality control of pharmaceutical active substances and finished products. Chemistry of Elements and the Periodic Table • Properties and reactivity of nonmetals • Properties and reactivity of metals • Basics of physiological functions of essential chemical elements (macro- and microelements) Students will be able to apply this knowledge in the study of other biopharmaceutical sciences.
13	Interrelation with Other Courses	1. Prerequisites from other courses: / 2. Knowledge from this course is required to follow content in: • Analytical Chemistry Applied in Pharmacy • Organic Chemistry Applied in Pharmacy • Bioorganic Chemistry
14	Teaching and Working Methods	Teaching Methods 1. Lectures 2. Interactive classes including discussions on specific tasks, cases, and problems Working Methods 1. Numerical exercises (students work individually or in groups to perform chemical calculations)

		2. Problem-solving (students work individually or in groups to solve specific problems to foster research and analytical skills, teamwork, and application of theoretical knowledge)				
15	Total Available Contact Hours	240 hours				
	Forms of Teaching	16.1.	Lectures – theoretical classes:		45 hours	
16	Activities	16.2.	Exercises (numerical):		45 hours	
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours		/	
		17.2.	Independent study: hours		Preparation for theoretical classes: 90 hours Preparation for practical classes: 22.5 hours	
		17.3.	Exam preparation:		37.5 hours	
18	Requirements for Signature	At least 24 points from the planned activities (16.1, 16.2, 17.1)				
19	Assessment Method					
	19.1	Final exam: points (if colloquia are not taken)		30-50 (60-100%)		
	19.2	Colloquium: points		Colloquium 1: 15–25 points Colloquium 2: 15–25 points		
	19.3	Practical exam: points		6-10		
	19.4	Seminar paper/project, written and oral presentation: points		/		
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)				
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.				
22	Literature					
	22.1	Required literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)
		1.	Liljana Anastasova, Rumenka Petkovska	Teaching Aid for Theoretical Classes in Inorganic Chemistry Applied	Faculty of Pharmacy, Ss. Cyril and Methodius	2025 (electronic)

				in Pharmacy, Second Edition	University, Skopje	
		2.	Rumenka Petkovska, Liljana Anastasova	Teaching Aid for Exercises in Inorganic Chemistry Applied in Pharmacy	Фармацевтски факултет, УКИМ, Скопје	2023 (electronic)
		3.	John W Hill, Ralph H. Petrucci, Terry W. McCreary, Scott, S.Perry	General Chemistry, 4th Ed	Pearson Education, Inc	2005
		4.	D.F.Shirver, P.W. Atkins	Inorganic Chemistry 4th Ed.	W.H.Freeman& Company New York, USA	2006
	22.2	Additional literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)
		1.	N. Greenwood, A. Earnshaw	Chemistry of the Elements, 2 nd Ed.	Elsevier Ltd.	1997
		2.	J.E. House, K. A. House	Descriptive Inorganic Chemistry, 3 rd Ed.	Elsevier Ltd.	2016 (electronic)

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	ANATOMY AND PHYSIOLOGY			
2	Code	FFMF05			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje, Faculty of Medicine Department of Anatomy and Department of Physiology			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	1	Semester:	I
7	Workload expressed in ECTS credits	8 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Department of Physiology Prof. Dr. Beti Dejanova (course coordinator) Prof. Dr. Sunchica Petrovska Prof. Dr. Lidija Todorovska Prof. Dr. Jasmina Pluncevic Gligoroska Prof. Dr. Sanja Manchevska Assoc. Prof. Dr. Ivanka Karagjozova Asst. Prof. Dr. Michaela Nestorova Brazhanska Asst. Prof. Dr. Biljana Spirkoska Vangelovska Asst. Prof. Dr. Vangel Ristovski Department of Anatomy Prof. Dr. Biljana Zafirova Prof. Dr. Niki Matveeva Prof. Dr. Julija Zhivadinovic Bogdanovska Prof. Dr. Ace Dodevski Prof. Dr. Biljana Trpkovska Prof. Dr. Biljana Bojadzhieva Stojanoska Prof. Dr. Elizabeta Chadikovska Asst. Prof. Dr. Anamarija Paunkoska			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: / Examination requirements: /			
11	Course Aims (Competencies) and Learning Outcomes	Goals The course aims to familiarize students with the anatomical structure and physiological function of the human body's organ systems, enabling them to acquire knowledge and skills for understanding physiological mechanisms and their regulatory processes.			

		- The course aims to enable students to apply the acquired knowledge and skills when examining the multiple physiological functions of organ systems. Learning Outcomes - Students will be able to identify the main aspects of anatomical organization and the structure of organs and tissues, as well as understand the key physiological regulatory mechanisms of organ system functions. - Students will be able to differentiate physiological from pathophysiological processes in the human body according to the regulatory mechanisms that maintain organ system homeostasis. - Students will be able to perform practical procedures on selected organ systems, analyze, and interpret the obtained results for certain physiological parameters in accordance with theoretical knowledge and skills from the course.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Course Content Fundamentals of Human Anatomy: Anatomy of the respiratory, cardiovascular, digestive, endocrine, urinary, genital, locomotor, peripheral and central nervous systems, and sensory organs. Fundamentals of Human Physiology: Cell physiology; muscle physiology; physiology of organ systems – blood, respiratory, cardiovascular, digestive, endocrine, reproductive, urinary, locomotor, peripheral and central nervous systems, and sensory organs; metabolism, liver, skin, and thermoregulation. Learning Outcomes - Students will acquire knowledge of the anatomical organization and topographic arrangement of organs and organ systems in the human body. - Students will understand basic physiological processes and mechanisms of organ systems and tissues, as well as the regulatory mechanisms that maintain homeostasis in the human body.
13	Interrelation with Other Courses	Knowledge of Anatomy and Physiology is required for attending the Pathophysiology course.
14	Teaching and Working Methods	Teaching Methods - Theoretical lectures – ex cathedra - Interactive classes involving discussions on anatomical regions, physiological mechanisms, and regulatory processes in the human body Working Methods

		1. Laboratory exercises (practical skills performed individually or in groups to better consolidate theoretical knowledge)				
15	Total Available Contact Hours	240 hours				
	Forms of Teaching Activities	16.1.	Lectures – theoretical classes:		45 hours Anatomy – 10 hours Physiology – 35 hours	
16		16.2.	Exercises (laboratory, auditory):		45 hours Anatomy – 10 hours Physiology – 35 hours	
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours		/	
		17.2.	Independent study: hours		Preparation for theoretical classes: 90 hours Preparation for practical classes: 20 hours	
		17.3.	Exam preparation:		40 hours	
18	Requirements for Signature	At least 25 points from the planned activities (16.1, 16.2) Activity and participation in the classes: Theoretical: 6–10 Practical: 12–20				
19	Assessment Method					
	19.1	Final exam: points (if colloquia are not taken)		Anatomy – 1 Physiology – 1		
	19.2	Colloquium: points		Colloquium 1 – Anatomy (12–20) Colloquium 2 – Physiology (30–50)		
	19.3	Practical exam: points		/		
	19.4	Seminar paper/project, written and oral presentation: points		/		
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)				
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.				
22	Literature					
	22.1	Required literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)

		1.	Zafirova B., Zhivadinović J., Matveeva N., et al.	Anatomy for Students of the Three-Year Professional Studies for Graduate Nurses/Technicians	UKIM, Faculty of Medicine, Skopje, Department of Anatomy	2022
		2.	Todorovska L., Maleska Ivanovska V., Dejanova B., et al.	Medical Physiology for Students of the Faculty of Pharmacy	UKIM, Faculty of Medicine, Skopje, Department of Physiology	2022
		3.	Petrovska S., Ivanovska Maleska V., Dejanova B., et al.	Practicum in Physiology for Pharmacy Students	UKIM, Faculty of Medicine, Skopje, Department of Physiology	2016
	22.2	Additional literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)
		1.	Frank H. Netter	Atlas of Human Anatomy	Elsevier Health Sciences	2022
		2.	Sh. Zibernagl, A. Despopulos	Physiological Color Atlas	Tabernakul	2010

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	ORGANIC CHEMISTRY APPLIED IN PHARMACY			
2	Code	FFIPHFA06			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Applied Chemistry and Pharmaceutical Analysis			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	1	Semester:	II
7	Workload expressed in ECTS credits	8 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Ana Poceva Panovska (course coordinator) Prof. Dr. Jelena Acevska Asst. Prof. Dr. Olga Gigopulu			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisites for attending the course: Inorganic Chemistry, 1st semester (signature required) Prerequisites for passing the course: Inorganic Chemistry, 1st semester (signature required)			
11	Course Aims (Competencies) and Learning Outcomes	Course Aim The course aims to provide students with the knowledge and skills to: • Understand the basic concepts of organic chemistry and know the structure, properties, and reactions of major classes of organic compounds relevant to pharmacy. • Perform synthesis, analysis, and interpretation of experimental results of compounds significant in pharmacy. • Connect organic chemistry with other related medical fields such as pharmaceutical chemistry, biochemistry, pharmacology, etc. • Apply acquired knowledge through basic and advanced organic chemistry reactions to synthesize pharmaceutically active substances. After successful completion of the course, the student will be able to: • Identify the main classes of organic compounds, recognize functional groups, isomerism, and properties relevant to pharmaceutical sciences. • Explain reaction mechanisms and predict synthesis products. • Relate important organic structures to biological activity. • Apply organic chemistry reactions in laboratory synthesis of pharmaceutically active substances.			

		• Interpret experimental results and propose scientifically based conclusions. • Apply principles of sustainable development to minimize environmental impact when working with organic solvents/compounds. • Apply acquired knowledge in other scientific disciplines for solving problems in pharmacy.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: Introduction to Organic Chemistry and its Application in Pharmacy • Definition and basics of organic chemistry, relevance in pharmaceutical sciences, overview of main classes of organic compounds. Learning outcomes: • Students will be able to describe what organic chemistry is and its role in drug research and development. • Students will be able to identify main classes of organic compounds with pharmaceutical applications. Chapter 2: Structure and Reactivity of Organic Compounds • Structure and bonding, carbon atom hybridization (sp, sp^2, sp^3), polarity, molecular representations, stereochemistry and 3D modeling, resonance, nucleophiles, electrophiles, chemical reactivity and mechanisms, reaction types, acidity and basicity of organic compounds. Learning outcomes: • Students will describe atomic structure and bonding in organic molecules, and explain the importance of polar and nonpolar bonds. • Students will represent molecules using different formula types and create 3D molecular models. • Students will distinguish nucleophiles and electrophiles and explain their role in reactions, and classify reaction mechanisms. • Students will predict acidity and basicity based on molecular structure and contributing factors. Chapter 3: Alkanes and Cyclic Systems – Conformations and Biological Relevance • Nomenclature, structure, and properties of alkanes and cycloalkanes. • Conformations of acyclic (free rotation around σ-bonds) and cyclic structures (cyclohexane conformations, substituent effects). • Conformations in drug molecules and influence on biological activity. Learning outcomes: • Students will describe nomenclature, structure, and physicochemical properties of alkanes and cycloalkanes. • Students will explain free rotation around σ-bonds and analyze cyclic conformations, including substituent effects. • Students will analyze drug molecule conformations and relate them to biological activity. Chapter 4: Unsaturated Compounds – Alkenes, Alkynes, and Dienes • Alkenes: characteristics, structure, preparation, and addition reactions.

		- Alkynes: characteristics, structure, preparation, addition reactions, and use in pharmaceutical synthesis. - Dienes: classification, Diels-Alder reaction. - Conjugated π-systems, biologically relevant compounds, and drugs. Learning outcomes: - Students will describe structure, properties, and addition reactions of alkenes and alkynes. - Students will understand conjugated π-systems and identify biologically active compounds containing them. Chapter 5: Stereochemistry and Chirality - Identify and describe R/S configurations using Cahn-Ingold-Prelog rules. - Distinguish enantiomers and diastereomers; explain chemical/physical properties; apply to pharmaceutical molecules. - Stereoisomeric ratio, enantiomeric purity, racemic mixtures, chiral drugs (e.g., ibuprofen, escitalopram). - Optical activity and chirality, stereochemistry and therapeutic activity, receptor selectivity, chiral drug design. Learning outcomes: - Students will differentiate enantiomers and diastereomers and explain their properties. - Students will calculate stereoisomeric ratios and enantiomeric purity, and explain racemic mixtures in pharmaceuticals. - Students will relate stereochemistry to drug activity and receptor selectivity. - Students will apply stereochemistry principles in designing chiral drugs. Chapter 6: Nucleophilic Substitution Reactions and Biological Application - SN1 and SN2 mechanisms: principles, influencing factors, stereochemical outcome, biologically relevant reactions, drugs activated via SN1/SN2. Learning outcomes: - Students will explain SN1/SN2 mechanisms and influencing factors. - Students will relate SN2 reactions to biological systems and identify drugs activated through these mechanisms. Chapter 7: Aromaticity and Reactivity – EAS and Synthesis Strategies - Aromaticity basics, benzyl position reactions, electrophilic aromatic substitution (EAS), directing effects, synthesis of polysubstituted aromatic compounds, pharmaceutical applications. Learning outcomes: - Students will explain aromaticity, EAS reactions, and directing effects of substituents. - Students will identify strategies for synthesizing polysubstituted aromatics and pharmaceutical compounds. Chapter 8: Alcohols, Phenols, Ethers, and Epoxides

		- Alcohols and phenols: characteristics, reactivity, Grignard reactions, metabolism of hydroxyl-containing drugs. - Ethers and epoxides: chemical properties, synthesis, metabolism, pharmaceutical relevance. Learning outcomes: - Students will describe properties and reactivity of alcohols, phenols, ethers, and epoxides. - Students will understand Grignard reactions and metabolism of hydroxyl-containing drugs. Chapter 9: Aldehydes and Ketones - Structure, electronic properties, non-nucleophilic addition, acetals as prodrugs, biological importance of carbonyl group, metabolism, and reactions with nucleophiles. Learning outcomes: - Students will describe structure and reactivity of aldehydes and ketones, including nucleophilic additions. - Students will explain oxidative/reductive transformations and role in drug pharmacokinetics. - Students will apply nucleophilic reactions in drug synthesis (oxygen, sulfur, nitrogen, hydrogen, carbon nucleophiles). Chapter 10: Carboxylic Acids and Derivatives – Reactivity and Pharmaceutical Application - Properties of carboxylic acids and derivatives, cyclic esters, macrolides, thioesters, cyclic amides, β-lactams, esters as prodrugs. Learning outcomes: - Students will describe properties and reactivity of carboxylic acids and derivatives. - Students will understand structures and pharmaceutical relevance of cyclic esters, macrolides, β-lactams. - Students will explain thioesters and esters as prodrugs. Chapter 11: Amines - Basic properties, synthesis methods (synthetic and biosynthetic), reactivity, pharmacologically active compounds, physiological pH and ionization effects. Learning outcomes: - Students will describe amines, methods of synthesis, and their reactions. - Students will understand pharmacological relevance of amino-containing compounds and effects of pH on bioavailability.
13	Interrelation with Other Courses	- The prerequisites of the course Inorganic Chemistry are related to the course Organic Chemistry Applied in Pharmacy. - The knowledge from this course is necessary for following the content of the courses Bioorganic Chemistry, Pharmaceutical Chemistry 1, Phytochemistry, and Biochemistry.

14	Teaching and Working Methods	Teaching methods used in the course: 1. Lectures 2. Interactive classes including discussions on specific tasks, cases, and problems Practical methods: 1. Laboratory exercises 2. Problem solving (students work individually or in groups to solve specific problems to develop research and analytical skills, teamwork, and the application of theoretical knowledge)		
15	Total Available Contact Hours	240 hours		
	Forms of Teaching Activities	16.1.	Lectures – theoretical classes:	45 hours
16	Teaching Activities	16.2.	Exercises (laboratory, auditory):	45 hours
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours	/
		17.2.	Independent study: hours	Preparation for theoretical classes: 90 hours Preparation for practical classes: 23 hours
		17.3.	Exam preparation:	37 hours
18	Requirements for Signature	At least 25 points from the planned activities (16.1, 16.2)		
19	Assessment Method			
	19.1	Final exam: points (if colloquia are not taken)	31-60	
	19.2	Colloquium: points	Colloquium 1 – (16–30) Colloquium 2 – (16–30)	
	19.3	Practical exam: points	6-10	
	19.4	Seminar paper/project, written and oral presentation: points	/	
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)		
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.		
22	Literature			
	22.1	Required literature		

		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)
		1.	John McMurry	Organic chemistry, 6th Ed.	Brooks/Cole, Thomson Learning	2004 (electronic)
		2.	Paul M Dewick	Essentials of Organic chemistry for students of Pharmacy, Medicinal Chemistry and Biological chemistry	John Wiley & Sons Ltd	2006 (electronic)
		3.	David R. Klein	Organic Chemistry, 3rd Edition	Wiley	2017 (electronic)
		4.	Ana Poceva- Panovska, Emil Popovski, Olga Gigopulu	Experimental Techniques and Syntheses in Organic Chemistry: Laboratory Manual,	Faculty of Pharmacy, Skopje	2023 (electronic)
	22.2	Additional literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)
		1.	Richard B. Silverman	Organic Chemistry in Drug Design and Action	Magor	2011 (electronic)
		2.	John McMurry	Organic Chemistry with Biological Applications, 3rd Edition	Cengage Learning	2010 (electronic)
		3.	David R. Klein	Organic Chemistry As a Second Language, 3e: First/Second Semester Topics	Wiley	2011 (electronic)

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHYSICAL CHEMISTRY FOR PHARMACISTS			
2	Code	FFIPHFA07			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Applied Chemistry and Pharmaceutical Analysis			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	1	Semester:	II
7	Workload expressed in ECTS credits	7 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Rumenka Petkovska (course coordinator) Prof. Dr. Zoran Kavrakovski Prof. Dr. Natalija Nakov Asst. Prof. Dr. Blagoj Achevski			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisites for attending the course: Mathematics and Applied Statistics in Pharmacy and Biophysics, 1st semester (signature required) Prerequisites for passing the course: Physical Chemistry for Pharmacists, 1st semester (signature required) and credit from Biophysics, 1st semester.			
11	Course Aims (Competencies) and Learning Outcomes	Course aim: The aim of the course is for students to gain understanding of the laws and principles of physical chemistry, the structure and properties of different states of matter, thermodynamic changes and equilibrium states, phase transitions in chemical and biological systems, kinetics of chemical reactions, and rheological characteristics of substances. Students will be able to apply this knowledge in various areas of pharmacy (e.g., formulation of pharmaceutical dosage forms, pharmacokinetics, determination of drug stability). Expected learning outcomes: Upon completion of the course, students will demonstrate knowledge and skills to interpret the significance of physicochemical properties of substances, including pharmaceutical active ingredients in drug formulation, as well as apply basic laws of physical chemistry to the processes of drug absorption, distribution, and elimination in biological systems.			
12	Detailed Course Content by Chapters and	Chapter: Introduction to Physical Chemistry Definition; thermodynamic systems; states of systems; measurement systems.			

	Units, with Learning Outcomes for Each Chapter	- States of matter: characteristics of gases (gas laws, isoprocesses); characteristics of liquids (surface tension, vapor pressure, viscosity); characteristics of solids (crystalline and amorphous structures, types of crystals, polymorphism). Learning outcomes: - Students will gain knowledge of the basics of physical chemistry (homogeneous and heterogeneous thermodynamic systems, extensive and intensive properties), characteristics of the three aggregate states, and physicochemical properties of substances including pharmaceutical active ingredients and excipients. - Students will apply Gibbs' rule to phase changes. Chapter: Thermodynamics and Thermochemistry - Thermodynamics: First, Second, and Third Laws; thermochemistry; Hess's law and thermochemical calculations; enthalpy of physical changes. Learning outcomes: - Students will be able to define the basic principles of thermodynamics, factors affecting spontaneity of chemical reactions/processes, the role of Gibbs free energy, and heat capacity. - Students will interpret thermal phenomena accompanying chemical reactions. Chapter: Chemical Kinetics - Reaction rate; molecularity of chemical reactions; reaction order (zero, first, second, pseudo-order); complex reactions; catalysis. Learning outcomes: - Students will understand reaction kinetics using examples such as degradation kinetics of pharmaceutical active substances, applicable for assessing shelf life of pharmaceutical dosage forms. - Students will identify factors influencing reaction rates, including enzyme-catalyzed reactions. Chapter: Disperse Systems - Solutions of electrolytes and nonelectrolytes (ideal and real solutions; Raoult's law; Henry's law; colligative properties; solubility and distribution phenomena; isotonicity). - Colloidal disperse systems; coarse disperse systems (emulsions and suspensions); kinetic, electrical, and optical properties of disperse systems; surfactants and solubilization. Learning outcomes: - Students will understand thermodynamic properties and osmotic characteristics of solutions, including pharmaceutical active substances, and the application of colloidal systems in pharmacy. - Students will identify suitable methods for determining molecular weight of nonelectrolytes. Chapter: Rheology - Viscosity; Newton's law of viscosity; non-Newtonian systems; determination of rheological properties; thixotropy; bioreology. Learning outcomes: - Students will understand the rheological characteristics of substances, applicable to the formulation of pharmaceutical dosage forms. - Students will select the appropriate viscometer for measuring rheological properties of substances or dosage forms.

		Chapter: Diffusion and Dissolution - Fick’s law of diffusion; thermodynamics of diffusion; transport of substances across cell membranes; dissolution models (Noyes-Whitney model, Higuchi-Krowel law). Learning outcomes: - Students will understand basic principles of diffusion, including in biological systems, transport across membranes, and release of active substances from pharmaceutical dosage forms.		
13	Interrelation with Other Courses	1. Prerequisite knowledge of Mathematics and Applied Statistics in Pharmacy and Biophysics are required for attending Physical Chemistry for Pharmacists. 2. Knowledge from Physical Chemistry for Pharmacists is required for following courses: Instrumental Pharmaceutical Analysis, Medical Chemistry, Basics of Pharmaceutical Technology.		
14	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive sessions including discussions on exercises, case studies, and problems Practical methods: 1. Laboratory exercises (hands-on skills) 2. Numerical exercises (students work individually or in groups to solve problems applying theoretical knowledge)		
15	Total Available Contact Hours	210 hours		
	Forms of	16.1.	Lectures – theoretical classes:	45 hours
16	Teaching Activities	16.2.	Exercises (laboratory, auditory):	45 hours
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours	/
		17.2.	Independent study: hours	Preparation for theoretical classes: 67.5 hours Preparation for practical classes: 22.5 hours
		17.3.	Exam preparation:	30 hours
18	Requirements for Signature	At least 24 points from the planned activities (16.1, 16.2)		
19	Assessment Method			
	19.1	Final exam: points (if colloquia are not taken)	30 - 50 points (60% - 100%)	
	19.2	Colloquium: points	Colloquium 1 – (15–25) Colloquium 2 – (15–25)	
	19.3	Practical exam: points	6-10	

	19.4	Seminar paper/project, written and oral presentation: points	/				
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)					
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.					
22	Literature						
	22.1	Required literature					
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)	
		1.	Natalija Nakov, Rumenka Petkovska, Zoran Kavrakovski	Teaching Manual for Theoretical Lectures in Physical Chemistry for Pharmacists	UKIM – Faculty of Pharmacy, Skopje	2024 / electronic	
		2.	Natalija Nakov, Rumenka Petkovska, Zoran Kavrakovski	Practicum in Physical Chemistry for Pharmacists	UKIM – Faculty of Pharmacy, Skopje	2024 / electronic	
		3.	Atkins W., J. De Paula	„Physical Chemistry“ 8th Ed	Oxford University Press	2010 / hard copy	
	22.2	Additional literature					
No.		Authors	Title	Publisher	Year / Edition (electronic / hard copy)		
1.		Joseph K.H. Ma, Boka W. Hadzija	„Basic physical Pharmacy“	Jones & Bartlett Learning LLC	2017 / hard copy		

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHARMACEUTICAL BOTANY AND BIOLOGY			
2	Code	FFIFG08			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmacognosy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	1	Semester:	II
7	Workload expressed in ECTS credits	7 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Biljana Bauer (course coordinator) Prof. Dr. Gjoshe Stefkov (course coordinator) Prof. Dr. Marija Karapandzova Assoc. Prof. Dr. Ivana Cvetkovikj Karanfilova Asst. Prof. Dr. Ana Trajkovska Asst. Prof. Dr. Veronika Stoilkova Gjorgievska			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisites for attending the course: / Prerequisites for passing the course: /			
11	Course Aims (Competencies) and Learning Outcomes	Course Objectives: The program aims to familiarize students with the plant cell, plant histology, and the anatomy and morphology of plant organs, as well as to study the morphological and taxonomic characteristics of medicinal plants. Upon successful completion of the course, students will acquire knowledge regarding: • The structure of cells, especially plant cells, and the mechanisms of communication within and between cells; • Cell structures and organelles and their functions (plasma membrane, plastids, vacuoles, cell wall); • Meristems present in plants and their locations; • Permanent tissues of plants and the function of each cellular component; • Primary function and forms of vegetative and reproductive plant organs; • Differences between organs and metamorphoses; • Distinguishing features of monocots versus dicots; • Basics of plant morphology; • Plant classification;			

		• Taxonomic, morphological, and chorological characteristics of lower plants (Thallophyta); • Taxonomic, morphological, and chorological characteristics of higher plants (Cormophyta).
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Course Content: Chapter 1: Introduction to Biology • Subject and scope of biology, division of disciplines, historical overview, importance of plants to humans, cytology: cell definition, cell as a biological system, differences between prokaryotic and eukaryotic cells, plant cell (shape and size, protoplast, plastids, protoplast products), cell wall, chemical organization and function of plasma membrane. Learning Outcomes: Students will acquire knowledge about the structure of cells, particularly plant cells, mechanisms of communication within and between cells, cell structures and organelles, and their functions (plasma membrane, plastids, vacuoles, cell wall). Chapter 2: Plant Histology • Concept of tissue, tissue classification, meristematic tissues, permanent (differentiated) tissues, simple tissues, parenchymatic tissues, mechanical tissues, permanent tissue systems: dermal system (epidermis, periderm, cortex), vascular system, secretory and excretory systems. Plant anatomy and morphology: organization of higher plants, plant organs; vegetative organs: root – function, morphology, metamorphoses, zones, anatomical structure (primary and secondary); shoot – function, morphology, branching, metamorphoses, bud – definition, components, types; stem – forms, dimensions, durability, anatomical structure, primary and secondary growth; leaf – function, morphology, components, types, metamorphoses, anatomical structure. Reproductive organs: flower – function, protective elements, inflorescences, flower anatomy, microsporogenesis and male gametophyte formation, megasporogenesis and female gametophyte formation, pollination, fertilization, endosperm formation, embryo formation; seed – structure, seed coat, embryo; fruit – structure, types, dispersal and distribution. Learning Outcomes: Students will acquire knowledge of plant meristems and their locations, permanent tissues and their functions, primary functions and forms of vegetative and reproductive organs, differences between organs and metamorphoses, distinguishing features of monocots and dicots, and the basics of plant morphology. Chapter 3: Plant Systematics • Study objectives, morphological foundations, taxonomic categories, plant classification; lower plants (Thallophyta), Regnum Monera, Regnum Protista, Regnum Fungi, Lichenes; higher plants

		(Cormophyta): Psilophyta, Bryophyta, Lycopodophyta, Sphenophyta, Filicinophyta, Ginkgoophyta, Gnetophyta, Cycadophyta, Coniferophyta (Pinaceae, Cupressaceae, Taxaceae); Angiosperms – Dicotyledones: Magnoliales, Aristolochiales, Ranunculales, Papaverales, Fagales, Urticales, Caryophyllales, Polygonales, Theales, Violales, Cucurbitales, Capparales, Salicales, Ericales, Primulales, Malvales, Euphorbiales, Rosales, Fabales, Myrtales, Rutales, Sapindales, Geraniales, Cornales, Rhamnales, Santalales, Oleales, Gentianales, Dipsacales, Boraginales, Scrophulariales, Lamiales, Asterales; Monocotyledones: Liliales, Iridales, Orchidales, Poales, Arales. Learning Outcomes: Students will acquire knowledge regarding plant classification, and the taxonomic, morphological, and chorological characteristics of lower plants (Thallophyta) as well as higher plants (Cormophyta).		
13	Interrelation with Other Courses	1. Prerequisites are not required/linked to the subject 2. Knowledge from the subject is required to follow the teaching content of Phytochemistry, Pharmacognosy, Phytotherapy and elective courses		
14	Teaching and Working Methods	Teaching methods used in the subject: 1. Lectures 2. Interactive classes which include discussions on specific tasks, cases, problems Working methods: 1. Laboratory exercises (practical skills for work), fieldwork 2. Problem solving (students work independently/in groups to solve specific problems in order to stimulate research and analytical skills, teamwork and application of theoretical knowledge) 3. Project work (preparation of a project which includes research on a given topic in order to develop abilities for independent research and abilities for presentation in front of an audience)		
15	Total Available Contact Hours	210 hours		
	Forms of	16.1.	Lectures – theoretical classes:	30 hours
16	Teaching Activities	16.2.	Exercises (laboratory, auditory):	75 hours
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours	15 hours
		17.2.	Independent study: hours	45 hours
		17.3.	Exam preparation:	45 hours
18	Requirements for Signature	At least 40 points from the planned activities (16.1, 16.2, 17.1)		
19	Assessment Method			

	19.1	Final exam: points (if colloquia are not taken)	25 - 50 points			
	19.2	Herbarium: points	4.5-5			
	19.3	Practical classes: points	13.5–15			
	19.4	Practical exam: points	3.5–7.5			
	19.5	Fieldwork	5,5–7,5			
	19.6	Theoretical classes	13–15			
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)				
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.				
22	Literature					
	22.1	Required literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)
		1.	Stern K., Jansky S., Bidlack J.,	Introductory Plant Biology,	9th Edition, McGraw-Hill Higher Education, 2003	2003 (hard copy)
		2.	Mauseth J.,	Botany: An Introduction to Plant Biology,	2nd Edition, Saunders College Publishing,	2006 (hard copy)
		3.	Jancic R,	Botanicapharmaceutica,	Nauka, Beograd, 2003	2003 (hard copy)
	22.2	Additional literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)
		1.	Alberts B, Johnson A., Lewis J, Raff M, Roberts K.,Walter P,	Molecular Biology of the Cell,	4th Ed., Garland Science,	2002 (hard copy)
			2.	Carp G.,	Cell and Molecular Biology; concepts and experiments,	4th Ed., , John Wiley & sons, Inc.,

		3.	Group of authors	Flora of the Republic of North Macedonia	Macedonian Academy of Sciences and Arts (MASA)	(hard copy)
		4.	Group of authors	Flora of the Republic of Serbia	Serbian Academy of Sciences and Arts (SANU)	(hard copy)
		5.	Group of authors	Flora of the Republic of Bulgaria	Bulgarian Academy of Sciences (BAS)	(hard copy)

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	MOLECULAR AND CELL BIOLOGY AND GENETICS			
2	Code	FFIFH09			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmaceutical Chemistry			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	1	Semester:	II
7	Workload expressed in ECTS credits	6 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Teachers involved in the course: Prof. Dr. Aleksandar Dimovski (course coordinator) Prof. Dr. Nadica Matevska Geshkovska Assistants participating in the practical classes: Asst. Prof. Dr. Marija Staninova Stojoska Asst. Prof. Dr. Elizabeta Krstevska Bozinovikj			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisites for attending the course: / Prerequisites for passing the course: /			
11	Course Aims (Competencies) and Learning Outcomes	- The aim of the course is for students to acquire and develop an understanding of the fundamental concepts of molecular biology and genetics. - The student will be able to apply the acquired knowledge in all subsequent subjects that require a basic understanding of molecular biology and genetics. - Upon completion of the course, the student will be able to understand the molecular bases of normal cellular and tissue function, the molecular bases of diseases, and the molecular mechanisms of drug action. - During the course, the student will acquire fundamental knowledge of the approaches and molecular analyses used to gain insights into molecular biology and genetics.			
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	1. Chapter: Introduction to Molecular Biology and Genetics Historical overview of the development of the discipline. The cell theory. Basic characteristics of prokaryotic and eukaryotic cells. Viruses – basic structure and function.			

		Learning outcomes: - Students will become familiar with the subject matter of molecular biology and genetics and will gain basic knowledge of the structure and function of viruses, prokaryotic and eukaryotic cells. 2. Chapter: Macromolecules and Energy - Introduction to the main macromolecules in the cell, with detailed focus on the structure and function of proteins. Introduction to the principles of energy utilization in living systems. Learning outcomes: - Students will become familiar with the main macromolecules in the cell, the structure and function of proteins, and the principles of energy utilization in living systems. 3. Chapter: Cell Membrane - Introduction to the basic structure and function of the cell membrane. Special focus on mechanisms of transport of various substances across the cell membrane. Principles of polarization, depolarization, and propagation of action potentials across the cell membrane. Learning outcomes: - Students will become familiar with the basic structure and function of the cell membrane, mechanisms of transport of substances across it, and principles of polarization, depolarization, and propagation of action potentials. 4. Chapter: Cellular Organelles - Introduction to the basic structure and function of cellular organelles: mitochondria, endoplasmic reticulum, Golgi apparatus, endo- and exo-membrane vesicular transport, lysosomes. Learning outcomes: - Students will become familiar with the structure and function of mitochondria, the endoplasmic reticulum, the Golgi apparatus, vesicular transport, and lysosomes. 5. Chapter: Extracellular Matrix, Cytoskeleton, and Movement within Cells - Introduction to the basic structure of the extracellular matrix, cytoskeleton, and principles of intracellular movement of substances.

		Learning outcomes: - Students will become familiar with the structure of the extracellular matrix, cytoskeleton, and principles of intracellular movement of substances. 6. Chapter: Cell Signaling - Introduction to the basic principles of cell signaling, with detailed focus on signaling via G-proteins and membrane receptor kinases. Learning outcomes: - Students will become familiar with the principles of cell signaling, especially signaling through G-proteins and membrane receptor kinases. 7. Chapter: Structure of DNA, Chromosomes, and Genomes. DNA Replication and Repair - Introduction to the basic principles of DNA structure, chromosomes, and the human genome. Overview of DNA replication mechanisms and mechanisms of DNA damage and repair. Learning outcomes: - Students will become familiar with the basic principles of DNA structure, chromosomes, and the human genome. They will also gain basic understanding of DNA replication, damage, and repair mechanisms. 8. Chapter: Gene Expression - Introduction to the basic principles of gene expression and mechanisms involved in the regulation of the process leading to a functional final product. Learning outcomes: - Students will become familiar with the principles of gene expression and the regulatory mechanisms at all levels, from initiation to production of the final functional protein. 9. Chapter: Cell Cycle and Cell Division - Introduction to the main phases of the cell cycle and the principles regulating cell cycle progression. Overview of the phases and regulatory principles of somatic and germ cell division (mitosis and meiosis).

		Learning outcomes: - Students will become familiar with the phases and regulation of the cell cycle and with the basic principles of somatic and germ cell division. 10. Chapter: Inheritance, Mutations, and Principles of Molecular Diagnostics - Introduction to the basic principles of inheritance of genetic information, the nature and types of genetic mutations associated with inherited and acquired diseases, and approaches in their molecular diagnosis. Learning outcomes: - Students will become familiar with the principles of inheritance of genetic information, types of genetic mutations, and approaches to molecular diagnostics.		
13	Interrelation with Other Courses	- For this subject, useful (but not mandatory) prior knowledge includes the subjects Physiology and Organic Chemistry Applied in Pharmacy. - The knowledge gained from this subject is required as prior knowledge for understanding the course content of the following subjects: Biochemistry, Fundamentals of Immunology, Pathology and Pathophysiology, Fundamentals of Pharmacology, Clinical Pharmacy and Pharmacotherapy, and Pharmacogenetics, Pharmacogenomics, and Individualized Therapy.		
14	Teaching and Working Methods	Teaching methods used in the subject: - Lectures Working methods: - Laboratory exercises (practical work skills)		
15	Total Available Contact Hours	180 hours		
	Forms of	16.1.	Lectures – theoretical classes:	45 hours
16	Teaching Activities	16.2.	Exercises (laboratory, auditory):	45 hours
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours	0 hours
		17.2.	Independent study: hours	Preparation for theoretical teaching: 45 hours Preparation for practical teaching: 22.5 hours
		17.3.	Exam preparation:	22.5 hours

18	Requirements for Signature	At least 30 points from the planned activities (16.1, 16.2, 17.1)				
19	Assessment Method					
	19.1	Final exam: points (if colloquia are not taken)	25 - 50 points			
	19.2	Colloquium: points	Colloquium 1: 13–25 Colloquium 2: 13–25			
	19.3	Practical exam: points	6-10			
	19.4	Seminar paper/project, written and oral presentation: points	/			
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)				
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.				
22	Literature					
	22.1	Required literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)
		1.	Gerald Karp	Cell and Molecular Biology: Concepts and Experiments	Wiley	2015
	22.2	Additional literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)
		1.	Alberts B, Johnson A., Lewis J, Raff M, Roberts K.,Walter P,	Molecular Biology of the Cell,	4th Ed., Garland Science,	2002 (hard copy)

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	SPORT AND HEALTH			
2	Code	FFFK10			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Physical Education, Sport and Health			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	1	Semester:	II
7	Workload expressed in ECTS credits	2 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Asst. Prof. Dr. Jana Karshakovska Dimitrioska			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisites for attending the course: / Prerequisites for passing the course: /			
11	Course Aims (Competencies) and Learning Outcomes	The aim of the course Sport and Health is for students to acquire new and improve existing motor knowledge and skills, to enhance motor, morphological, and functional abilities in order to promote health, satisfy the need for movement, enable students to use their free time rationally, meaningfully, and purposefully, as well as to improve the quality of life during youth, adulthood, and old age. The course also provides knowledge about the structure, rules, and principles of the training process and the specific characteristics of training activities.			
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Course content: The importance of physical activity. Specific indicators from scientific research on the health, economic, psychological, sociological, and other aspects of physical activity and its influence on personal and social development. A. Program – Basic Regular Program: basketball, volleyball, handball, futsal, development of motor abilities, dance fitness programs (aerobics, step aerobics, Pilates, etc.) B. Program – Elective Classes (self-financed): swimming, skiing, hiking, camping, cycling, rollerblading, fitness, tennis, ice skating. C. Program for Students with Special Needs: physical activities depending on the student's diagnosis. D. Program – Sports Competitions: faculty and university sports			

		competitions. E. Extracurricular Sports Activities.				
13	Interrelation with Other Courses	/				
14	Teaching and Working Methods	Lectures, exercises, and diagnostics of motor abilities.				
15	Total Available Contact Hours	60 hours				
	Forms of	16.1.	Lectures – theoretical classes:	15 hours		
16	Teaching Activities	16.2.	Exercises (frontal, group, individual, station, circuit): hours	40 hours		
		16.3	Practice: hours	/		
17	Other Forms of Activities	17.1.	Diagnosis of motor abilities (through standardized motor tests MAKFIT)	5		
		17.2.	Independent assignments: hours	/		
		17.3.	Home study: hours	/		
18	Requirements for Signature	Regular attendance at classes.				
19	Assessment Method					
	19.1	Motor tests	20			
	19.2	Individual work/project	20			
	19.3	Activity (presentation of innovative exercises)	20			
	19.4	Final exam	40			
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)				
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.				
22	Literature	The list of literature is determined in agreement with the course instructor and the Library of the Faculty of Physical Education, Sport and Health.				
	22.1	Required literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)
		1.	/	/	/	/
		2.	/	/	/	/
		3.	/	/	/	/
	22.2	Additional literature				

		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)
		1.	/	/	/	/

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	BIOORGANIC CHEMISTRY			
2	Code	FFIPHFA11			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Applied Chemistry and Pharmaceutical Analysis			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	2	Semester:	III
7	Workload expressed in ECTS credits	8 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Ana Poceva Panovska (course coordinator) Prof. Dr. Katerina Brezovska Prof. Dr. Jasmina Tonikj Ribarska Asst. Prof. Dr. Olga Gigopulu			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Organic Chemistry Applied in Pharmacy, 2nd semester (signature) Prerequisite for taking the exam: Organic Chemistry Applied in Pharmacy, 2nd semester (credits)			
11	Course Aims (Competencies) and Learning Outcomes	The aim of the course is for students to acquire/develop skills: • to classify and analyze the structure of different types of carbohydrates, such as monosaccharides, amino sugars, aminoglycoside antibiotics, glycosides, and polysaccharides, their reactivity, and their pharmaceutical application in drugs and therapeutic agents. • to analyze the structure and function of amino acids and peptides and learn how to apply methods for their synthesis and sequencing. • to understand the structure and reactivity of lipids (triglycerides, phospholipids, steroids, prostaglandins, and terpenes), as well as their basic functions. • to understand the structure of nucleosides, nucleotides, and nucleic acids. • to understand the structure of coenzymes and the basics of their reactivity. • to understand the fundamental reaction mechanisms related to biochemical processes, including reactions of biomolecules such as carbohydrates, amino acids, and lipids, and apply this knowledge to explain biochemical reactions. • to understand the structure and reactivity of heterocyclic compounds, including aromatic heterocycles with one or more heteroatoms and condensed heterocyclic systems, and apply this knowledge in approaches to the synthesis of pharmaceutically active molecules.			

		Upon successful completion of the course, the student will be able to: • classify and analyze the structure of various types of carbohydrates (monosaccharides, amino sugars, aminoglycoside antibiotics, glycosides, and polysaccharides), understand their reactivity and stability, and apply this knowledge in a biochemical context. • understand the structure and reactivity of amino acids and methods of peptide/protein synthesis. Additionally, they will be able to apply methods for peptide synthesis and peptide sequencing. • analyze and understand the structure and reactivity of various types of lipids (triglycerides, phospholipids, steroids, prostaglandins, and terpenes), as well as their biological role and application in pharmacy. • recognize and analyze the structure and function of nucleosides, nucleotides, and nucleic acids, and understand their involvement in metabolism and biological processes, with emphasis on their application in drug development. • identify and analyze the structure and reactivity of heterocyclic compounds and apply this knowledge in the synthesis of pharmaceutically active substances for the development of new drugs and therapeutic molecules.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: Carbohydrates • Classification, characteristics, and reactivity: Monosaccharides (structural isomerism, stereochemistry, anomeric forms), amino sugars and aminoglycoside antibiotics (structure, reactivity, and pharmacological application), glycosides (formation, stability, and application in drugs). • Disaccharides and polysaccharides: Structure, physicochemical properties, biological role, and their significance in biochemical and pharmaceutical contexts. Learning outcomes: • Students will be able to classify various types of carbohydrates and analyze their structure, reactivity, and stability. • Students will be able to explain the biochemical role of carbohydrates and the significance of their physicochemical properties and application in pharmaceutical contexts. • Apply the acquired knowledge of structural and reactive aspects of carbohydrates in the development and analysis of pharmaceutical products. Chapter 2: Amino Acids and Peptides • Classification and structure of amino acids (basic, polar and nonpolar, essential and non-essential). • Physicochemical properties: isoelectric point, acid-base equilibrium, reactivity of functional groups of amino acids. • Structure of peptides (primary, secondary, tertiary, and quaternary structures).

		• Chemical and biochemical methods for peptide synthesis: classical and modern techniques. • Methodologies for peptide sequencing. • Pharmaceutical application of peptides: therapeutic agents and biological activities. Learning outcomes: • Students will be able to analyze the structure and reactivity of amino acids and peptides, and apply the acquired knowledge in the identification and classification of amino acids and peptides of pharmaceutical importance. • Students will learn to apply modern methods for peptide synthesis and sequencing and explain their applications. Chapter 3: Lipids • Classification and structure: Triglycerides, phospholipids (structure, polarity, and role in cell membranes), steroids (structure, classification, and biological significance), prostaglandins and other eicosanoids (synthesis and biological functions), terpenes (structure, classification, and pharmaceutical application). • Reactivity, importance, and application of different classes of lipids. • The role of lipids in biological membranes. Learning outcomes: • Students will be able to analyze the structure, classification, and biological role of different types of lipids and connect their structure with their function in biological systems. • Students will be able to explain the basic chemical properties and reactions of lipids. Chapter 4: Nucleosides, Nucleotides, and Nucleic Acids • Basic structure and classification of nucleosides and nucleotides. • Chemical properties of purine and pyrimidine bases. • Polymerization and structure of nucleic acids (DNA and RNA). Learning outcomes: • Identify and analyze the structure and classification of nucleosides, nucleotides, and their purine and pyrimidine bases, and explain and apply concepts related to the polymerization and structure of nucleic acids (DNA and RNA).

	Chapter 5: Structure and Reactivity of Coenzymes and Reaction Mechanisms in Biochemical Processes of Carbohydrates, Amino Acids, and Lipids • Chemistry of the α-carbon atom, biological significance of aldol and Claisen condensations and their examples in metabolic reactions. • Structural characteristics of coenzymes and their role in biochemical reactions. Mechanisms of coenzyme activation in enzymatic reactions. • Reaction mechanisms in biochemical processes. Learning outcomes: • Students will be able to recognize the α-carbon atom and its reactivity, explain mechanisms and biological significance of aldol and Claisen condensations, and identify examples in metabolic reactions. • Students will describe the structure of major coenzymes (NAD⁺, FAD, CoA, ATP, etc.) and their role in biochemical reactions, linking them to biological functions such as electron or methyl/acetyl group transfer. • Students will be able to explain the activation mechanisms and specificity of coenzymes in various biochemical reactions (addition, elimination, nucleophilic substitution). • Students will recognize organic reactions and mechanisms in carbohydrate, amino acid, and lipid metabolism. • Students will apply learned concepts of coenzymes in drug development strategies based on coenzyme/enzyme inhibition. Chapter 6: Heterocyclic Compounds • Five- and six-membered aromatic heterocycles with one or more heteroatoms and condensed heterocyclic systems: • Nomenclature, classification, structure, physical properties, and chemical reactions • Overview of main synthetic approaches • Biological and pharmacological importance • Examples of pharmaceutically active substances based on these heterocyclic systems. Learning outcomes: • Students will be able to describe the structure, characteristics, and reactivity of various heterocyclic compounds, including aromatic five-, six-, and seven-membered heterocycles with one or two heteroatoms, as well as condensed heterocyclic systems.

		- Identify drugs based on heterocyclic structures. - Students will relate heterocyclic structures to their importance in developing pharmaceutically active molecules, understanding their role in the therapeutic properties of drugs. - Students will analyze the main methods for synthesis of aromatic heterocycles and their application in drug creation, gaining skills to identify basic reactions and approaches to synthesizing such molecules.		
13	Interrelation with Other Courses	- The prior knowledge from the <i>course</i> Organic Chemistry Applied in Pharmacy is related to the course Bioorganic Chemistry. - The knowledge gained from this course is necessary for following the content of the courses Biochemistry, Medical Chemistry, Pharmaceutical Chemistry 1, <i>and</i> Phytochemistry.		
14	Teaching and Working Methods	Teaching methods used in the course: - Lectures - Interactive sessions that include discussions on specific tasks, cases, and problems Working methods: - Laboratory exercises - Problem-solving (students work independently or in groups to solve specific problems in order to develop research and analytical skills, teamwork, and application of theoretical knowledge)		
15	Total Available Contact Hours	240 hours		
	Forms of	16.1.	Lectures – theoretical classes:	45 hours
16	Teaching Activities	16.2.	Exercises (laboratory, auditory):	45 hours
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours	/
		17.2.	Independent study: hours	Preparation for theoretical classes: 90 hours Preparation for practical classes: 23 hours
		17.3.	Exam preparation:	37 hours
18	Requirements for Signature	At least 25 points from the planned activities (16.1, 16.2)		
19	Assessment Method			
	19.1	Final exam: points (if colloquia are not taken)	31-60	
	19.2	Colloquium: points	Colloquium 1 – (16–30) Colloquium 2 – (16–30)	
	19.3	Practical exam: points	6-10	

	19.4	Seminar paper/project, written and oral presentation: points				
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)				
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.				
22	Literature					
	22.1	Required literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)
		1.	John McMurry	Organic chemistry, 6th Ed.	Brooks/Cole, Thomson Learning	2004 (electronic)
		2.	John McMurry	Organic Chemistry with Biological Applications, 3rd Edition	Cengage Learning	2010 (electronic)
		3.	Louis D. Quin John A. Tyrell	Fundamentals of heterocyclic chemistry,Importance in nature and in the synthesis of pharmaceuticals	Wiley	2010 (electronic)
		4.	Ana Poceva-Panovska, Emil Popovski, Olga Gigopulu	Experimental Techniques and Syntheses in Organic Chemistry: Laboratory Manual,	Faculty of Pharmacy, Skopje	2023 (electronic)
	22.2	Additional literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)
		1.	David R. Klein	Organic Chemistry, 3rd Edition	Wiley	2017 (electronic)
2.		John A. Joule Keith Mills	Heterocyclic Chemistry at a Glance	Wiley	2013 (electronic)	

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	ANALYTICAL CHEMISTRY APPLIED IN PHARMACY			
2	Code	FFIPHFA12			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Applied Chemistry and Pharmaceutical Analysis			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	2	Semester:	III
7	Workload expressed in ECTS credits	8 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Jasmina Tonikj Ribarska (course coordinator) Prof. Dr. Suzana Trajkovikj Jolevska Asst. Prof. Dr. Blagoj Achevski			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Credits obtained from the course General and Inorganic Chemistry Applied in Pharmacy (1st semester). Prerequisite for taking the exam: Completed attendance and signature from the course Analytical Chemistry Applied in Pharmacy and credits obtained from the course General and Inorganic Chemistry Applied in Pharmacy (1st semester).			
11	Course Aims (Competencies) and Learning Outcomes	Course aim: The aim of this course is for students to acquire theoretical and practical knowledge in the field of analytical chemistry applied in pharmacy, including the principles of qualitative and quantitative chemical analysis, and understanding the influence of experimental conditions on chemical reactions and analytical results. Students will be able to apply the acquired knowledge in various areas of pharmacy (e.g., examination of chemical substances for pharmaceutical use, development, testing, and quality control of finished pharmaceutical products). Expected learning outcomes: Upon successful completion of the course, students will: Gain knowledge of chemical equilibrium establishment, the influence of electrolytes on chemical equilibrium, and the effect of equilibrium on chemical reactions.			

		• Understand classical analytical methods and their principles, applications, and limitations in pharmaceutical analysis. • Identify potential sources of analytical errors and apply analytical methods for the examination of substances for pharmaceutical use, as well as for the development, testing, and quality control of finished pharmaceutical products. • Perform calculations, evaluate analytical results, and develop the ability to independently solve analytical problems.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter: Introduction to Analytical Chemistry • Basic principles, aims, and tasks of analytical chemistry; application of analytical chemistry in pharmaceutical analysis. Learning outcomes: • Students will acquire knowledge about the aims and tasks of analytical chemistry, the basic principles of qualitative and quantitative chemical analysis, and identify the role of analytical chemistry in pharmaceutical applications. Chapter: Chemical Equilibrium • Establishment of chemical equilibrium, equilibrium constants; influence of electrolytes; types of chemical reactions; selectivity and sensitivity of reactions. Learning outcomes: • Students will understand the laws of chemical equilibrium, the effect of electrolytes, and the selection and application of appropriate reactions in pharmaceutical analyses. Chapter: Qualitative Chemical Analysis • Qualitative chemical analysis of ions in substances for pharmaceutical use. Learning outcomes: • Students will acquire knowledge of the principles of qualitative chemical analysis and its application in pharmaceutical testing. Chapter: Chemical Reactions in Solution • Acid-base reactions in aqueous and non-aqueous media; complex formation reactions; oxidation-reduction reactions; precipitation reactions. Learning outcomes: • Students will understand the principles of chemical reactions in solution and their application in developing methods for pharmaceutical analyses. Chapter: Classical Quantitative Analytical Methods • Principles of classical quantitative methods; construction of titration curves. Learning outcomes:

	- Students will understand the principles of classical quantitative analytical methods and their application in pharmaceutical analysis, including titration curve construction. Chapter: Quantitative Chemical Analysis - Analytical problem-solving, sampling, sample preparation, analysis, and result calculation. <i>Volumetric titrations</i> – applied to the determination of chemical substances for pharmaceutical use/pharmaceutical dosage forms. <i>Gravimetric methods</i> – applied to determining parameters for testing pharmaceutical substances/dosage forms. Learning outcomes: - Students will understand the principles and applications of volumetric and gravimetric methods in pharmaceutical analysis. Chapter: Acid-Base Titrations - Titration of strong and weak acids and bases, polyfunctional systems, non-aqueous titrations, standard solutions, titration curve construction, indicators, and endpoints. Learning outcomes: - Students will gain knowledge of the principles and applications of acid-base titrations in pharmaceutical analysis. Chapter: Complexometric Titrations - Chelate complexes, EDTA titrations, titration curves, indicators, and endpoints. Learning outcomes: - Students will acquire knowledge of the principles and pharmaceutical applications of complexometric titrations. Chapter: Redox Titrations - Theoretical bases of redox reactions; titrations using standard oxidizing/reducing agents; titration curves, indicators, and endpoints. Learning outcomes: - Students will understand the principles and applications of redox titrations in pharmaceutical analysis. Chapter: Precipitation Titrations - Equilibria in heterogeneous systems, solubility products, titrations based on precipitation reactions, standard solutions, titration curves, indicators, endpoints, and gravimetric methods. Learning outcomes: - Students will understand the principles and pharmaceutical applications of precipitation titrations. Chapter: Separation Methods

		- Principles of separation methods and their application in extracting pharmacologically active substances from various matrices, removing impurities from chemical substances, and isolating active ingredients from solid and liquid dosage forms. Learning outcomes: - Students will acquire knowledge of the principles and applications of separation methods in pharmaceutical analysis.		
13	Interrelation with Other Courses	Prerequisite knowledge: - Knowledge from the course General and Inorganic Chemistry Applied in Pharmacy is required/related to this course. - The knowledge from Analytical Chemistry Applied in Pharmacy is necessary for following courses such as Instrumental Pharmaceutical Analysis, Medical Chemistry, Biochemistry, Drug Analytics and Legislation, and Bioanalytical Chemistry.		
14	Teaching and Working Methods	Teaching methods used in the course: - Lectures - Interactive sessions including discussions on selected tasks, cases, and problems Working methods: - Laboratory exercises (development of practical skills) - Numerical exercises - Problem-solving (students work independently or in groups to solve specific analytical problems, encouraging research and analytical skills, teamwork, and application of theoretical knowledge) - Project work (developing a project involving research on a selected topic to foster independent research and presentation skills).		
15	Total Available Contact Hours	240 hours		
16	Forms of Teaching Activities	16.1.	Lectures – theoretical classes:	45 hours
		16.2.	Exercises (laboratory, auditory):	60 hours
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours	8.5 hours
		17.2.	Independent study: hours	Preparation for theoretical classes: 67.5 hours Preparation for practical classes: 30 hours
		17.3.	Exam preparation:	30 hours
18	Requirements for Signature	At least 30 points from the planned activities (16.1, 16.2)		
19	Assessment Method			

	19.1	Final exam: points (if colloquia are not taken)	26-50				
	19.2	Colloquium: points	Colloquium 1 – (13–25) Colloquium 2 – (13–25)				
	19.3	Practical exam: points	10-15				
	19.4	Seminar paper/project, written and oral presentation: points	5				
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)					
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.					
22	Literature						
	22.1	Required literature					
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)	
		1.	Skoog D., West D., Holler F., S. Crouch	Fundamentals of Analytical Chemistry	10th Edition Harcourt Brace College Publishers	2021	
		2.	D. Skoog, D. West, F. Holler, S. Crouch	Introduction to Analytical Chemistry.	Prosvetno Delo, Skopje.	2009	
		3.	S. Trajkovic Jolevska, J. Tonikj Ribarska	Practicum in Analytical Chemistry for students of the integrated studies program - Master of Pharmacy	Faculty of Pharmacy, Ss. Cyril and Methodius University, Skopje	2018	
		4.	S. Trajkovic Jolevska, J. Tonikj Ribarska	Collection of Problems in Analytical Chemistry for students of the integrated studies program – Master of Pharmacy	Faculty of Pharmacy, Ss. Cyril and Methodius University, Skopje	2018	
	22.2	Additional literature					
		No.	Authors	Title	Publisher	Year / Edition	

						(electronic / hard copy)
		1.	Harris D., C. Lucy	Quantitative Chemical Analysis	10th Edition Freeman and Company, New York	2019

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PATHOPHYSIOLOGY			
2	Code	FFMF13			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Medicine Institute of Pathophysiology and Nuclear Medicine			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	2	Semester:	III
7	Workload expressed in ECTS credits	6 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Venjamin Majstorov (course coordinator) Prof. Dr. Daniela Pop Gjorgcheva Prof. Dr. Ana Ugrinska Prof. Dr. Sinisha Stojanoski Assoc. Prof. Dr. Tanja Makazlieva Assoc. Prof. Dr. Nevena Manevska Scientific Advisor Dr. Sonja Kuzmanovska Scientific Advisor Dr. Toni Tripunoski Scientific Associate Dr. Anamarija Jankulovska Asst. Dr. Maja Zdravkovska Asst. Dr. Nikolina Bojinovska Kolovchevska Asst. Dr. Bojana Stoilovska Rizova			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for enrollment: Anatomy with Physiology (signature) Prerequisite for exam: Anatomy with Physiology (credits)			
11	Course Aims (Competencies) and Learning Outcomes	Course objectives The aim of the course is for students to acquire and develop an understanding of the functional aspects of the mechanisms of diseases and the altered responses of the human body when changes occur in its external and internal environment. Students will be able to apply the acquired knowledge in the analysis, interpretation, and problem-solving of physiological changes in the human body that result from various internal and external factors affecting homeostasis. Expected learning outcomes Upon successful completion of the course, students will be able to discuss the pathophysiological mechanisms of diseases and recognize and explain them. They will be able to demonstrate the experimental methods presented in the			

		practical sessions, identify the main changes in the experimental model, and assess the effects of various pathogenic factors. Moreover, they will be able to connect theoretical knowledge with acquired practical experience.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter: Subject, methods, and importance of pathophysiology. Etiological pathogenic factors of the external environment: physical, chemical, and biological. • Definition of subject and methods in pathophysiology, etiopathogenesis of diseases, disease and death. Pathophysiological mechanisms of shock and crush syndrome as a special form of shock. Biological effects of ultrasound and laser. Effects of thermal factors—hypothermia and hyperthermia. Effects of chemical agents—xenobiotics. Effects of radiation—light, infrared, ultraviolet, and ionizing radiation. Effects of hypoxia and fever. Learning outcomes: • Students will be able to define the subject and methods of pathophysiology, identify exogenous and endogenous pathological factors, and gain knowledge about the etiopathogenesis of diseases resulting from various pathogenic influences. Chapter: Pathophysiology of the immune system • Definition of general reactivity and resistance, hereditary factors, components of the immune system (nonspecific and specific), immune system diseases—hypersensitivity (allergic) reactions and their types, immunodeficiencies, autoimmune diseases, and pathophysiology of transplantation immunity. Learning outcomes: • Students will gain knowledge about common immune system diseases, be able to describe types of allergic reactions, states of immunodeficiency, and identify autoimmune diseases. Chapter: Disorders of energy metabolism and nutrient metabolism • Study of conditions such as malnutrition, obesity, and metabolic disturbances of carbohydrates, fats, and proteins. Learning outcomes: • Students will understand the causes and consequences of malnutrition and obesity, discuss conditions of hypoglycemia and hyperglycemia, disorders of lipoproteins and lipid deposition, as well as protein deficiency. Chapter: Pathophysiology of the hematopoietic system and hemostasis • Disorders of the erythrocyte lineage, anemia and its types, disorders of the leukocyte lineage—quantitative and qualitative, leukemias, and hemostasis disorders. Learning outcomes: • Students will define common blood cell disorders, understand the types and effects of anemia, describe qualitative and quantitative leukocyte disorders including malignant forms, and identify the main hemostasis disorders (vascular, platelet, and coagulation factors). Chapter: Pathophysiology of the cardiovascular system • Conditions of altered cardiac output, heart failure (left and right), valvular disorders, arrhythmias, syncope, coronary circulation disorders, arterial hypertension, and pericardial diseases.

	Learning outcomes: • Students will gain knowledge about disturbances of cardiac output, differentiate left and right heart failure and their consequences, describe valvular diseases, identify arrhythmias and coronary circulation disorders, and understand the etiopathogenesis of arterial hypertension. Chapter: Pathophysiology of the respiratory system • Disorders of ventilation, ventilation/perfusion and gas diffusion ratio, pulmonary edema, pathophysiology of the pleura and atelectasis. Learning outcomes: • Students will define restrictive and obstructive ventilation disorders, understand ventilation-perfusion mismatches, describe mechanisms of pulmonary edema and atelectasis, and become familiar with pleural diseases. Chapter: Pathophysiology of the gastrointestinal system • Disorders of the functions of the pharynx and esophagus, stomach, small intestine, pancreas, and colon. Learning outcomes: • Students will understand common swallowing disorders, disturbances of gastric motor and mucosal function, comprehend the pathogenesis of ulcer disease, intestinal mucosal dysfunction, and major disorders of colon function. Chapter: Pathophysiology of the hepatobiliary system • Disorders of hepatic metabolic functions, bile excretion and composition, portal hypertension, and ascites. Learning outcomes: • Students will understand carbohydrate, lipid, and protein metabolic disorders in liver diseases, differentiate types of bilirubin metabolism disorders, and understand the pathogenesis of bile secretion disorders, portal hypertension, and their consequences. Chapter: Pathophysiology of the nephro-urinary system and acid-base balance • Disorders of renal concentrating and diluting capacity, urine volume and composition, renal dysfunction, renal insufficiency, and edema; mechanisms maintaining acid-base balance; types of acid-base disorders. Learning outcomes: • Students will describe common renal functional disorders, understand mechanisms of oliguria and polyuria, identify urine composition changes, and explain causes and mechanisms of renal insufficiency and edema. • Students will understand mechanisms maintaining acid-base balance and identify main types of acid-base disturbances. Chapter: Pathophysiology of the endocrine system • Disorders of the endocrine function of the hypothalamus and pituitary, thyroid diseases, parathyroid disorders, adrenal diseases, and pathophysiology of male and female sex hormones. Learning outcomes: • Students will define and explain dysfunctions of the hypothalamus and

		pituitary, understand diseases of the thyroid, parathyroid, and adrenal glands, and describe disorders in secretion of male and female sex hormones.		
13	Interrelation with Other Courses	1. Prerequisite courses: Anatomy and Physiology are required and related to Pathophysiology. 2. Subsequent courses: Knowledge of Pathophysiology is required for Pharmaceutical Chemistry, Fundamentals of Pharmacology, Clinical Biochemistry, Clinical Pharmacy, and Pharmacotherapy.		
14	Teaching and Working Methods	Teaching methods 1. Lectures 2. Interactive sessions including discussions of specific tasks, cases, and problems Working methods 1. Laboratory exercises (practical skills training) 2. Problem-solving (individual or group work to develop research and analytical skills, teamwork, and application of theoretical knowledge)		
15	Total Available Contact Hours	180 hours		
	Forms of	16.1.	Lectures – theoretical classes:	40 hours
16	Teaching Activities	16.2.	Exercises (laboratory, auditory):	14 hours
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours	/
		17.2.	Independent study: hours	Preparation for theoretical classes: 60 hours Preparation for practical classes: 7 hours
		17.3.	Exam preparation:	59 hours
18	Requirements for Signature	At least 30 points from the planned activities (16.1, 16.2, 17.1)		
19	Assessment Method			
	19.1	Final oral examination (Pathophysiological mechanisms through the analysis of output information from diagnostic methods) — points	5-10	
	19.2	Colloquium: points	Colloquium 1 (General Pathophysiology): 10–20 points Colloquium 2 (Special Pathophysiology): 10–20 points	
	19.3	Practical exam: points	10-15	
	19.4	Attendance and participation in theoretical classes: points	10-15	

		Attendance and participation in practical classes: 20–25 points	20-25				
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)					
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.					
22	Literature						
		Required literature					
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)	
	22.1	1.	Vaskova O., Miceva Ristevska S., Pop Gjorceva D., Miladinova D., Loparska S., and Kuzmanovska S.	Pathological Physiology for Pharmacy Students: Textbook and Practicum	Borografika	2011	
		Additional literature					
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)	
22.2	1.	McPhee, S. J., & Ganong, W. F.	Pathophysiology of Disease – An Introduction to Clinical Medicine	Tabernakul	2010		

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	MICROBIOLOGY			
2	Code	FFMF14			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of medicine Department of Microbiology with Parasitology (Institute of Microbiology and Parasitology)			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	2	Semester:	III
7	Workload expressed in ECTS credits	5 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Maja Jurhar Pavlova (course coordinator) Prof. Dr. Gordana Jankoska Prof. Dr. Jaklina Cekovska Dr. Liljana Labacevska Gjatovska, Senior Research Associate Dr. Marko Kostovski, Research Associate Asst. Dr. Radomir Jovchevski Asst. Dr. Danica Kovacheva Trpkovska			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for enrollment: Obtained signature from the subject ANATOMY AND PHYSIOLOGY Prerequisite for exam: /			
11	Course Aims (Competencies) and Learning Outcomes	Course objectives (competencies) The aim of the course is to introduce students to the world of microorganisms, their involvement in diseases, the factors that have a negative impact on microorganisms, as well as the treatment and prophylaxis of infectious diseases. Expected outcomes: Upon completion of the course, students are expected: • To demonstrate knowledge of the general characteristics of bacteria, viruses, fungi, and worms; • To become familiar with the morphology and pathogenicity of microorganisms of interest in human medicine; with the infectious diseases they cause, as well as their prophylaxis and treatment; • To be able to perform macroscopic and microscopic identification of bacteria; • To have practical knowledge of sterilization processes; • To have knowledge of possible contaminants in pharmaceutical preparations; • To respect safe methods of storing pharmaceutical preparations;			

		• To perform regular control of conditions for the safety of pharmaceutical preparations; • To know the consequences of improper storage and incorrect use of pharmaceutical preparations; • To predict potential contaminants of pharmaceutical preparations; • To have knowledge of microorganisms that produce antibiotics.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Course content: • Introduction to microbiology and parasitology. • Pharmaceutical significance of microorganisms • Morphology and structure of bacteria. • Morphology and structure of viruses and differences between them and bacteria. • Physiology of microorganisms: growth and replication. • Morphology, structure, and reproduction of viruses and fungi • Physical and chemical factors that inhibit growth and replication, including antimicrobial agents (antibiotics and chemotherapeutics). • Sterilization and disinfection • Genetics of microorganisms. • Ecology of microorganisms: associations. Normal microflora. Distribution of microorganisms. • Pathogenesis and virulence of microorganisms. • Epidemiology: transmission of microorganisms, biofilm formation • Pathogenesis of infection • Immune response of the host to microorganisms. • Vaccines and sera • Bacteriology: Classification of bacteria • The most common bacterial pathogens causing respiratory infections, urogenital infections, gastrointestinal infections, sepsis, and meningitis • Virology: the most common causes of viral infections • Mycology: Yeasts, molds, and dermatophytes. • Protozoology: representatives of protozoa of body cavities, blood and tissue protozoa, and antiprotozoal agents • Helminthology: Morphology and biology of helminths, the most significant representatives among cestodes, trematodes and nematodes; anthelmintics • Nosocomial infections (NIIs), Infection prevention and control • Microorganisms that contaminate pharmaceutical products • Regulation of microorganisms and synthesis of macromolecules in relation to understanding the mechanisms of action of various chemotherapeutics and as a basis for genetic technology (Microorganisms producing antibiotics). • Alternatives to antimicrobial therapy; Probiotics (Lactobacillus) • Methods for documenting sterilization effectiveness. • Need for sterilization procedures in process control.
13	Interrelation with Other Courses	The prior knowledge from the subject Anatomy and Physiology is needed/related to the subject.

14	Teaching and Working Methods	Teaching methods used in the course: 1. Lectures (Contact hours (lectures) and consultations) 2. Interactive classes that include discussions of certain tasks, cases, problems Working methods: 1. Laboratory exercises (practical work skills) 2. Problem solving – problem-based learning (students work independently/in groups to solve specific problems in order to stimulate research and analytical skills, teamwork, and application of theoretical knowledge) 3. Project work (preparation of a project including research on a given topic with the aim of developing skills for independent research and abilities for presentation before an audience). Seminars/workshops, home study.		
15	Total Available Contact Hours	150 hours		
16	Forms of Teaching Activities	16.1.	Lectures – theoretical classes:	35 hours
		16.2.	Exercises (laboratory, auditory):	30 hours
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours	12 hours
		17.2.	Independent study: hours	Preparation for theoretical classes: 36 hours Preparation for practical classes: 15 hours
		17.3.	Exam preparation:	22.5 hours
18	Requirements for Signature	At least 24 points from the planned activities (16.1, 16.2, 17.1), maximum 30		
19	Assessment Method			
	19.1	Final oral examination — points	<i>Practical exam and failed midterms</i>	
	19.2	Colloquium: points	Colloquium 1: 12–22 points Colloquium 2: 12–22 points	
	19.3	Practical exam: points	11-21	
	19.4	Seminar paper/project, written and oral presentation: points	1-5	
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)		
21	Method for Monitoring	Open discussion and anonymous student survey conducted after course completion.		

	Teaching Quality					
22	Literature					
	22.1	Required literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)
		1.	Prof. Dr. Elena T. Dokić et al.	<i>Medical Microbiology for Pharmacists</i>	Department of Microbiology, Faculty of Medicine, Ss. Cyril and Methodius University	2016, hard copy.
		2.	Prof. Dr. Jaklina Cekovska et al.	<i>Practicum for Pharmacy Students</i>	Department of Microbiology, Faculty of Medicine, Ss. Cyril and Methodius University	2016, hard copy
	22.2	Additional literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)
		1.	N. Panovski et al.	<i>Medical Microbiology and Parasitology – General Part</i>	Department of Microbiology, Faculty of Medicine	2011, hard copy.
		2.	N. Panovski et al.	<i>Medical Microbiology and Parasitology – Special Part</i>	Department of Microbiology, Faculty of Medicine	2011, hard copy
			Translators and reviewers: Prof. Dr. Nikola Panovski, Prof. Dr. Milena Petrovska, Prof. Dr. Kaća Popovska, Prof. Dr. Elena T. Dokić	“Medical Microbiology”	17th edition, within the project of the Government of the Republic of Macedonia	2006 Translated 2011, hard copy

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHARMACEUTICAL LAW AND ETHICS			
2	Code	FFIFH15			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmaceutical Chemistry			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	2	Semester:	III
7	Workload expressed in ECTS credits	3 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Katerina Anchevska Netkovska (course coordinator) Asst. Prof. Dr. Evgenija Mihajloska Asst. Prof. Dr. Aleksandar Dimkovski			
9	Language	English			
10	Prerequisites for attending and passing the course	/			
11	Course Aims (Competencies) and Learning Outcomes	Course Objective: The course aims to introduce students to the fundamental concepts of pharmaceutical law, the role and significance of legal regulations related to pharmaceutical practice, understanding national, European, and international legal frameworks relevant to pharmacy, and developing the ability to apply them in practice. The course also addresses the basic principles, rights, and obligations of healthcare provision and regulations governing the responsibilities of healthcare professionals, as well as regulations regarding the use of advanced technologies in pharmacy. Additionally, students will gain an understanding of applied ethics and bioethics in pharmacy. Expected Learning Outcomes: Upon completion of the course, students will be able to: • Understand and apply the laws and legal acts regulating all aspects of pharmaceutical practice; • Comprehend the legal aspects of healthcare and the laws regulating pharmacists' rights and responsibilities; • Identify and apply normative ethical principles and distinguish between legal and ethical issues faced by pharmacists in professional practice;			

		Analyze and understand the basic concepts and legal regulations related to pharmaceutical law and professional ethics in pharmacy.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: Healthcare Legislation and Pharmaceutical Law - Regulatory framework for laws of interest to human health; role and historical development of pharmaceutical law; pharmaceutical law and the legal system; sources of pharmaceutical law. Learning Outcomes: - Students will be able to describe healthcare legislation, outline the basic principles of pharmaceutical law, and explain its relationship with other legal branches. - Students will be able to identify national and international sources of pharmaceutical law. Chapter 2: National Healthcare and Pharmacy Regulations - Regulation of healthcare professions (pharmaceutical practice) and healthcare institutions; role and significance of the Pharmaceutical Chamber; Law on Healthcare; Law on Health Insurance. Learning Outcomes: - Students will be able to explain national principles of pharmaceutical legislation; - Students will describe the legal aspects of healthcare and laws regulating pharmacists' rights and duties in North Macedonia; - Students will describe accreditation and supervision of healthcare institutions and explain the role of the Pharmaceutical Chamber. Chapter 3: Law on Medicines and Medical Devices and Subordinate Regulations - Marketing authorization for medicines; trade in medicines; medical devices; advertising of medicines and medical devices; pharmacovigilance. Learning Outcomes: - Students will be able to identify the main provisions of the Law on Medicines and Medical Devices, describe national procedures and the role of regulatory authorities in approval and trade of medicines and devices, and explain basic principles of healthcare advertising; - Students will be able to identify and describe subordinate regulations concerning basic information on medicines and reporting of adverse reactions.

		Chapter 4: Patients' Rights - European Charter of Patients' Rights; Law on Protection of Patients' Rights; Law on Personal Data Protection; Public Health Law. Learning Outcomes: - Students will be able to describe the basic rights and obligations of patients; - Students will understand the legal regulations protecting patient privacy and explain the role of the Public Health Law. Chapter 5: Ethics in Pharmacy as a Healthcare Profession - Basic principles of ethics, bioethics, and ethical codes in the pharmacy profession. Learning Outcomes: - Students will be able to describe the main ethical principles and codes in pharmacy and perform ethical analyses of pharmaceutical practices, distinguishing between legal and ethical issues encountered in professional practice.		
13	Interrelation with Other Courses	Prerequisite knowledge from other courses: Not required. Knowledge from this course: Required (as prior knowledge) for following courses: Social Pharmacy, Pharmaceutical Care, and Basics of Clinical Pharmacy.		
14	Teaching and Working Methods	Teaching methods used in the course: - Lectures - Interactive sessions including discussions of specific cases and problems Working methods: Problem-solving: Students work independently or in groups to solve specific problems, aimed at developing research and analytical skills, teamwork, and application of theoretical knowledge. Project work: Preparation of a project involving research on a given topic, aimed at developing independent research skills and presentation abilities before an audience.		
15	Total Available Contact Hours	90 hours		
	Forms of	16.1.	Lectures – theoretical classes:	15 hours
16	Teaching Activities	16.2.	Exercises (laboratory, auditory):	15 hours

17	Other Forms of Activities	17.1.	Project tasks/seminars: hours	15 hours		
		17.2.	Independent study: hours	30 hours		
		17.3.	Exam preparation:	15 hours		
18	Requirements for Signature	At least 30 points from the planned activities (16.1, 16.2, 17.1)				
19	Assessment Method					
	19.1	Final exam: points (if colloquia are not taken)	26-50			
	19.2	Colloquium: points	/			
	19.3	Practical exam: points	/			
	19.4	Seminar paper/project, written and oral presentation: points	10-20			
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)				
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.				
22	Literature					
	22.1	Required literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)
		1.	Government and Assembly of the Republic of North Macedonia	Current laws and by-laws in RNM in the field of health and pharmacy	Official Gazette of RNM	2024– / electronic edition
		2.	Assembly of the Pharmaceutical Chamber of RNM	Code of Professional Ethical Duties and Rights of Healthcare Professionals with Higher Education in the Field of Pharmacy	Pharmaceutical Chamber of RNM	2013 / electronic edition

		3.	European Medicines Agency	European international regulations for medicinal products and medical devices	EU	2024– / electronic edition
		4.	Gordon E. Appelbe, Joy Wingfield Dale and Appelbe's	Pharmacy and Medicines Law	The Pharmaceutical Press	2021 / electronic edition
		5.	Gordon E. Appelbe, Joy Wingfield Dale and Appelbe's	Pharmacy and Medicines Law	The Pharmaceutical Press	2019 / electronic edition
	22.2	Additional literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)
		1.	Amy Marie Haddad, Robert Veatch	Case Studies in pharmacy ethics (3nd)	New York: Oxford University Press.	2017/ electronic

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHARMACEUTICAL CHEMISTRY 1			
2	Code	FFIFH16			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmaceutical Chemistry			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	2	Semester:	IV
7	Workload expressed in ECTS credits	7 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Zorica Naumovska (course coordinator) Prof. Dr. Aleksandra Kapedanovska Nestorovska Prof. Dr. Ana Poceva Panovska Asst. Prof. Dr. Evgenija Mihajloska Asst. Prof. Dr. Aleksandar Dimkovski			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisites for attending the course: Completed: Organic Chemistry Applied in Pharmacy (2nd semester; 8 ECTS), Bioorganic Chemistry (3rd semester; signature). Prerequisite for taking the exam: Passed Bioorganic Chemistry (3rd semester; 8 ECTS).			
11	Course Aims (Competencies) and Learning Outcomes	The aim of the course is to introduce students to the physicochemical and biopharmaceutical properties of medicinal substances that influence the therapeutic effect of drugs in vivo and in vitro, including knowledge of drug release, absorption, metabolic transformation, distribution, and elimination across different routes of administration. Students will further learn: • the classification and characteristics of drug targets; • the role of functional groups in drug–receptor interactions; • the processes of drug discovery and development; • ligand-based and structure-based drug design; • fundamentals of Quantitative Structure–Activity Relationship (QSAR); • the role of metabolic enzymes and their polymorphic variations; • Phase I (functionalization) and Phase II (conjugation) reactions in drug biotransformation; • different types of prodrugs used in clinical practice.			

		Expected Learning Outcomes Upon completion of the course, students will have knowledge of the mechanisms of drug action administered by various routes, including processes of release, absorption, metabolism, distribution, and elimination. Students will be able to: • understand the role of physicochemical properties of drugs; • recognize different drug targets and modes of drug–receptor interactions; • apply software tools in drug discovery, including 3D-QSAR, ligand-based, and structure-based design; • understand the influence of metabolic enzyme polymorphisms on therapeutic response; • describe metabolic pathways (Phase I and II) and classify prodrugs used in practice.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: Physicochemical Properties of Drugs • Definition of key physicochemical properties and their influence on biological activity (correlation between physicochemical properties and biological activity). • Biopharmaceutical characteristics; drug–receptor interactions; receptors and drug action. Learning outcomes: Students will gain knowledge about the role of physicochemical properties of medicinal substances in relation to their biological activity. Chapter 2: Definition of the LADME System • Key factors influencing drug biodistribution depending on administration route; processes of release, absorption, metabolism, distribution, elimination; interaction with drug targets. Learning outcomes: Students will understand the LADME system and drug–target interactions in the organism. Chapter 3: Drug Targets • Definition of drugs and drug targets (enzymes, receptors, nucleic acids, transport proteins). • Signal transduction and transporter proteins as drug targets.

	Learning outcomes: Students will learn about different classes of drug targets and approaches used in discovering new targets. Chapter 4: Drug Discovery and Development – Lead Identification and Optimization • Identification and selection of drug targets; structure-based and ligand-based design; affinity and activity assays; role of molecular modelling (drug design using software tools, drug–receptor interactions, stereochemical properties, optical isomerism). • Lead optimization using computational techniques; structural characterization. Learning outcomes: Students will understand the stages of drug discovery, including target selection, assay development, lead optimization using computational methods and QSAR. Chapter 5: Drug Design – Optimization of Drug–Target Interactions • Structure–Activity Relationship (SAR); role of functional groups; pharmacophore identification. Learning outcomes: Students will be able to explain SAR principles and identify structural elements essential for activity. Chapter 6: Drug Design – Optimization of Drug Properties and Development to Market • Optimization of hydrophilic/lipophilic balance; resistance to chemical/enzymatic degradation; reduction of toxicity; use of endogenous molecules (peptides, peptidomimetics, oligonucleotides). • Development from lead to final drug (preclinical and clinical stages). Learning outcomes: Students will understand optimization strategies for drug properties and challenges in advancing a compound from hit to marketable drug. Chapter 7: Introduction to Drug Metabolism • Definitions and concepts; pathways of deactivation and elimination; modifying factors (physiological, pathophysiological, therapeutic, genetic/epigenetic); metabolic phenotype; enzyme systems; substrate recognition; structure–metabolism relationships; reactive metabolites; induction and inhibition. Learning outcomes: Students will understand principles of drug biotransformation and its clinical

		relevance, as well as classes of metabolic reactions and factors influencing enzyme activity. Chapter 8: Biotransformation Pathways – Phase I Reactions - Functionalization reactions: oxidation, reduction, hydrolysis; mechanisms, stereochemical/regiospecificity; reactive metabolites; examples and clinical significance. Learning outcomes: Students will recognize and analyze Phase I reactions and correlate parent structures with metabolic products. Chapter 9: Biotransformation Pathways – Phase II Reactions - Conjugation reactions: glucuronidation, sulfation, glutathione conjugation, methylation, amino-acid conjugation, acetylation; enzyme systems; distribution; examples. Learning outcomes: Students will analyze Phase II pathways and evaluate their clinical significance. Chapter 10: Prodrugs – Principles, Approaches, and Applications - Concepts, rationale for prodrug design; activation mechanisms; classification; techniques; advantages/limitations; selected case studies. Learning outcomes: Students will explain prodrug design strategies and classify prodrugs based on activation mechanisms. Chapter 11: Drug Metabolism and Pharmacokinetics - Approaches to studying CYP450 activity; prediction of absorption fraction, clearance, volume of distribution; physiologically based pharmacokinetic (PBPK) models; in vitro evaluation of drug–drug interactions; detection and characterization of metabolites. Learning outcomes: Students will acquire knowledge of models and methods used in drug metabolism research and their clinical relevance.
13	Interrelation with Other Courses	The prior knowledge from the courses Pharmaceutical Chemistry 1, Pharmaceutical Chemistry 2, and Fundamentals of Pharmacology is required/related to the course. The knowledge gained from the courses Pharmaceutical Chemistry 1 and Fundamentals of Pharmacology is necessary.

14	Teaching and Working Methods	Teaching methods used in the course: 1. Lectures 2. Interactive classes that include discussions of specific tasks, cases, and problems Working methods: 1. Laboratory exercises (practical working skills) 2. Problem-solving (students work independently/in groups to solve specific problems in order to encourage research and analytical skills, teamwork, and application of theoretical knowledge) 3. Project work (preparation of a project that includes research on a given topic, with the aim of developing abilities for independent research and skills for presenting in front of an audience)		
15	Total Available Contact Hours	210 hours		
16	Forms of Teaching Activities	16.1.	Lectures – theoretical classes:	45 hours
		16.2.	Exercises (laboratory, auditory):	45 hours
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours	/
		17.2.	Independent study: hours	Preparation for theoretical classes: 75 hours Preparation for practical classes: 22.5 hours
		17.3.	Exam preparation:	15 hours, theory 7,5 hours, practical
18	Requirements for Signature	At least 40 points from the planned activities (16.1, 16.2)		
19	Assessment Method			
	19.1	Final exam: points (if colloquia are not taken)	25-50	
	19.2	Colloquium: points	Colloquium 1 – (13-25) Colloquium 2 – (13-25)	
	19.3	Practical exam: points	6-10	
	19.4	Seminar paper/project, written and oral presentation: points	/	
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)		
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.		
22	Literature			
	22.1	Required literature		

		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)
		1.	Graham L. Patrick	An Introduction to Medicinal Chemistry FIFTH EDITION	Oxford university press	2019
		2.	Lamke L. Thomas	Foye's Principles of Medicinal Chemistry 7th Edition	Lippincott Williams & Wilkins	2012
		3.	Laurence Brunton	Goodman and Gilman's The Pharmacological Basis of Therapeutics, Twelfth Edition (Goodman and Gilmans the Pharmacological Basis of Therapeutics) 12th Edition	McGraw Hill / Medical	2011
	22.2	Additional literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)
		1.	Marc Harrold; Robin Zavod	Basic Concepts in Medicinal Chemistry, 3rd Edition	ASHP	
		2.	Authorized lectures	Faculty of Pharmacy – Skopje, Ss. Cyril and Methodius University in Skopje; Faculty of Medicine – Skopje, Ss. Cyril and Methodius University in Skopje.		

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	INSTRUMENTAL PHARMACEUTICAL ANALYSES			
2	Code	FFIPHFA17			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Applied Chemistry and Pharmaceutical Analysis			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	2	Semester:	IV
7	Workload expressed in ECTS credits	7 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Jelena Acevska (course coordinator) Prof. Dr. Katerina Brezovska Prof. Dr. Natalija Nakov Prof. Dr. Aneta Dimitrovska Prof. Dr. Zoran Kavrakovski Asst. Prof. Dr. Blagoj Achevski Asst. M.Sc. Hrisanta Godzo			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisites for attending the course: Mathematics and Applied Statistics in Pharmacy (credits), Physical Chemistry for Pharmacists (credits), Analytical Chemistry Applied in Pharmacy (signature), Organic Chemistry Applied in Pharmacy (signature) Prerequisites for taking the exam: Mathematics and Applied Statistics in Pharmacy (credits), Physical Chemistry for Pharmacists (credits), Analytical Chemistry Applied in Pharmacy (signature), Organic Chemistry Applied in Pharmacy (signature)			
11	Course Aims (Competencies) and Learning Outcomes	- The aim of the course is for students to acquire knowledge of the basic principles of modern instrumental methods and techniques, with special emphasis on their application for qualitative and quantitative analysis in various fields of pharmacy (research, development, and quality control of pharmaceutical substances and dosage forms). - The student will acquire skills for handling instrumental analytical equipment and for analysing, interpreting, and documenting analytical results. Learning outcomes: - Upon successful completion of the course, the student will acquire knowledge of the principles of modern instrumental methods, skills for			

		performing analyses using spectroscopic methods, electrochemical methods, and chromatographic techniques, identification of potential sources of error, statistical calculation, and evaluation of obtained results.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: Fundamentals of Spectroscopic Methods • Properties of electromagnetic radiation • Electromagnetic spectrum • Absorption of electromagnetic radiation (atomic absorption and molecular absorption) • Relaxation processes / emission of electromagnetic radiation • Quantitative aspects of spectroscopic methods (Lambert–Beer law) Learning outcomes: • Students will be able to explain the properties of electromagnetic radiation and distinguish the different types of absorption and emission. • Apply the Lambert–Beer law for quantitative analysis. Chapter 2: Atomic Spectrometry • Atomic absorption spectrometry (AAS): atomic absorption spectra, sample atomization, instruments • Atomic emission spectrometry (AES): plasma-based emission spectrometry and flame emission spectroscopy • Interferences in atomic absorption/emission spectrometry; methods for quantitative determination Learning outcomes: • Students will be able to explain the principles of AAS and AES and the mechanisms of atomic absorption/emission. • Acquire knowledge for performing quantitative determination methods. Chapter 3: Ultraviolet and Visible Spectrometry • Absorption of radiation, chromophores • Colour and visible spectra • Absorption bands in UV/Vis spectrometry (factors affecting position and intensity) • Qualitative and quantitative analysis • Derivative spectrophotometry Learning outcomes: • Students will gain theoretical and practical foundations for UV/Vis spectrometry in qualitative and quantitative analysis.

		- Acquire knowledge and skills for performing quantitative determinations. Chapter 3 (second): Molecular Luminescence Spectrometry - Theory of fluorescence and phosphorescence - Factors influencing fluorescence and phosphorescence - Fluorescence and molecular structure - Application of fluorescence methods Learning outcomes: - Students will understand the theory and mechanisms of fluorescence and phosphorescence. - Gain insight into the use of fluorescence methods in analytical, biochemical, and immunochemical examinations. Chapter 4: Infrared Spectroscopy - Absorption of IR radiation by molecules - Types of molecular vibrations - IR spectroscopy instruments - Applications (interpretation of IR spectra, qualitative and quantitative analysis) Learning outcomes: - Students will understand the nature of IR absorption by molecules. - Apply IR spectroscopy for qualitative and quantitative analysis. Chapter 5: Nuclear Magnetic Resonance Spectroscopy (NMR) - Basic principles of NMR spectroscopy - Applications of NMR spectroscopy Learning outcomes: - Students will understand the basic principles of NMR and gain knowledge of its applications in pharmaceutical analysis. Chapter 6: Mass Spectrometry - Principle of mass spectrometry - Instruments (sample introduction, ion sources, mass analyzers, detectors) - Interpretation of mass spectra - Applications in pharmaceutical analysis

		Learning outcomes: • Students will be able to explain the basic principles of mass spectrometry. • Develop skills for selecting appropriate MS configurations for analysis. • Understand qualitative and quantitative applications of MS. Chapter 7: Electroanalytical Methods • Electrochemical cell and electrode potential • Reference and indicator electrodes • Potentiometric methods (direct potentiometric measurements and potentiometric titrations) • Electrogravimetric methods, coulometric methods, voltammetry • Applications Learning outcomes: • Students will understand the principles and applications of electrochemical methods in pharmaceutical analysis. • Perform direct potentiometric measurements and titrations. Chapter 8: Chromatography 8.1 Introduction to Chromatography • Basic principles • Classification of chromatographic methods • Applications (qualitative and quantitative analysis) 8.2 Thin-Layer Chromatography (TLC) • TLC principles • Detection methods • Applications (qualitative, semi-quantitative, quantitative) 8.3 High-Performance Liquid Chromatography (HPLC) • Column efficiency • HPLC instrumentation • Method development, column selection, mobile phase selection • Principles and applications of partition chromatography, ion-pair chromatography, chiral stationary phases, adsorption chromatography, ion-exchange chromatography, gel chromatography 8.4 Gas Chromatography (GC) • Principles of gas-liquid and gas-solid chromatography • GC instrumentation

		- Applications of gas–liquid chromatography Learning outcomes: - Students will be able to explain the basic principles of chromatographic separation. - Understand different chromatographic types based on separation mechanism and stationary/mobile phases. - Describe parameters affecting efficiency and resolution. - Apply chromatography for qualitative and quantitative analysis of organic and inorganic compounds. Chapter 9: Optical Methods 9.1 Polarimetry and Refractometry - Basic principles and applications in pharmaceutical analysis - Instruments 9.2 Microscopy - Basic principles and applications in pharmaceutical analysis Learning outcomes: - Students will understand the basic principles of optical analytical methods and their applications. - Use polarimeters and refractometers for qualitative and quantitative analysis.
13	Interrelation with Other Courses	Prior knowledge from the following courses is required: Mathematics and Applied Statistics in Pharmacy, Analytical Chemistry Applied in Pharmacy, Physical Chemistry for Pharmacists, Organic Chemistry Applied in Pharmacy. Knowledge from this course is required for: Phytochemistry and Drug Analytics and Legislation.
14	Teaching and Working Methods	Teaching methods: - Lectures - Interactive classes including discussion of tasks, cases, and problems Working methods: - Laboratory exercises (practical skills) - Problem-solving (individual/group work aimed at developing research, analytical skills, teamwork, and application of theoretical knowledge)
15	Total Available Contact Hours	210 hours

16	Forms of Teaching Activities	16.1.	Lectures – theoretical classes:	45 hours		
		16.2.	Exercises (laboratory, auditory):	45 hours		
17	Other Forms of Activities	17.1.	Project tasks/seminars: hours	/		
		17.2.	Independent study: hours	Preparation for theoretical classes: 67.5 hours Preparation for practical classes: 22.5 hours		
		17.3.	Exam preparation:	30 hours		
18	Requirements for Signature	At least 25 points from the planned activities (16.1, 16.2)				
19	Assessment Method					
	19.1	Final exam: points (if colloquia are not taken)	30-60			
	19.2	Colloquium: points	Colloquium 1 – (15–30) Colloquium 2 – (15–30)			
	19.3	Practical exam: points	5-10			
	19.4	Seminar paper/project, written and oral presentation: points	/			
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)				
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.				
22	Literature					
	22.1	Required literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy to be indicated)
		1.	Dimitrovska A. et al.	Instrumental Pharmaceutical Analyses	UKIM, Skopje	2021, electronic
		2.	Skoog DA, Holler F.J. and Nieman T.A	Principles of Instrumental Analysis	Saunders College Publishing	2018
		3.	K. Brezovska et al.	Instrumental Pharmaceutical Analysis – Practical Teaching	Reviewed Practicum for Exercises (Faculty of	2015

					Pharmacy, UKIM, Skopje)	
	22.2	Additional literature				
		No.	Authors	Title	Publisher	Year / Edition (electronic / hard copy)
		1.	D. A. Skoog, D. M. West, F. J. Holler, S. R. Crouch	Introduction to Analytical Chemistry	Prosvetno delo	2009, printed version

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHYTOCHEMISTRY			
2	Code	FFIFG18			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmacognosy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	2	Semester:	IV
7	Workload expressed in ECTS credits	7 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr Marija Karapandzova (course coordinator) Prof. Dr Gjoshe Stefkov Asst. Prof. Dr. Ana Trajkovska Asst. Prof. Dr. Veronika Stoilkovska Gjorgievska			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: signature from <i>Pharmaceutical Botany and Biology (II semester)</i> and <i>Bioorganic Chemistry (III semester)</i> . Examination requirements: passed exams in those same subjects.			
11	Course Aims (Competencies) and Learning Outcomes	To introduce students to the main classes of secondary metabolites, their biosynthesis in plants, physical-chemical properties, extraction and isolation, methods of examination and analysis, biological-pharmacological activities, and their importance and use in medicine and pharmacy. Students will acquire knowledge of: • main classes and biosynthesis of secondary metabolites; • biosynthetic origin and classification; • structure, solubility and chemical properties; • extraction and isolation from plant material; • methods for testing and analysis; • biological and pharmacological properties and applications as pure active substances or as components of herbal drugs and extracts.			
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1 – Basic Metabolic Pathways and Origin of Secondary Metabolites • Enzymes, photosynthesis, primary metabolites and formation of secondary-metabolite groups. <i>Learning outcome:</i> understanding enzyme roles, photosynthesis process, and basic biosynthetic routes of primary and secondary metabolites. Chapter 2 – Primary Metabolites (Carbohydrates, Lipids and Derivatives of Amino Acids and Proteins) • Carbohydrates (mono-, oligo- and polysaccharides); lipids (triglycerides, prostaglandins, waxes, phospholipids, plant alkynes and gluco-resins); amino-acid and protein derivatives (amino acids, peptides, proteins, proteids, cyanogenic			

		heterosides, glucosinolates, and other sulfur compounds). <i>Learning outcome:</i> recognizing basic structures, distribution, physical-chemical characteristics, extraction and testing methods, pharmacological activity, and application in pharmacy and medicine. Chapter 3 – Secondary Metabolites (Phenolic Compounds, Terpenoids and Steroids, and Alkaloids) • Phenolics (simple phenols, phenolic glycosides, coumarins, lignans, neolignans, flavonoids, anthocyanidins, tannins, quinones); terpenoids and steroids (monoterpenes, sesquiterpenes, essential oils, iridoids, sesquiterpene lactones, diterpenes, triterpenoid and steroidal saponins, cardiotonic glycosides, tetraterpenes); alkaloids (derivatives of ornithine and lysine, phenylalanine and tyrosine, tryptophan, anthranilic acid, histidine, terpenoid and purine alkaloids). <i>Learning outcome:</i> recognizing key structures, distribution, properties, extraction, testing methods, biological activity and medical/pharmaceutical uses.
13	Interrelation with Other Courses	• Requires prior knowledge from <i>Pharmaceutical Botany and Biology</i> and <i>Bioorganic Chemistry</i>; • Provides basis for <i>Pharmacognosy</i> and <i>Phytotherapy</i>.
14	Teaching and Working Methods	Teaching: Lectures; Interactive classes with discussion. Working: Laboratory exercises; Problem-solving (individual or group work to encourage research and team skills); Project work (independent research and oral presentation).
15	Total Available Contact Hours	210 hours
16	Forms of Teaching Activities	45 hours lectures + 60 hours exercises
17	Other Forms of Activities	8 hours project work; 75 hours self-study; 22 hours exam preparation
18	Requirements for Signature	Minimum 30 points from activities
19	Assessment Method	• Final exam 25–50 pts (if colloquia not taken) • Colloquium 1 – 13–25 pts; Colloquium 2 – 13–25 pts • Practical exam – 6–10 pts • Project/Seminar presentation – written and oral
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: Kulevanova S., Stefkov Gj., Karapandzova M. <i>Phytochemistry</i>. UKIM, 2011. Additional:

		Bruneton J. <i>Pharmacognosy, Phytochemistry and Medicinal Plants</i>, 2nd Ed., Intercept Ltd., 1999. Evans W. <i>Treas and Evans' Pharmacognosy</i>, W.B. Saunders, 2002.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	BIOCHEMISTRY			
2	Code	FFIPB19			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Applied Biochemistry			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	2	Semester:	IV
7	Workload expressed in ECTS credits	6 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr Marija Hiljadnikova Bajro (course coordinator) Prof. Dr Tatjana Kadifkova Panovska Asst. Prof. Dr. Kristina Shutevska Achevska			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: fulfillment of the attendance requirements in Bioorganic Chemistry (III semester). Examination requirements: prior completion of Organic Chemistry Applied in Pharmacy (II semester) and compliance with the attendance requirements of this course..			
11	Course Aims (Competencies) and Learning Outcomes	Course Aim: The course aims to help students develop an understanding of the basic concepts of biochemistry, the reactions underlying anabolic and catabolic metabolism of nutrients, the catalytic role of enzymes in these processes, and the biochemical aspects of water, electrolyte, and acid-base homeostasis. Students should perceive the importance of biochemical reactions and the enzymes catalyzing them to understand: mechanisms of disease development, laboratory tests used in clinical practice, and pharmacodynamics and pharmacokinetics of drugs used in therapy. Learning Outcomes: As a result, students are expected to possess solid theoretical knowledge and be able to: perform basic reactions demonstrating biochemical properties of organic biomolecules, conduct qualitative and quantitative analyses, demonstrate enzyme kinetics and determine reference value intervals, and apply and interpret simple laboratory analyses, including routine urine examination.			
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Introduction to Biochemistry Definition and importance of biochemistry; structure and functions of biomolecules; Metabolism: catabolic and anabolic pathways; hierarchical organization of biomolecules and the role of functional groups in biological processes. <i>Learning outcomes:</i> Explain the significance and basic concepts of biochemistry, identify structure and function of biomolecules, and distinguish basic metabolic processes in the organism.			

		Proteins – Structure, Function and Metabolism Structural and functional organization of proteins; biological role of amino acids and their classification based on chemical properties and solubility; protein metabolism: protein synthesis, catabolism of amino acids, deamination, transamination, urea cycle and nitrogen elimination. <i>Learning outcomes:</i> Explain structural levels and biological functions of proteins, analyze the processes involved in protein metabolism, and the mechanisms of amino acid degradation to nitrogen homeostasis in the human body.. Carbohydrates – Structure, Function and Metabolism Structure and classification of carbohydrates; processes of carbohydrate digestion and absorption, and the role of specific digestive enzymes; metabolic pathways – glycolysis, glycogenesis, glycogenolysis, gluconeogenesis; regulation of carbohydrate metabolism. <i>Learning outcomes:</i> Explain structural characteristics and biological role of carbohydrates, analyze the major carbohydrate metabolic pathways, and interpret disorders associated with carbohydrate metabolism. Citric Acid Cycle (CAC) Biochemical role in oxidative metabolism; phases of CAC; connection with glycolysis, β-oxidation of fatty acids, and amino-acid degradation; regulation and role in biosynthesis; biological oxidations and respiratory chain. <i>Learning outcomes:</i> Describe the reactions of the citric acid cycle, biological oxidations, and the respiratory chain; evaluate their role in energy production and biosynthetic processes; and assess their integration with other metabolic pathways. Pentose Phosphate Pathway (PPP) Characteristics of PPP as an alternative glucose-degradation route; oxidative and non-oxidative phases; role in cell metabolism and relation to glycolysis; regulation and importance of PPP in different cell types. <i>Learning outcomes:</i> Describe and explain PPP reactions, analyze its role in NADPH and ribose-5-phosphate production, and assess its clinical relevance across different cell types. Enzymes – Structure, Properties and Mechanism of Action Enzymes as biological catalysts; active site and allosteric regulation; mechanism of catalysis; Michaelis–Menten kinetics (V_{max}, K_m); factors affecting enzyme activity; inhibition types; regulatory roles in metabolic pathways and their importance in maintaining cellular homeostasis. <i>Learning outcomes:</i> Define structural and functional properties of enzymes, analyze the mechanisms of enzymatic catalysis and the kinetics of enzyme-mediated reactions, and evaluate the factors affecting enzyme activity and regulatory roles of enzymes in maintaining metabolic and cellular homeostasis. Water Metabolism Role and distribution of water in the human body; composition of intra-, extra- (vascular, interstitial) and transcellular fluids;

		filtration and reabsorption forces; movement through membranes; hormonal control of water homeostasis. <i>Learning outcomes:</i> Describe water balance and hormonal regulation. Electrolyte Biochemistry Role of electrolytes in the body, their metabolism and the regulatory mechanisms that maintain electrolyte balance. <i>Learning outcomes:</i> Apply knowledge of macro- and micro-elements present in the human body, with particular emphasis on the mechanisms that regulate their concentrations within the body and its individual compartments. Biochemical Aspects of Acid-Base Balance Definition of acid–base balance, sources of acidity in the human body and mechanisms of its neutralization, and the role of biological buffer systems. <i>Learning outcomes:</i> Explain the importance of acid-base balance for normal physiological function, as well as the mechanisms by which it is maintained through biological buffer systems, the respiratory system, and renal regulation. Biochemical Characteristics and Metabolism of Lipids Definition and characteristics of lipids with emphasis on complex lipids and their structural features and functions; absorption; metabolic transformations with focus on β-oxidation, ketogenesis, and the regulation of intracellular hydrolysis; composition and function of lipoproteins. <i>Learning outcomes:</i> Understand the importance of lipids in the human body, explain their metabolism and regulation, role of ketogenesis in physiological and pathological conditions, and distinguish the four classes of lipoproteins. Biochemistry of the Endocrine System Definition of hormonal systems; general mechanisms of endogenous hormone synthesis, transport and cellular receptor-level action; Function and metabolism of neurosecretory, tropic, glandular and tissue-specific hormones. <i>Learning outcomes:</i> Understand general concepts and differences in the metabolism of lipid- and water-soluble hormones and apply knowledge of the metabolism of specific hormone classes in further advanced education within the field of pharmacy. Nucleotide Metabolism Structure and biological roles of nucleotides; metabolism of purine and pyrimidine nucleotides. <i>Learning outcomes:</i> Understand the concepts of <i>de novo</i> and salvage synthesis pathways, degradation reactions, and final products of nucleotide metabolism. Biochemistry of Hemoglobin and Heme Metabolism Structure and function of hemoglobin; physiological types of hemoglobin and pathological derivatives; heme biosynthesis and degradation; regulation of hemoglobin synthesis. <i>Learning outcomes:</i> Explain the role of hemoglobin in respiration and the maintenance of acid-base balance,

		differences among various forms of hemoglobin and their physiological and clinical significance, and describe the key concepts of heme biosynthesis and degradation, including hemoglobin breakdown and the formation and elimination of bilirubin.
13	Interrelation with Other Courses	1. Prior knowledge from Organic Chemistry Applied in Pharmacy and Bioorganic Chemistry is required. 2. Knowledge from this course is needed for Medical Chemistry, Pharmaceutical Chemistry I, Bromatology, Clinical Biochemistry, and Toxicology.
14	Teaching and Working Methods	Teaching: Lectures; interactive classes with discussion of selected problems. Working methods: • Laboratory exercises (practical skills) • Problem-solving (individual or group work to foster research and analytical skills, teamwork, and application of theoretical knowledge).
15	Total Available Contact Hours	180 hours
16	Forms of Teaching Activities	16.1. Lectures (theoretical): 45 hours 16.2. Exercises (laboratory/auditory): 45 hours
17	Other Forms of Activities	17.1. Project tasks/seminars: / 17.2. Independent study: Preparation for lectures – 50 h; for practicals – 20 h 17.3. Exam preparation: 20 h
18	Requirements for Signature	At least 30 points from the planned activities.
19	Assessment Method	• Final exam: 25–50 points (if colloquia not taken) • Colloquium 1: 13–25 points Colloquium 2: 13–25 points • Practical exam: 6–10 points • Project/Seminar presentation (written and oral): /
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory literature 1. Nelson D.L., Cox M.M. <i>Lehninger Principles of Biochemistry</i> . 7th ed. W.H. Freeman (Macmillan Learning); 2017 (digital edition). 2. Rodwell V.W., Bender D.A., Botham K.M., Kennelly P.J., Weil P.A. <i>Harper's Illustrated Biochemistry</i> , 31st edition. McGraw-Hill Education; 2018 (digital edition). 3. Berg J.M., Tymoczko J.L., Stryer L. <i>Biochemistry</i> . 7th ed. W.H. Freeman; 2012 (digital edition). Additional literature

		Ferrier D.R. <i>Lippincott Illustrated Reviews: Biochemistry</i> . 7th ed. Wolters Kluwer; 2017 (digital edition).

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	FUNDAMENTALS OF IMMUNOLOGY			
2	Code	FFIFH20			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmaceutical Chemistry			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	2	Semester:	IV
7	Workload expressed in ECTS credits	3 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr Aleksandar Dimovski (course coordinator) Prof. Dr Nadica Matevska Geshkovska Assistants for practical classes: Asst. Prof. Marija Staninova Stojoska Asst. Prof. Elizabeta Krstevska Bozinovikj			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: Anatomy and Physiology; Molecular and Cell Biology and Genetics; Microbiology. Examination requirements: Anatomy and Physiology; Molecular and Cell Biology and Genetics.			
11	Course Aims (Competencies) and Learning Outcomes	• The aim of the course is for students to acquire/develop an understanding of the fundamental concepts of immunology. • Students will be able to apply the acquired knowledge in all subsequent courses that require basic immunology. • Upon completion, students will understand the concepts of the structure and functioning of innate and adaptive immunity. • During the course, students will gain basic knowledge of approaches and analyses used to obtain insights in immunology.			
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	1) Basic Principles of the Immune Response Fundamental principles of the structure of the immune system; cells participating in the immune response. <i>Learning outcomes:</i> Students will become familiar with the structure and basic operating principles of the immune system and with the cells involved in immune responses. 2) B-cell Immunity – Structure and Function of Antibodies Basics of antibody structure and the molecular basis of their synthesis. <i>Learning outcomes:</i> Students will become familiar with antibody structure and the molecular foundations of antibody synthesis. 3) B-cell Immunity – B Lymphocytes Basics of development, activation, and function of B lymphocytes. <i>Learning outcomes:</i> Students will become familiar with the fundamentals of B-cell development, activation, and function.			

		4) T-cell Immunity – Structure and Function of the T-cell Receptor and the HLA System Basics of development, activation, and function of T lymphocytes; T-cell receptor and antigen presentation via the HLA system. <i>Learning outcomes:</i> Students will become familiar with the fundamentals of T-cell development, activation, and function. 5) T-cell Immunity – T Cells Basics of structure and (cellular) organization relevant to T-cell function. <i>Learning outcomes:</i> Students will become familiar with the basic structural aspects supporting T-cell function. 6) Adaptive Immune Response Fundamental principles of the adaptive immune response mediated by B and T lymphocytes. <i>Learning outcomes:</i> Students will become familiar with the core principles of adaptive immunity mediated by B and T cells. 7) Defense Against Infections Coordinated action of innate and adaptive immune mechanisms. <i>Learning outcomes:</i> Students will become familiar with the principles of coordinated activity between innate and adaptive immune responses. 8) Hypersensitivity Reactions and Autoimmune Diseases Basic principles and molecular foundations of hypersensitivity reactions and autoimmune diseases; basic therapeutic approaches. <i>Learning outcomes:</i> Students will become familiar with the principles and molecular basis of hypersensitivity and autoimmunity and the main approaches to their treatment. 9) Immunodeficiencies and Transplantation of Tissues and Organs Mechanisms underlying congenital and acquired immunodeficiencies; basic principles of tissue and organ transplantation. <i>Learning outcomes:</i> Students will become familiar with mechanisms of primary and secondary immunodeficiencies and the fundamentals of transplantation. 10) Immunological Methods Basic principles of immunological methods applied in the diagnosis and therapy of diseases. <i>Learning outcomes:</i> Students will become familiar with the principles of applying immunological methods in diagnostics and therapy.
13	Interrelation with Other Courses	1. Prior knowledge required from: Anatomy and Physiology; Molecular and Cell Biology and Genetics; Microbiology. 2. Knowledge from this course is required for: Biochemistry; Pathology and Pathophysiology; Clinical Pharmacy and Pharmacotherapy; Pharmacogenetics, Pharmacogenomics and Individualized Therapy.
14	Teaching and Working Methods	Teaching methods: Lectures. Working methods: Laboratory exercises (practical skills).

15	Total Available Contact Hours	90 hours
16	Forms of Teaching Activities	16.1. Lectures (theoretical): 30 hours 16.2. Exercises (laboratory/auditory): 15 hours
17	Other Forms of Activities	17.1. Project tasks/seminars: 0 hours 17.2. Independent study: Preparation for lectures – 30 hours; Preparation for practicals – 7.5 hours 17.3. Exam preparation: 7.5 hours
18	Requirements for Signature	At least 30 points from the planned activities.
19	Assessment Method	19.1. Final exam: 25–50 points (if colloquia are not taken) 19.2. Colloquium: — 19.3. Practical exam: 6–10 points 19.4. Seminar/project, written and oral presentation: —
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory literature 1. Punt J., Stranford S., Jones P., Owen J. <i>Kuby Immunology</i>. New York: W.H. Freeman, translated textbook, 2011. Additional literature 1. H. Chapel, M. Haeney, S. Misbah, N. Snowden. <i>Essentials of Clinical Immunology</i>. Wiley, translated textbook, 2010.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHARMACOGNOSY			
2	Code	FFIFG21			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmacognosy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	3	Semester:	V
7	Workload expressed in ECTS credits	8 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Gjoshe Stefkov (course coordinator) Prof. Dr. Marija Karapandzova Asst. Prof. Dr. Ana Trajkovska Asst. Prof. Dr. Veronika Stoilkovska Gjorgievska			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: Signature from <i>Phytochemistry</i> (IV semester). Examination requirements: Passed exam in <i>Phytochemistry</i> (IV semester).			
11	Course Aims (Competencies) and Learning Outcomes	Aims: To introduce students to the most important natural medicinal raw materials (pharmacopoeial and other herbal drugs), their biological sources (botanical and other natural sources), collection and production of herbal materials, macro- and microscopic characteristics of drugs, chemical composition, biological and pharmacological activity and use, as well as testing and evaluation of their quality. Learning outcomes: Students will acquire knowledge regarding: • the biological origin of drugs and plants as sources of drugs, key pharmacopoeial drugs and related herbal materials; • the ability to explain the macroscopic and microscopic characteristics of herbal drugs; • the ability to explain the chemical composition of herbal drugs; • the ability to discuss quality evaluation of herbal drugs according to the European Pharmacopoeia (Ph. Eur.) and other quality standards; • the ability to explain biological and pharmacological properties of herbal drugs and their use in contemporary medical and pharmaceutical practice.			
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: Introduction to Pharmacognosy • Approaches, production and obtaining of natural medicinal raw materials/drugs/herbal substances • Standards in production • Collections of monographs <i>Learning outcomes:</i> Students will gain knowledge of pharmacognosy concepts; approaches to, production and			

		obtaining of natural medicinal raw materials; production standards; and the main collections of monographs. Chapter 2: Herbal Drugs with Primary Metabolites (Carbohydrates, Lipids, and Derivatives of Amino Acids and Proteins) • Drugs containing carbohydrates (simple, polysaccharides, mucilages) • Drugs containing fats, oils and waxes • Drugs containing derivatives of amino acids (cyanogenic and sulfur-containing heterosides) <i>Learning outcomes:</i> Students will: – understand monograph data for drugs containing primary metabolites; – learn their distribution, biological sources (botanical and other natural), collection and production; – describe macro- and microscopic characteristics and chemical composition; – explain biological/pharmacological activity, use, and quality testing/evaluation of these drugs. Chapter 3: Herbal Drugs with Secondary Metabolites (Phenolic Compounds; Terpenoids and Steroids; Alkaloids) • Drugs containing phenolic compounds: simple phenols and phenolic glycosides, coumarins, lignans, neolignans and related compounds, flavonoids, anthocyanidins, tannins, quinones • Drugs containing terpenoids and steroids: monoterpenes, sesquiterpenes, essential oils, iridoids, sesquiterpene lactones, diterpenes, triterpenoid and steroidal saponins, cardiogenic glycosides, tetraterpenes • Drugs containing alkaloids: derivatives of ornithine and lysine; derivatives of phenylalanine and tyrosine; derivatives of tryptophan; derivatives of anthranilic acid; derivatives of histidine; terpenoid and purine alkaloids <i>Learning outcomes:</i> Students will: – understand monograph data for drugs with secondary metabolites; – learn their distribution, biological sources, collection and production; – explain macro-/microscopic characteristics, chemical composition, biological/pharmacological activity and use; – perform and discuss quality testing and evaluation.
13	Interrelation with Other Courses	1. Prior knowledge from <i>Pharmaceutical Botany and Biology</i>, <i>Bioorganic Chemistry</i> and <i>Phytochemistry</i> is required/related to this course. 2. Knowledge from this course is required for <i>Phytotherapy</i>.
14	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive classes including discussion of selected tasks, cases and problems Working methods: 1. Laboratory exercises (practical skills)

		2. Problem-solving (individual/group work to encourage research and analytical skills, teamwork and application of theoretical knowledge) 3. Project work (preparation of a project including research on a given topic to develop independent research and presentation skills).
15	Total Available Contact Hours	240 hours
16	Forms of Teaching Activities	16.1. Lectures (theoretical): 45 hours 16.2. Exercises (laboratory/auditory): 60 hours
17	Other Forms of Activities	17.1. Project tasks/seminars: 15 hours 17.2. Independent study: 75 hours 17.3. Exam preparation: 45 hours
18	Requirements for Signature	At least 30 points from the planned activities.
19	Assessment Method	19.1. Final exam: 25–50 points (if colloquia are not taken) 19.2. Colloquium: / 19.3. Practical exam: 6–10 points 19.4. Seminar/project, written and oral presentation: 1–5 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory literature 1. Kulevanova S., Stefkov Gj., Karapandzova M. <i>Pharmacognosy: Natural Medicinal and Aromatic Raw Materials</i>. UKIM (peer-reviewed textbook), 2011 (hard copy). 2. Kulevanova S., Stefkov Gj., Karapandzova M., Cvetkovikj Karanfilova I. <i>Pharmacognosy: Natural Medicinal and Aromatic Raw Materials</i>. UKIM (peer-reviewed textbook), 2023 (electronic edition). Additional literature 1. Bruneton J. <i>Pharmacognosy, Phytochemistry and Medicinal Plants</i>, 2nd Ed. Intercept Ltd., 1999 (hard copy). 2. Evans W. <i>Evans' Pharmacognosy</i>. W.B. Saunders, 2002 (hard copy).

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHARMACEUTICAL TECHNOLOGY I			
2	Code	FFIFT22			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmaceutical Technology			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	3	Semester:	V
7	Workload expressed in ECTS credits	7 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Maja Simonoska Crcarevska (course coordinator) Prof. Dr. Katerina Gorachinova Prof. Dr. Renata Slaveska Raicki Prof. Dr. Marija Glavash Dodov Prof. Dr. Nikola Geshkovski Asst. Prof. Dr. Ljubica Mihailova Asst. Prof. Dr. Dushko Shalabalija Asst. M.Sc. Teodora Tasevska			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: Credits from <i>FUNDAMENTALS OF PHARMACY</i> (Semester I), <i>Biophysics</i> (Semester I), <i>Physical Chemistry for Pharmacists</i> (Semester II), and signature from <i>Microbiology</i> (Semester III). Examination requirements: Signature from <i>Pharmaceutical Technology I</i> (Semester V).			
11	Course Aims (Competencies) and Learning Outcomes	Course aims To enable students to acquire and develop an understanding of the fundamental concepts of pharmaceutical technology, including core regulatory aspects (laws, bylaws, pharmacopoeial requirements and Good Manufacturing Practice – GMP – as they relate to the development, production, dispensing and use of pharmaceutical dosage forms (PDFs)). The course introduces concepts and methods for analyzing pharmaceutical incompatibility, stability of dosage forms, rheological characteristics, pharmaceutical-technological operations (mechanical, thermal, diffusional), and sterilization. Students also gain knowledge of the basic types of PDFs and the excipients used in their preparation with respect to functionality and safety. Detailed knowledge is provided for non-sterile liquid PDFs (solutions), focusing on preformulation, formulation and use, as well as extractive preparations and homeopathic medicines. Graduate profile / what students will be able to do Students will be able to analyze and evaluate regulatory aspects of the development, production and use of PDFs, including pharmacopoeial requirements and GMP; interpret and solve problems related to pharmaceutical incompatibility and dosage-			

		form stability; analyze rheological properties of materials and PDFs for effective and safe use; select and apply pharmaceutical-technological operations and sterilization procedures; and prepare/evaluate non-sterile liquid PDFs, extractive preparations and homeopathic medicines. They will also be able to collaborate in teams to address challenges in developing safe and functional pharmaceutical products. Learning outcomes – Upon completion, students will be able to: • Identify and explain regulatory aspects of PDF development, production and use, including pharmacopoeial requirements and GMP. • Analyze and solve problems related to pharmaceutical incompatibility and stability of PDFs. • Apply methods to analyze rheological properties of materials and PDFs to ensure efficacy and safety. • Select and apply appropriate pharmaceutical-technological operations for preparing suitable PDFs. • Select and apply appropriate sterilization techniques for PDFs. • Prepare and evaluate non-sterile liquid PDFs, with emphasis on preformulation, formulation and application, including extractive preparations and homeopathic medicines. • Work in teams to address challenges in the development of safe and functional PDFs.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter: Regulatory Aspects for PDFs • <i>Unit 1.</i> Regulatory framework for PDFs: production; community pharmacy (types of pharmacies, premises, equipment and personnel); wholesalers; industrial production; GDP and GMP. • <i>Unit 2.</i> Prescription practice: prescription types; prescribing, preparing and dispensing medicines according to current laws and bylaws. <i>Learning outcomes:</i> Understand the regulatory framework for PDFs, the role of pharmacies and wholesalers, and principles of GDP/GMP. Know prescription types, prescribing, preparation and dispensing, and basic requirements for manufacture, storage and distribution of medicines; apply regulatory principles in practice. Chapter: Incompatibility Overview of incompatibility to ensure stability and efficacy of products through rational selection of excipients and packaging; ensuring compatibility with APIs and minimizing risks that compromise quality and safety. Types: physical, chemical, physicochemical and microbiological incompatibilities; testing methods: thermal, chromatographic, spectroscopic and other analytical techniques for assessing incompatibilities and identifying potential interactions among APIs, excipients and contact packaging. <i>Learning outcomes:</i> Understand the significance of incompatibility for stability and efficacy; recognize types and impacts on quality/safety; know commonly used

	methods/analytical techniques for assessing interactions among APIs, excipients and packaging. Chapter: Stability Importance of stability of APIs and PDFs; methodology and regulatory requirements; types of stability; influencing factors; tests across development and production. <i>Learning outcomes:</i> Explain stability and its importance for patient safety/therapy effectiveness; identify factors affecting physical, chemical, microbiological, toxicological and therapeutic stability; define/apply stability tests (stress, long-term, accelerated), calculate degradation rate constants and estimate shelf life; interpret guideline requirements (ICH, EMA); understand basics of stability protocol design (batch selection, packaging, testing frequency, storage conditions). Chapter: Pharmaceutical-Technological Operations • <i>Unit 1.</i> Basic terminology; characteristics of operations and manufacturing processes; classification of operations. Filtration (principles, types, membrane filtration, industrial filtration); centrifugation (principles, types and equipment). • <i>Unit 2.</i> Comminution and sieving; particle size and its influence in vivo and in manufacturing; techniques for particle-size characterization and size distribution. • <i>Unit 3.</i> Thermal and diffusional operations with focus on drying; types; equilibrium moisture content; drying rate as a critical parameter; techniques and equipment. • <i>Unit 4.</i> Mixing. Principles of rheology and its impact on preparation and performance of PDFs. Effect of rheology on processability, stability, efficacy and safety. Mixing as a key operation: role of rheology in selecting methods/equipment; basic principles, equipment types and factors affecting process efficiency. • <i>Unit 5.</i> Sterilization. Microbiological quality of PDFs by route of administration per European Pharmacopoeia. Sterilization types and execution per European Pharmacopoeia, EMA and GMP; biological indicators and verification; selection and application of sterilization in injectables, ophthalmics, implants and other sterile products; validation and control of sterilization processes. <i>Learning outcomes:</i> – Know filtration principles and influencing factors; select suitable filters and understand industrial applications; understand centrifugation principles/equipment and conditions for successful phase separation. – Understand effects of particle size on in-vivo behavior and manufacturing; apply comminution/sieving methods and size/distribution measurements. – Understand drying principles, equilibrium moisture and drying rate; identify suitable techniques/equipment and choose methods based on material/process needs. – Understand the role of rheology in preparation, stability and performance; select mixing methods/equipment based on

		material/product specifics. – Understand the importance of sterilization; select appropriate methods; analyze biological indicators; apply control and validation principles per regulatory requirements. Chapter: Non-Sterile Liquid PDFs • <i>Unit 1.</i> Concepts of design and development of PDFs; classification; selection of excipients; formulation principles; excipient functions supporting stability, efficacy and safety. • <i>Unit 2.</i> Types of liquid PDFs, advantages/limitations; expression of concentration; basic solubility principles and strategies to improve API solubility for optimal bioavailability and efficacy. • <i>Unit 3.</i> Pharmaceutical water quality: contaminants; purification methods/techniques; storage/distribution; regulation of water quality for pharmaceutical use. • <i>Unit 4.</i> Solution dosage forms for oral and external use—classification and application. Aqueous and non-aqueous preparations per European Pharmacopoeia and other relevant pharmacopoeias (USP, BP): for oral use (alcoholic solutions, elixirs, aromatic waters, linctuses, syrups, mixtures, oral drops, colonic lavage solutions); for external use (lotions, liniments, collodions, ear preparations, irrigations, mouth and throat rinses, nasal products). Composition, preparation and administration. • <i>Unit 5.</i> Extractive preparations and homeopathic medicines (aqueous, hydroalcoholic and non-aqueous): preparation procedures; pharm-tech testing; labeling and storage. <i>Learning outcomes:</i> – Understand design/development concepts, classification of non-sterile liquids, and the importance of excipients for stability, efficacy and safety. – Identify types of liquid PDFs; analyze pros/cons; apply principles to improve solubility and bioavailability. – Understand water-quality requirements, purification, storage, distribution and regulation per pharmacopoeias. – Gain practical skills for classification, composition and preparation of oral and external solutions in line with pharmacopoeial requirements and correct use. – Apply methods for preparation and storage of extractive preparations and homeopathic medicines and understand their specific use and regulation in practice.
13	Interrelation with Other Courses	1. Prior knowledge from <i>FUNDAMENTALS OF PHARMACY</i> (I), <i>Biophysics</i> (I), <i>Physical Chemistry for Pharmacists</i> (II), <i>Microbiology</i> (III) is required/related. 2. Knowledge from this course is required as prior knowledge for <i>Pharmaceutical Technology II</i>, <i>Advanced Pharmaceutical Technology</i>, and <i>Biopharmacy</i>.
14	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive classes (discussion of selected tasks, cases and problems) Working methods:

		1. Laboratory exercises (practical skills) 2. Problem-solving (individual/group work to foster research and analytical skills, teamwork and application of theory) 3. Project work (research on a given topic to develop independent research and presentation skills).
15	Total Available Contact Hours	7 ECTS × 30 hours = 210 hours
16	Forms of Teaching Activities	16.1. Lectures (theoretical): number of teaching weeks (15) × 3 hours/week = 45 hours 16.2. Exercises (laboratory/auditory): number of teaching weeks (15) × 3 hours/week = 45 hours
17	Other Forms of Activities	17.1. Project tasks/seminars: 8 hours — individual/team research of specific problems and proposed solutions related to the topic. 17.2. Independent study: Preparation for lectures – 67 hours; Preparation for practicals – 22.5 hours — independent research, study and problem-solving to deepen knowledge. 17.3. Exam preparation: 22.5 hours — review and systematization before the exam.
18	Requirements for Signature	At least 30 points from the planned activities.
19	Assessment Method	19.1. Final exam: 25–50 points (if colloquia are not taken) 19.2. Colloquia: Colloquium 1 – 13–25 points; Colloquium 2 – 13–25 points 19.3. Practical exam: 6–10 points 19.4. Seminar/project, written and oral presentation: 5 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory literature (<i>specify electronic/hard copy as noted</i>) 1. A. Simov, <i>Pharmaceutical Technology</i>, Z. Simova, 2001 — hard copy. 2. Ansel M., Popovich N., Allen L., <i>Pharmaceutical Dosage Forms and Drug Delivery Systems</i>, 8th Ed., Williams & Wilkins, 2004 — electronic edition. 3. Aulton M., <i>Pharmaceutics: The Science of Dosage Form Design</i>, 2nd Ed., Churchill Livingstone, 2002 — electronic edition. 4. <i>Remington: The Science and Practice of Pharmacy</i>, 21st Ed., Mack Pub. Co., 2005 — electronic edition. 5. <i>European Pharmacopoeia</i> — electronic edition. 6. <i>British Pharmacopoeia</i> — electronic edition. 7. <i>British National Formulary</i> — electronic edition.

		8. <i>United States Pharmacopeia</i> — electronic edition. 9. <i>United States Pharmacopeia Drug Information</i> — electronic edition. 10. Laws and bylaws in the field of pharmacy — electronic edition. Additional literature 1. Relevant papers in international scientific journals — electronic editions. 2. Joseph D. Nally, <i>Good Manufacturing Practices for Pharmaceuticals</i>, 6th Ed., Informa Healthcare, 2007 — electronic edition. 3. Kim Huynh-Ba, <i>Handbook of Stability Testing in Pharmaceutical Development</i>, Springer, 2009 — electronic edition. 4. T. Sandle, <i>Sterility, Sterilisation and Sterility Assurance for Pharmaceuticals: Technology, Validation and Current Regulations</i>, Elsevier Science, 2013 — electronic edition.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHARMACEUTICAL CHEMISTRY II			
2	Code	FFIFH23			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmaceutical Chemistry			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	3	Semester:	V
7	Workload expressed in ECTS credits	6 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Aleksandra Grozdanova (course coordinator) Prof. Dr. Ljubica Shuturkova Prof. Dr. Zoran Sterjev Prof. Dr. Zorica Naumovska Asst. Prof. Dr. Evgenija Mihajloska Asst. Prof. Dr. Aleksandar Dimkovski			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: Completed (attended) <i>Pathology and Pathophysiology</i> (Semester 3); completed (attended) <i>Pharmaceutical Chemistry I</i> (Semester 4). Examination requirements: Passed <i>Microbiology</i> (Semester 3); passed <i>Pharmaceutical Chemistry I</i> (Semester 4).			
11	Course Aims (Competencies) and Learning Outcomes	Aim: To introduce students to pharmaceutical-chemical principles necessary to understand structure–activity relationships (SAR) and the molecular mechanisms of action of medicines organized by their pharmacotherapeutic classes. Expected learning outcomes: Upon completion, students will understand mechanisms of action based on SAR for therapeutic agents used in the treatment of various diseases.			
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: Antimicrobial Drugs <i>Learning outcomes:</i> Classify groups of antimicrobials active against major human pathogens. Chapter 2: Antiseptics and Disinfectants Biocides; microbial susceptibility to biocides; representatives, uses, structural features and mechanisms of action of: oxidants; heavy-metal compounds; halogens and halogen-based compounds; cationic antiseptics; acridine and quinoline derivatives; alcohols; aldehydes; phenols; alkyl and halogen derivatives of phenol; acids. <i>Learning outcomes:</i> Recognize and classify agents used as antiseptics/disinfectants; describe their uses, mechanisms of action and resistance, and understand SAR within this group. Chapter 3: Antibiotics Mechanisms of action; antimicrobial spectrum; microbial resistance; chemical classification; representatives, uses, structural characteristics and mechanisms of action of: β -lactams; aminoglycosides; macrolides; tetracyclines; antifungal			

	antibiotics; polypeptide antibiotics. <i>Learning outcomes:</i> Classify antibiotic groups; recognize key representatives; describe mechanisms of action and resistance; outline uses; understand antibiotic SAR and challenges in developing new antibiotics. Chapter 4: Sulfonamides Inhibitors of folic-acid synthesis; structural features of sulfonamides and sulfones; mechanisms of action; microbial resistance; representatives, uses and structural characteristics. <i>Learning outcomes:</i> Classify sulfonamides/sulfones; recognize key representatives; explain mechanisms of action/resistance; relate structure to activity. Chapter 5: Antituberculosis Agents (Tuberculostatics) Tuberculosis; general therapeutic principles; representatives and structural features of first-, second- and third-line agents. <i>Learning outcomes:</i> Describe TB therapy principles; recognize key agents; explain mechanisms of action and resistance; relate structure to activity; outline contemporary therapeutic approaches. Chapter 6: Antiviral Drugs Viruses and stages of replication; classes of selective replication inhibitors; representatives, uses, structural features and mechanisms of action of: nucleoside and non-nucleoside analogues; viral protease inhibitors; viral DNA-polymerase inhibitors; capsid assembly inhibitors; neuraminidase inhibitors; immunomodulators; immunoglobulins. <i>Learning outcomes:</i> Classify antiviral groups and representatives; describe antiviral mechanisms and resistance; relate structure to activity and understand how chemical modifications affect activity; recognize challenges in developing new antivirals. Chapter 7: Antiprotozoal Agents Protozoal diseases and protozoa; amoebiasis and amoebicides; agents against <i>Pneumocystis</i>, toxoplasmosis, leishmaniasis, trypanosomiasis; representatives, uses and mechanisms. <i>Learning outcomes:</i> Classify protozoal diseases and drugs; describe mechanisms of action/resistance; relate structure to antiprotozoal activity. Chapter 8: Antimalarial Drugs Malaria and malarial infection; clinical/pharmacological classification; representatives, mechanisms and structural characteristics of classes. <i>Learning outcomes:</i> Describe principles of malaria therapy and mechanisms across disease stages; classify antimalarial groups and representatives; understand SAR. Chapter 9: Anthelmintics Clinically important helminths; agents against nematodes, trematodes and cestodes; representatives, uses, structural features and mechanisms. <i>Learning outcomes:</i> Describe classes/representatives acting

		against nematodes, trematodes and cestodes; outline uses, mechanisms and resistance; understand SAR. Chapter 10: Antifungal Drugs Fungal infections; antifungal mechanisms; classes of antifungal agents; representatives, uses, structural features and mechanisms. <i>Learning outcomes:</i> Describe clinical types of mycotic infections; classify antifungal drugs and representatives; explain mechanisms of action/resistance and SAR. Chapter 11: Chemotherapeutics (Antineoplastic Agents) Mechanisms of action and resistance; representatives, uses and structural features of: alkylating agents; antimetabolites; antibiotics; plant alkaloids and glycosides. <i>Learning outcomes:</i> Understand mechanisms of action; classify antineoplastic groups and representatives with principal uses; explain resistance; relate structure to antineoplastic activity. Chapter 12: Biologics and Vaccines Categories of biological medicines and vaccine types; specific features, mechanisms of action and clinical applications; representatives, uses and structural/technological characteristics of products obtained by DNA technology, monoclonal antibodies, immunotherapy, and vaccines. <i>Learning outcomes:</i> Understand mechanisms and applications of biologics and vaccines; classify groups and key representatives; recognize principles relevant to efficacy, safety and (where applicable) resistance; appreciate structure/technology–activity relationships.
13	Interrelation with Other Courses	1. Prior knowledge required from: <i>Pathology and Pathophysiology, Microbiology, and Medical Chemistry.</i> 2. Knowledge from this course is required for: <i>Foundations of Clinical Pharmacy and Clinical Pharmacy and Pharmacotherapy.</i>
14	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive classes (discussion of selected tasks, cases, problems) Working methods: 1. Laboratory exercises (practical skills) 2. Problem-solving (individual/group work to foster research and analytical skills, teamwork, and application of theoretical knowledge)
15	Total Available Contact Hours	180 hours
16	Forms of Teaching Activities	16.1. Lectures (theoretical): 45 hours 16.2. Exercises (laboratory/auditory): 45 hours
17	Other Forms of Activities	17.1. Project tasks/seminars: 0 hours 17.2. Independent study: Preparation for lectures – 45 hours; Preparation for practicals – 22.5 hours 17.3. Exam preparation: 15 hours (theory) + 7.5 hours (theory)

18	Requirements for Signature	40 points.
19	Assessment Method	19.1. Final exam: 25–50 points (if colloquia are not taken) 19.2. Colloquia: Colloquium 1 – 13–25 points; Colloquium 2 – 13–25 points 19.3. Practical exam: 6–10 points 19.4. Seminar/project, written and oral presentation: —
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory literature (<i>specify electronic/hard copy as noted</i>) 1. Beale J. Jr., Block J. H. (eds.). <i>Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry</i>, 12th Ed., Wolters Kluwer Health, 2010 — electronic edition. 2. Roche V. F., Zito S. W., Lemke T. L., Williams D. A. <i>Foye's Principles of Medicinal Chemistry</i>, 8th Ed., Lippincott Williams & Wilkins (Wolters Kluwer), 2020 — electronic edition. 3. Golan D. E. <i>Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy</i>, 4th Ed., Lippincott Williams & Wilkins (Wolters Kluwer), 2016 — electronic edition. Additional literature 1. Relevant scientific articles in the field — electronic editions.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	FUNDAMENTALS OF PHARMACOLOGY			
2	Code	FFIFH24			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmaceutical Chemistry			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	3	Semester:	V
7	Workload expressed in ECTS credits	ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Nadica Matevska Geshkovska (course coordinator) Prof. Dr. Kristina Mladenovska Prof. Dr. Dimche Zafirov Asst. Prof. Dr Marija Staninova Asst. Prof. Dr. Elizabeta Krstevska Bozinovikj			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: Anatomy and Physiology (Semester I, passed); Molecular and Cell Biology and Genetics (Semester II, passed); Pathology and Pathophysiology (Semester III, attended); Biochemistry (Semester IV, attended); Fundamentals of Immunology (Semester IV, attended). Examination requirements: Signature from <i>Fundamentals of Pharmacology</i> (Semester V); Pathology and Pathophysiology (Semester III, passed).			
11	Course Aims (Competencies) and Learning Outcomes	Aims To develop an understanding of core pharmacology concepts applicable across the study program. Students will learn mechanisms of drug action (pharmacodynamics) and how the body handles drugs (pharmacokinetics), apply these to simple medical problems, perform basic measurements of pharmacological effects of new/undefined substances, study endogenous mediators, and assess toxicity/adverse effects using various experimental systems and healthy volunteers/patients (for pharmacological-toxicological and clinical investigation). Students will perform calculations related to affinity and potency, and to absorption, distribution, metabolism and elimination (ADME); understand adverse effects, inter-individual variability and drug interactions; interpret risk–benefit; grasp principles of chemical transmission and peripheral neural control (mediators and drugs that modulate nervous-system function); understand inflammation and immune-response mediators and the action of anti-inflammatory drugs; and find/interpret scientific information on novel mechanisms, evaluating evidence for efficacy and safety in drug development and use. Learning outcomes Students will be able to connect pharmacology with related			

		medical sciences, interpret drug actions, and apply pharmacodynamics and pharmacokinetics in therapeutics.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: General Principles of Drug Action Drug–target binding models and primary target classes; specificity, affinity, potency, agonism/antagonism; desensitization and tachyphylaxis; constitutive receptor activation; quantitative aspects of drug–target interactions. <i>Learning outcome:</i> Understand general principles of drug action at primary therapeutic targets and off-target sites (primary and secondary pharmacodynamics). Chapter 2: Molecular Aspects of Drug Action Sites of drug action (receptors, ion channels, enzymes, transporters); molecular structure and activation of receptors (ligand-gated ion channels; G-protein-coupled receptors; kinase-linked and related receptors; nuclear receptors) and voltage-gated channels; second messengers and signaling cascades. <i>Learning outcome:</i> Relate drugs to receptor/ion-channel structure and functional coupling to effector systems. Chapter 3: Cellular Aspects of Drug Action Regulation of intracellular Ca^{2+}; excitation, contraction and mediator release; pathophysiological and pharmacological views of proliferation, angiogenesis and apoptosis. <i>Learning outcome:</i> Understand how drugs modulate mechanisms governing cell function and the therapeutic implications of proliferation/apoptosis. Chapter 4: Methods and Measurements in Pharmacology Bioassay—principles and design; in-vitro and in-vivo systems for pharmacological–toxicological testing; human subjects in experimental assessment of human pharmacology; clinical trials—design, bias avoidance, sample size, outcome measures, frequentist vs Bayesian approaches, placebo, meta-analysis, benefit–risk evaluation. <i>Learning outcome:</i> Understand principles for measuring pharmacological activity, safety and toxicity of novel substances from laboratory to clinic. Chapter 5: Drug Kinetics Molecular transport mechanisms; fundamentals of absorption, distribution and elimination; linear vs non-linear pharmacokinetics; quantitative models and parameters describing the extent and rate of ADME. <i>Learning outcome:</i> Understand determinants of bioavailability, influencing factors, PK models/parameters, and their role in route selection and dosing regimens. Chapter 6: Chemical Mediators and the Peripheral Nervous System Principles of chemical transmission; stages of neurochemical transmission and drug action sites; cholinergic transmission (physiology; transmitters; acetylcholine receptors; mechanisms, effects, adverse effects, pharmacokinetics and clinical use of cholinergic drugs). <i>Learning outcome:</i> Understand how drugs act on chemical

		transmission and neuromodulation in the peripheral nervous system—especially cholinergic pathways. Chapter 7: Adrenergic & Serotonergic Transmission, Purinergic Neurotransmitters and Cannabinoids Physiology of adrenergic transmission; transmitters and receptors; drugs acting on adrenergic receptors and noradrenergic neurons. Serotonin (5-HT) as peripheral mediator—biosynthesis, metabolism, receptors, pharmacological effects and drugs acting on 5-HT receptors. Purinergic transmitters (ATP, ADP, adenosine)—receptors and functions. Cannabinoids—endocannabinoids, plant cannabinoids and synthetic ligands; receptors; physiology; mechanisms. <i>Learning outcome:</i> Understand mechanisms and therapeutic potential of drugs acting on adrenergic, serotonergic, purinergic and endocannabinoid systems. Chapter 8: Inflammation and Immune Responses Acute inflammation and outcomes; mediators of inflammatory and immune responses; anti-inflammatory and immunosuppressive drugs. <i>Learning outcome:</i> Recognize key features of inflammation and principal mediators controlling immune responses. Chapter 9: Peptide and Protein Mediators General pharmacology of peptides; types of peptide mediators; biosynthesis/regulation; peptide antagonists; peptide/protein drugs (actions, mechanisms, pharmacokinetics, adverse effects). Nitric oxide (NO) as local/circulating mediator—biosynthesis, degradation/transport, actions; therapeutic approaches (NO, NO donors, NOS inhibitors, drugs that potentiate NO). <i>Learning outcome:</i> Understand characteristics and therapeutic potential of peptide mediators/drugs and of agents acting on the L-arginine/NO pathway. Chapter 10: Adverse Drug Reactions and Individual Variability ADR types; drug toxicity and general mechanisms of cell injury/death—non-covalent interactions (lipid peroxidation; reactive oxygen species; glutathione depletion; –SH modification), covalent interactions; hepatotoxicity, nephrotoxicity; mutagenesis/carcinogenesis; teratogenesis/fetal toxicity; drug allergy. Individual variability in treatment responses—effects of race/ethnicity, age, sex, physiological states (pregnancy, lactation), genetics, idiosyncrasy, disease, and PD/PK drug–drug interactions. <i>Learning outcome:</i> Anticipate, avoid and recognize ADRs in practice; identify factors causing inter-/intra-individual variability and adjust therapy appropriately.
13	Interrelation with Other Courses	1. Prior knowledge required from: <i>Anatomy and Physiology</i> (I), <i>Molecular and Cell Biology and Genetics</i> (II), <i>Pathology and Pathophysiology</i> (III), <i>Biochemistry</i> (IV), <i>Fundamentals of Immunology</i> (IV).

		2. Knowledge from this course is required for: <i>Pharmaceutical Chemistry II</i> (VI), <i>Phytotherapy</i> (VI), <i>Foundations of Clinical Pharmacy</i> (VII), <i>Clinical Pharmacy and Pharmacotherapy</i> (VIII), <i>Biopharmaceutics</i> (VIII), <i>Toxicology</i> (IX), <i>Pharmacogenetics and Pharmacogenomics</i> (IX).
14	Teaching and Working Methods	Teaching methods: Lectures Working methods: 1. Laboratory exercises (practical skills) 2. Problem-solving (individual/group work to promote research and analytical skills, teamwork, and application of theory)
15	Total Available Contact Hours	180 hours
16	Forms of Teaching Activities	16.1. Lectures (theoretical): 45 hours 16.2. Exercises (laboratory/auditory; problem-solving): 45 hours
17	Other Forms of Activities	17.1. Project tasks/seminars: — 17.2. Independent study: Preparation for lectures – 45 hours; Preparation for practicals – 22.5 hours 17.3. Exam preparation: 22.5 hours
18	Requirements for Signature	At least 30 points from the planned activities.
19	Assessment Method	19.1. Final exam: 25–50 points (if colloquia are not taken) 19.2. Colloquia: Colloquium 1 – 13–25 points; Colloquium 2 – 13–25 points 19.3. Practical exam: 6–10 points 19.4. Seminar/project, written and oral presentation: —
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory literature 1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J. <i>Pharmacology</i> . Academic Press, 2007 — 6th ed., hard copy, Macedonian translation. 2. Ritter J. M., Flower R. J., Henderson G., Loke Y. K., MacEwan D., Robinson E., Fullerton J. <i>Rang & Dale's Pharmacology</i> . Elsevier, 2023 — 10th ed., electronic copy. Additional literature 1. Brunton L. L., Lazo J. S., Parker K. L. <i>Goodman & Gilman's The Pharmacological Basis of Therapeutics</i> . Tabernakul, 2011 — 11th ed., hard copy, Macedonian translation.

		2. Golan D. E., Tashjian A. H., Armstrong E. J., Armstrong A. W. <i>Principles of Pharmacology</i>. Ars Lamina, 2008 — hard copy, Macedonian translation. 3. Relevant articles in international scientific journals (from 2018 onwards), electronic editions.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	SOCIAL PHARMACY AND PUBLIC HEALTH			
2	Code	FFIFH25			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmaceutical Chemistry			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	3	Semester:	V
7	Workload expressed in ECTS credits	6 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Aleksandra Grozdanova (course coordinator) Prof. Dr. Katerina Anchevska Netkovska Asst. Prof. Dr. Evgenija Mihajloska Asst. Prof. Dr. Aleksandar Dimkovski			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: / Examination requirements: /			
11	Course Aims (Competencies) and Learning Outcomes	Aim: To develop students' understanding of social pharmacy and society's relationship to medicines and treatment. The course examines the social role of the pharmacist as a healthcare professional, the provision of pharmaceutical care, and patient communication and education. It also covers social research in pharmacy and pharmacy as part of public health. Learning outcomes: Upon completion, students will: • understand the pharmacist's role in healthcare and in organizing/providing pharmaceutical care; • participate actively in public-health policies; • apply different methodologies in health-related social research.			
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: Development and Role of Social Pharmacy <i>Learning outcome:</i> Describe the role of social pharmacy in healthcare and understand how social factors influence health and the use of medicines. Chapter 2: Health, Illness and Treatment as Social Conditions <i>Learning outcome:</i> Describe social contexts of health/illness and understand challenges in delivering empathic, equitable and effective care. Chapter 3: Use, Misuse and the Placebo Effect of Medicines <i>Learning outcome:</i> Describe contexts of medicine use—therapeutic benefit, misuse and placebo effect—in order to identify benefit, outcomes or potential misuse. Chapter 4: The Professional Role of the Pharmacist <i>Learning outcome:</i> Understand the pharmacist's role in healthcare and the delivery of pharmaceutical care. Chapter 5: Pharmacy as Part of Public Health <i>Learning outcome:</i> Understand the pharmacist's responsibilities			

		in promoting public health through disease prevention, health education and vaccination programs. Chapter 6: Social Research in Pharmacy <i>Learning outcome:</i> Design, conduct and analyze studies on social aspects of healthcare and medicine use, including patient behavior, evaluation of healthcare interventions and assessment of public-health policies. Chapter 7: Preparing Students for Professional Practice – the Pharmacy Game <i>Learning outcome:</i> Become familiar with the Pharmacy Game as a modern educational tool simulating real-world community pharmacy practice, designed to deliver experiential learning that improves practical and communication skills and fosters professionalism.
13	Interrelation with Other Courses	1. Prior knowledge required from: <i>Foundations of Pharmacy</i>. 2. Knowledge from this course is required for: <i>Pharmaceutical Care; Foundations of Clinical Pharmacy; Clinical Pharmacy and Pharmacotherapy</i>.
14	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive classes (discussion of selected cases and problems) Working methods: 1. Problem-solving (individual/group work to develop research and analytical skills, teamwork and application of theory) 2. Project work (research on a given topic to develop independent inquiry and presentation skills)
15	Total Available Contact Hours	90 hours
16	Forms of Teaching Activities	16.1. Lectures (theoretical): 30 hours 16.2. Exercises (laboratory/auditory): 0 hours
17	Other Forms of Activities	17.1. Project tasks/seminars: 15 hours 17.2. Independent study: 15 hours 17.3. Exam preparation: 30 hours
18	Requirements for Signature	At least 30 points from the planned activities.
19	Assessment Method	19.1. Final exam: 26–50 points (if colloquia are not taken) 19.2. Colloquia: — 19.3. Practical exam: — 19.4. Seminar/project, written and oral presentation: 10–20 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)

21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory literature (<i>specify electronic/hard copy as noted</i>) 1. Parastou Donyai, <i>Social and Cognitive Pharmacy: Theory and Case Studies</i>, Pharmaceutical Press, 2012 — electronic edition. 2. Nathaniel M. Rickles, Albert I. Wertheimer, Mickey C. Smith, <i>Social and Behavioral Aspects of Pharmaceutical Care</i>, 2nd Ed., Jones & Bartlett Publishers, 2010 — electronic edition. 3. Robert B. Volas, Nil Coxacy, <i>Public Health and Preventive Medicine (Wallace/Maxcy Rosenau–Last)</i>, Tabernakul, 2010 — hard copy. Additional literature 1. Relevant papers in international scientific journals (from 2023 onwards) — electronic editions.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHARMACEUTICAL CHEMISTRY III			
2	Code	FFIFH26			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmaceutical Chemistry			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	3	Semester:	VI
7	Workload expressed in ECTS credits	8 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Zoran Sterjev (course coordinator) Prof. Dr. Ljubica Shuturkova Prof. Dr. Aleksandra Grozdanova Prof. Dr. Kristina Mladenovska Prof. Dr. Aleksandra Kapedanovska Nestorovska Prof. Dr. Zorica Naumovska Asst. Prof. Dr. Evgenija Mihajloska Asst. Prof. Dr. Aleksandar Dimkovski			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: attended Pharmaceutical Chemistry I (Semester IV), Pharmaceutical Chemistry II (Semester V), and Fundamentals of Pharmacology (Semester V). Examination requirements: passed Pharmaceutical Chemistry I (Semester IV).			
11	Course Aims (Competencies) and Learning Outcomes	Aims (competencies) To familiarize students with pharmaceutical-chemical principles required to understand structure–activity relationships (SAR) and molecular mechanisms of drug action across major pharmacotherapeutic groups. Expected learning outcomes Upon completion, students will be able to explain mechanisms of action based on SAR for therapeutic agents used to treat diverse diseases, recognize key representatives within classes, relate chemical modifications to pharmacological effect, adverse reactions and interactions, and formulate professionally reasoned opinions informed by results—supporting public health and healthcare system performance.			
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: CNS Depressants and Stimulants Nervous system overview; drug classes acting on the CNS: general anesthetics; barbiturates; benzodiazepines; drugs for insomnia; CNS stimulants. <i>Learning outcome:</i> Classify CNS-active drug groups; identify key representatives; describe uses, mechanisms, adverse reactions and interactions; relate structure to activity. Chapter 2: Anticonvulsants Antiepileptic drugs; mechanisms; SAR; chemical and pharmacological characteristics.			

	<i>Learning outcome:</i> Explain mechanisms; recognize principal agents; describe use and SAR principles. Chapter 3: Central Dopaminergic Drugs Dopamine, receptors and pathways; therapy of Parkinson's disease—dopamine agonists, MAO-B inhibitors, non-ergot derivatives; anticholinergics. <i>Learning outcome:</i> Describe dopaminergic pharmacotherapy procedures and mechanisms; identify main agents and SAR features. Chapter 4: Drugs for Alzheimer's Disease Therapeutic approaches; acetylcholinesterase inhibitors; NMDA-receptor antagonists. <i>Learning outcome:</i> Explain mechanisms and SAR; recognize principal preparations and clinical use. Chapter 5: Local Anesthetics, Analgesics and Antipyretics Molecular mechanism of local anesthetics; agents, SAR and use. Non-opioid analgesics/antipyretics and anti-inflammatory drugs—mechanisms, agents, SAR, use. <i>Learning outcome:</i> Describe mechanisms, major agents, clinical application and adverse effects; connect structure to activity. Chapter 6: Adrenergic and Cholinergic Drugs and Related Agents Autonomic nervous system; adrenergic neurotransmitters and receptors; sympathomimetics; adrenergic receptor agonists/antagonists; overview of cholinergic agents. <i>Learning outcome:</i> Classify autonomic drugs; explain mechanisms, uses, key adverse effects; relate SAR to pharmacological profile. Chapter 7: Drugs Acting on the Cardiovascular System Antianginals/vasodilators; antiarrhythmics/rhythm-modifying agents; antihypertensives; antihyperlipidemic/anti-atherosclerotic drugs; diuretics; anticoagulants/antiplatelet agents. <i>Learning outcome:</i> Classify classes; describe mechanisms, principal agents, indications and major adverse effects; link structure to activity. Chapter 8: Steroids and Therapeutically Related Compounds Steroids and analogues in therapy; development of adrenocorticoid drugs; systemic corticosteroids; inhaled/intranasal glucocorticoids; adrenocorticoid antagonists. <i>Learning outcome:</i> Recognize/ classify therapeutic steroids; describe mechanisms, effects, clinical applications and adverse effects; understand SAR. Chapter 9: Histamine and Antihistamines Mechanisms and SAR of H₁ antagonists; inhibitors of histamine release; dual-acting antihistamines. <i>Learning outcome:</i> Classify antihistamines; describe mechanisms, effects and major adverse effects; connect structure to activity.

		Chapter 10: Drugs for Bone Disorders Calciotherapy; bisphosphonates; selective estrogen-receptor modulators (SERMs). <i>Learning outcome:</i> Classify classes for bone disease; describe mechanisms, key representatives, effects and adverse effects; relate SAR to effect. Chapter 11: Drugs for Gastrointestinal Disorders Agents for achlorhydria; peptic-ulcer therapy (antacids, proton-pump inhibitors, H₂ antagonists); antidiarrheals; laxatives; antiemetics; gastrointestinal hormones. <i>Learning outcome:</i> Classify GI drug groups; describe mechanisms, effects, leading representatives and adverse effects; connect structure to activity. Chapter 12: Vitamins and Trace Elements Fat-soluble and water-soluble vitamins; therapeutic use of micro- and macroelements; iron preparations and therapy of iron-deficiency anemia. <i>Learning outcome:</i> Classify vitamins; describe pharmacological effects; outline therapeutic applications of minerals and trace elements.
13	Interrelation with Other Courses	• Prior knowledge required from: <i>Pharmaceutical Chemistry I, Pharmaceutical Chemistry II, Fundamentals of Pharmacology.</i> • Knowledge from this course is required for / supports: advanced topics in medicinal/pharmaceutical chemistry and <i>Clinical Pharmacy & Pharmacotherapy.</i>
14	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive classes (discussion of selected tasks, cases and problems) Working methods: 1. Laboratory exercises (practical skills) 2. Problem-solving (individual/group work to foster research and analytical skills, teamwork and application of theory) 3. Project work (topic-based research to develop independent inquiry and presentation skills)
15	Total Available Contact Hours	240 hours
16	Forms of Teaching Activities	16.1. Lectures (theoretical): 45 hours 16.2. Exercises (laboratory/auditory): 45 hours
17	Other Forms of Activities	17.1. Project tasks/seminars: — 17.2. Independent study: Preparation for lectures – 75 hours; Preparation for practicals – 22.5 hours 17.3. Exam preparation: 15 hours (theory) + 7.5 hours (theory)
18	Requirements for Signature	40 points.
19	Assessment Method	19.1. Final exam (if colloquia are not taken): 25–50 points 19.2. Colloquia: Colloquium 1 – 13–25 points; Colloquium 2 – 13–25 points

		19.3. Practical exam: 6–10 points 19.4. Seminar/project, written and oral presentation: —
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory literature (<i>specify format as noted</i>) 1. John M. Beale, <i>Organic Medicinal and Pharmaceutical Chemistry</i>, 12th ed., Lippincott Williams & Wilkins (Wolters Kluwer), 2011 — electronic edition. 2. Donald Cairns, <i>Essentials of Pharmaceutical Chemistry</i>, Pharmaceutical Press, 2012 — electronic edition. Additional literature 1. Authorized lecture notes, Faculty of Pharmacy – Skopje (UKIM); Faculty of Medicine – Skopje (UKIM) — current year, electronic copy.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHARMACEUTICAL TECHNOLOGY II			
2	Code	FFIFT27			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmaceutical Technology			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	3	Semester:	VI
7	Workload expressed in ECTS credits	7 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Marija Glavash Dodov (course coordinator) Prof. Dr. Katerina Gorachinova Prof. Dr. Renata Slaveska Raicki Prof. Dr. Maja Simonoska Crcarevska Prof. Dr. Nikola Geshkovski Asst. Prof. Dr. Ljubica Mihailova Asst. Prof. Dr. Dushko Shalabalija Asst. M.Sc. Teodora Tasevska			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: signature in Pharmaceutical Technology I (Semester V). Examination requirements: passed Pharmaceutical Technology I (Semester V).			
11	Course Aims (Competencies) and Learning Outcomes	Aims Students gain detailed knowledge and understanding of the development, preparation and pharmacopoeial requirements for conventional sterile and non-sterile dosage forms—liquid, semisolid and solid. Emphasis is placed on pharmaceutical-technological testing relevant to preformulation/formulation development and manufacture, therapeutic design considerations, critical physicochemical properties of actives and specific excipients, as well as manufacturing processes compliant with current GMP and the key in-process parameters that drive product quality. Competencies / Outcomes Upon completion students will be able to: • Prepare and evaluate sterile liquid dosage forms (preformulation, formulation, use). • Prepare and evaluate liquid dispersed systems (colloids, suspensions, emulsions). • Prepare and evaluate gaseous dosage forms. • Prepare and evaluate semisolid dosage forms for external use. • Prepare and evaluate dosage forms for body cavities. • Prepare and evaluate uncoated solid dosage forms (powders, tablets, soft & hard capsules). • Prepare and evaluate coated solid dosage forms (principles, coating techniques, use).			

		• Discuss manufacturing processes for conventional dosage forms and appropriate in-process controls. • Analyze and solve pharmaceutical development problems for conventional forms. • Apply analytical methods relevant to formulation development of conventional forms. • Work effectively in teams to solve development and professional practice problems in industry, clinics or community pharmacy settings.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter: Sterile Dosage Forms for Parenteral Use • Advantages and specifics of parenterals; excipients used; classification by type, physical state, and route of administration. <i>Outcome:</i> Describe, differentiate, design and apply principles for parenteral formulations. Chapter: Sterile Dosage Forms for Ocular Use • Design objectives; ideal API properties; formulation development and preparation/industrial manufacture; patient counseling. <i>Outcome:</i> Explain design and manufacture considerations and provide appropriate counseling. Chapter: Liquid Dispersed Systems (Colloids, Suspensions, Emulsions) • Design objectives; ideal API properties; formulation development and preparation/industrial manufacture; patient counseling. <i>Outcome:</i> Apply design principles, select excipients/processes, and counsel on correct use. Chapter: Gaseous Dosage Forms • Design objectives; ideal API properties; formulation development and preparation/industrial manufacture; patient counseling. <i>Outcome:</i> Explain formulation/manufacture and appropriate patient guidance. Chapter: Semisolid Dosage Forms for Dermal Use and Forms for Body Cavities • Design objectives; ideal API properties; formulation development and preparation/industrial manufacture; patient counseling. <i>Outcome:</i> Design/evaluate semisolids and cavity forms and advise on correct application. Chapter: Uncoated Solid Dosage Forms (Powders, Tablets, Soft & Hard Capsules) • Design objectives; ideal API properties; formulation development and preparation/industrial manufacture, specific equipment and process parameters; patient counseling. <i>Outcome:</i> Link API/excipient properties to process selection and product performance; counsel patients. Chapter: Coated Solid Dosage Forms (Powders, Film-coated Tablets, Dragees) • Design objectives; ideal API properties; formulation

		development and preparation/industrial manufacture, coating techniques/equipment and critical parameters; patient counseling. <i>Outcome:</i> Select coating systems/parameters to meet target product profile and use requirements.
13	Interrelation with Other Courses	• Requires prior knowledge from: Pharmaceutical Technology I. • Supports (as prerequisite for): Advanced Pharmaceutical Technology; Biopharmacy.
14	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive classes (discussion of tasks, cases, problems) Working methods: 1. Laboratory exercises (practical skills) 2. Problem solving (individual/group work to foster research/analytical skills, teamwork, and application of theory) 3. Project work (topic-based research to develop independent inquiry and presentation skills)
15	Total Available Contact Hours	7 ECTS × 30 hours = 210 hours
16	Forms of Teaching Activities	16.1. Lectures (theoretical): 15 weeks × 3 h = 45 hours 16.2. Exercises (laboratory/auditory): 15 weeks × 3 h = 45 hours
17	Other Forms of Activities	17.1. Project/seminar tasks: 8 hours (individual or team problem-oriented projects) 17.2. Independent study: 67 hours (lecture prep) + 22.5 hours (practical prep) 17.3. Exam preparation: 22.5 hours (review & systematization)
18	Requirements for Signature	At least 30 points from activities.
19	Assessment Method	19.1. Final exam (if colloquia are not taken): 25–50 points 19.2. Colloquia: Colloquium 1: 13–25; Colloquium 2: 13–25 19.3. Practical exam: 6–10 points 19.4. Seminar/project, written & oral presentation: 5 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory literature (specify format) 1. A. Simov, <i>Pharmaceutical Technology</i>, Ž. Simova, 2001 — hard copy. 2. Ansel M., Popovich N., Allen L., <i>Pharmaceutical Dosage Forms and Drug Delivery Systems</i>, 8th ed., Williams & Wilkins, 2004 — electronic.

		3. Aulton M., <i>Pharmaceutics: The Science of Dosage Form Design</i>, 2nd ed., Churchill Livingstone, 2002 — electronic. 4. <i>Remington: The Science and Practice of Pharmacy</i>, 21st ed., Mack Publishing Co., 2005 — electronic. 5. <i>European Pharmacopoeia</i> — electronic. 6. <i>British Pharmacopoeia</i> — electronic. 7. <i>British National Formulary</i> — electronic. 8. <i>United States Pharmacopeia</i> — electronic. 9. <i>United States Pharmacopeia—Drug Information</i> — electronic. 10. Applicable pharmaceutical laws and by-laws — electronic. Additional literature 1. Relevant papers in international scientific journals — electronic. 2. Joseph D. Nally, <i>Good Manufacturing Practices for Pharmaceuticals</i>, 6th ed., Informa Healthcare, 2007 — electronic.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHYTOTHERAPY			
2	Code	FFIFG28			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmacognosy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	3	Semester:	VI
7	Workload expressed in ECTS credits	5 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Gjoshe Stefkov (course coordinator) Prof. Dr. Marija Karapandzova			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: Passed exam in Phytochemistry (IV semester) and obtained signature in Pharmacognosy (V semester). Examination requirements: Passed exam in Pharmacognosy (V semester).			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: The aim of the course is to provide students with fundamental knowledge in phytotherapy (modern herbal medicine), its role and significance as part of complementary and alternative medicine, the most important herbal drugs and herbal medicinal products, traditional and modern herbal medicines, active principles, mechanisms of action, efficacy and safety, application of herbal medicines in disease treatment, complexity of herbal preparations, and regulatory aspects within the European Union and North Macedonia. Students will become familiar with strategies of herbal treatment and the most significant herbal medicines used for diseases of the major systems in the human body. Learning Outcomes: Upon completion, students will be able to: • Understand the principles of traditional and modern herbal therapy and basic strategies of herbal medicine; • Identify traditional and modern herbal medicines, their complexity, standardization, and quality requirements; • Evaluate efficacy and safety of herbal medicines and interpret levels of evidence supporting their use; • Recognize adverse effects and contraindications; • Understand the use of traditional and modern herbal medicines for the treatment of diseases related to the central nervous, cardiovascular, respiratory, digestive, urinary, and reproductive			

		systems, as well as metabolic and dermatological disorders; • Identify anti-inflammatory herbal agents and adaptogenic substances.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	General Part Chapter I: Definitions and Introduction to Phytotherapy • Definition and introduction to phytotherapy; main characteristics of modern herbal medicine compared to traditional healing; traditional and modern herbal medicines; complexity, standardization, quality, efficacy, safety, and potential toxicity. • Pharmaceutical forms of modern herbal preparations and quality requirements. • Regulatory aspects of traditional and herbal medicines, and the position of traditional herbal medicine as part of complementary and alternative medicine. Learning outcomes: Students will understand the basic principles of phytotherapy, the characteristics of modern herbal medicine, the complexity and classification of herbal medicines, quality control, and regulatory frameworks. Special Part The special part of the course covers herbal treatment strategies and the most important traditional and modern herbal medicines, their composition, active principles, mechanisms of action, level of evidence for demonstrated efficacy, safety data, methods of administration, dosage, possible interactions and contraindications, and regulatory status in the EU (EMA), USA (FDA), other parts of the world, and North Macedonia. The following chapters correspond to organ/system-based therapeutic applications: • Chapter II: Nervous system and adaptogenic agents • Chapter III: Cardiovascular system • Chapter IV: Metabolic diseases • Chapter V: Urinary system • Chapter VI: Respiratory system; immunomodulatory and stimulant agents • Chapter VII: Male and female reproductive system • Chapter VIII: Digestive, hepatic, and biliary system • Chapter IX: Dermal system and anti-inflammatory agents Learning outcomes: Students will acquire knowledge and ability to: • Describe herbal treatment strategies and major traditional and modern herbal medicines; • Explain composition, active principles, mechanisms of action, and evidence of efficacy; • Evaluate safety, dosing, administration, interactions, and contraindications; • Understand the regulatory status of herbal medicines in the EU, USA, and North Macedonia.

13	Interrelation with Other Courses	1. Prerequisite knowledge: Pharmaceutical Botany and Biology, Phytochemistry, Pharmacognosy. 2. Acquired knowledge is useful for elective courses related to natural and herbal medicines.
14	Teaching and Working Methods	Teaching Methods: 1. Lectures 2. Consultations Working Methods: 1. Problem solving (individual or group work to encourage analytical thinking and teamwork) 2. Project work (independent research and oral presentation) 3. Home study
15	Total Available Contact Hours	150 hours
16	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 30 hours 16.2. Exercises (laboratory or auditory): /
17	Other Forms of Activities	17.1. Project or seminar work: 45 hours 17.2. Independent study: 30 hours 17.3. Exam preparation: 45 hours
18	Requirements for Signature	At least 30 points from the planned activities.
19	Assessment Method	19.1. Final exam (if colloquia are not taken): 25–50 points 19.2. Colloquium: x 19.3. Practical exam: x 19.4. Seminar/project (written and oral presentation): 6–10 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory Literature 1. Svetlana Kulevanova, <i>Fundamentals of Phytotherapy</i> , University “Ss. Cyril and Methodius” – Skopje, 2021 (electronic edition). 2. Svetlana Kulevanova, <i>Modern Herbal Medicine (Phytotherapy)</i> , University “Ss. Cyril and Methodius” – Skopje, 2015 (electronic edition). Additional Literature 1. Francesco Capasso, Timothy Gaginella, Giuliano Grandolini, Angelo Izzo, <i>Phytotherapy: A Quick Reference to Herbal Medicine</i> , Springer, 2003 (electronic edition).

		2. Simon Mills, Kerry Bone, <i>Principles and Practice of Phytotherapy</i> , Churchill Livingstone, 2000 (electronic edition).

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	BROMATOLOGY			
2	Code	FFIPB29			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Applied Biochemistry			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	3	Semester:	VI
7	Workload expressed in ECTS credits	6 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Tanja Petreska Ivanovska (course coordinator) Asst. Prof. Dr. Zoran Zivikj Asst. M.sc. Ana Marija Bajatovska			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: Passed exams in Pathology and Pathophysiology (III semester) and Biochemistry (IV semester). Examination requirements: /			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: The aim of the course is students to gain a solid understanding of the main food components and the principles of nutrition, as well as the effects of dietary habits on human health. Students will also learn to apply this knowledge in nutritional counseling within pharmaceutical and clinical practice, and will acquire the skills needed to perform laboratory assessments of food quality and safety. Learning Outcomes: Upon successful completion of the course, students will be able to: • Describe the key parameters used to assess quality and safety of different types of food products. • Understand regulatory criteria for food products and dietary supplements. • Perform analytical methods for determining the quality and safety of drinking water and food products. • Analyze and characterize the quality and safety of food products and drinking water. • Understand physicochemical characteristics of macronutrients (carbohydrates, lipids, proteins) and micronutrients (vitamins, minerals). • Explain the role and importance of macro- and micronutrients in physiological and pathophysiological conditions. • Calculate individualized energy and nutrient requirements and prepare appropriate diet plans. • Select food products according to their characteristics and quality for personalized nutrition. • Identify health risks associated with inadequate diet.			

		• Identify risks associated with interactions between food, medicines, and dietary supplements. • Explain the significance and evaluate the benefits and risks of genetically modified foods. • Design and create diet regimens for specific diseases.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter: Introduction to Food and Nutrition Definition, aims, and scope of bromatology; physiological/pathological role of food; classification, and legal regulation of food products; food quality and safety; novel foods; nutrients; principles of balanced nutrition. Learning outcomes: Students will be able to explain both physiological and pathological role of food, apply principles of balanced nutrition in diet planning, and understand the requirements for food quality and safety. Chapter: Energy Requirements Metabolism and energy needs; factors influencing energy expenditure; energy value of macronutrients and foods; calorimetry; energy balance; calculation of energy value of foods and mixed meals; specific dynamic action of food; use of energy and nutrient tables. Learning outcomes: Students will be able to determine individual energy requirements based on sex, age, physical activity and nutritional status, and calculate appropriate dietary intake. Chapter: Food Analysis Analysis of food components; sample preparation; water content and water activity; methods for determining water, ash, fat, protein, and carbohydrates. Learning outcomes: Students will be able to conduct analytical methods for the determination of moisture, ash, fat, protein, and carbohydrate content in food products. Chapter: Drinking Water Water as a food product; quality and safety standards for drinking water; methods for physicochemical and microbiological analyses. Learning outcomes: Students will be able to analyze the quality and safety of drinking water. Chapter: Carbohydrates Definition, classification, and nomenclature of carbohydrates; physicochemical properties; methods for isolation and identification; nutritional and energetic characteristics of mono-, di-, and polysaccharides; glycemic index and its relevance. Learning outcomes: Students will be able to discuss the chemical structures, physicochemical properties, methods of isolation and identification, and nutritional significance of carbohydrates. Chapter: Lipids Definition, classification, and nomenclature of lipids; physicochemical properties; methods for isolation and identification; nutritional and energetic characteristics.

		Learning outcomes: Students will be able to discuss the chemical structures, physicochemical properties, methods of isolation, and nutritional characteristics of lipids. Chapter: Proteins Definition, classification, and nomenclature of proteins; physicochemical properties; methods for isolation and identification; nutritional characteristics. Learning outcomes: Students will be able to discuss the chemical structures, physicochemical properties, methods of isolation and identification, and nutritional role of proteins. Chapter: Food Products Definition, classification, quality and safety of foods; production and preservation methods; regulations and nutritional characteristics of foods of animal origin (milk and dairy products, meat, eggs) and plant origin (cereals, bakery products, fruits, vegetables). Learning outcomes: Students will be able to explain food quality, food safety, and production procedures, and apply this knowledge in design of dietary plans. Chapter: Food Additives Definition, classification, role, and application; justified use and potential health risks. Learning outcomes: Students will be able to recognize food additives, explain their role when added to food, and understand the legal requirements for their use. Chapter: Nutrition in Chronic Diseases Principles of nutrition and diet therapy for the management of chronic diseases, including diabetes, obesity, cardiovascular, renal, hepatic, and digestive disorders, osteoporosis, cancer, malnutrition, allergies, and food intolerances. Learning outcomes: Students will be able to design personalized diet plans tailored to specific chronic diseases. Chapter: Drug–Food Interactions Definition, significance, and classification of drug–food interactions; effects of food on drug pharmacokinetics and pharmacodynamics; potential health risks and strategies for prevention; effects of drugs on nutritional status; principles of nutritional counseling. Learning outcomes: Students will be able to identify the most common drug–food interactions and to mitigate the risks through nutritional counseling. Chapter: Genetically Modified Food Definition, classification, production methods, safety considerations, potential risks and benefits, regulatory frameworks, analytical assessment of genetically modified foods. Learning outcomes: Students will be able to explain the concept as well as potential risks and benefits of genetically modified foods.
13	Interrelation with Other Courses	• Requires prior knowledge from: Pathophysiology (III semester), Biochemistry (IV semester).

		• Knowledge gained is necessary for: Clinical Biochemistry (VIII semester), Toxicology (IX semester), and Clinical Pharmacy and Pharmacotherapy (IX semester).
14	Teaching and Working Methods	Teaching Methods: 1. Lectures 2. Interactive classes (case discussions and problem solving) Working Methods: 1. Laboratory exercises (practical skills) 2. Problem solving (individual/group work to encourage analytical thinking and teamwork)
15	Total Available Contact Hours	180 hours
16	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 45 hours 16.2. Exercises (laboratory/auditory): 45 hours
17	Other Forms of Activities	17.1. Project tasks/seminars: / 17.2. Independent study: theoretical preparation 50 hours, practical preparation 20 hours 17.3. Exam preparation: 20 hours
18	Requirements for Signature	At least 30 points from the planned activities.
19	Assessment Method	19.1. Final exam (if colloquia are not taken): 25–50 points 19.2. Colloquium 1: 13–25 points 19.3. Colloquium 2: 13–25 points 19.4. Practical exam: 6–10 points 19.5. Seminar/project presentation (written and oral): /
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory Literature 1. Zimmerman, M., Snow, B., <i>An Introduction to Nutrition</i>, Creative Common License, 2012 / 1st edition – digital issue. 2. Vaclavik, V.A., Christioan, E.W., <i>Essentials of Food Science</i>, Springer, 2014 / 4th edition – digital issue. 3. Velíšek, J. <i>The Chemistry of Food</i>, Wiley Blackwell, 2014 / 1st edition – digital issue. 4. Roth, R.A., <i>Nutrition & Diet Therapy</i>, Indiana/Purdue University, 2011 / 10th edition – digital issue. 5. Nielsen, S.S., <i>Food Analysis</i>, Springer International Publishing, 2019 / 5th edition – digital issue. Additional Literature 1. Coulston, A.M., Boushey, C.J., Ferruzzi, M.G., Delahanty, L.M., <i>Nutrition in the Prevention and</i>

		<i>Treatment of Disease</i>, Academic Press, 2017 / 4th edition – digital issue. 2. Visakh, P.M., Iturriaga, L.B., Ribotta, P., Thomas, S., <i>Advances in Food Science and Nutrition</i>, Scrinever Publishing, 2014 – digital issue. 3. Varzakas, T., Tzia, C., <i>Handbook of Food Processing Food Safety, Quality and Manufacturing Processes</i>, CRC Press Taylor & Francis Group, 2016 / 1st edition – digital issue.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	CLINICAL BIOCHEMISTRY			
2	Code	FFIPB30			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Applied Biochemistry			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	4	Semester:	VII
7	Workload expressed in ECTS credits	7 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Tatjana Kadifkova Panovska (course coordinator) Prof. Dr. Marija Hiljadnikova Bajro Asst. Prof. Dr. Kristina Shutevska Achevska			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: completed credits in Pathophysiology (III semester) and Biochemistry (IV semester). Examination requirements: compliance with the attendance requirements of this course.			
11	Course Aims (Competencies) and Learning Outcomes	Course Aim: To provide understanding of the biochemical mechanisms involved in the development of diseases, as well as the laboratory tests that contribute to establishing a diagnosis, monitoring disease progression, and evaluating the effectiveness of treatment. Learning Outcomes: Upon completion, students will be able to have acquired solid theoretical knowledge and practical skills, enabling them to apply these competencies through the performance of routine tests commonly used in clinical biochemistry laboratories. They should be able to carry out laboratory calculations, compare obtained results with reference values, and provide a basic interpretation of the laboratory findings.			
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Introduction to Clinical Biochemical Laboratory Analysis Quality control implementation, monitoring, collection and analysis of biological samples. Processing laboratory data and interpreting results. Biochemical markers as indicators of physiological and pathological changes. Impact of pre-analytical factors on the validity of biochemical tests. <i>Learning outcomes:</i> Explain principles of quality control; identify biochemical markers and their role in health/disease assessment; analyze pre-analytical factors affecting test accuracy. Disorders of Carbohydrate Metabolism and Clinical Evaluation Disorders of carbohydrate metabolism. Hormonal regulation (insulin, glucagon, cortisol, adrenaline). Pathophysiological			

	conditions: hypoglycemia, glycosuria, glycogen storage diseases, impaired glucose tolerance. <i>Learning outcomes:</i> Explain disorders of carbohydrate metabolism, describe the mechanisms of hormonal regulation of carbohydrate homeostasis, and analyze pathophysiological conditions associated with impaired carbohydrate metabolism. Proteins and Their Clinical Significance Biochemical properties and structural organization of proteins; protein metabolism: digestion, absorption, and synthesis; methods for protein separation and analysis. Clinical significance of alterations in total protein and protein fractions under pathological conditions: hypoproteinemia, hyperproteinemia, dysproteinemia, proteinuria. <i>Learning outcomes:</i> Explain the structural and functional characteristics of proteins; analyze the processes involved in protein metabolism; interpret alterations in the concentrations of proteins and their fractions in various clinical conditions. Lipid Metabolism and Clinical Application Physiological roles (energy, structure, regulation); digestion, absorption, transport; metabolism of triglycerides, cholesterol, phospholipids under normal and pathological conditions. Dyslipidemia pathophysiology; clinical significance of lipid parameters in diagnosis and cardiovascular risk assessment. <i>Learning outcomes:</i> Explain the processes of lipid digestion, absorption, and transport; analyze lipid metabolism under physiological and pathophysiological conditions; evaluate the clinical relevance of lipid parameters in clinical biochemistry and cardiovascular medicine. Enzymes in Clinical Biochemistry Properties, classification, catalytic roles; principles of measuring enzyme activity in biological fluids. Diagnostic significance of enzymes in organ and tissue injury. Specific markers of hepatic, cardiac, muscle, and pancreatic function: aminotransferases, creatine kinase, lactate dehydrogenase, alkaline phosphatase, γ-glutamyltransferase, amylase, lipase. <i>Learning outcomes:</i> Explain enzyme properties and roles; analyze the methods used for determining enzymatic activity; evaluate the clinical significance of enzyme markers in the assessment of specific organ and tissue injury. Electrolytes and Minerals – Clinical Significance and Regulation Regulation and physiological roles of sodium, potassium, chloride, calcium, phosphate, and magnesium in maintaining osmolality, fluid and electrolyte balance, and acid–base homeostasis. Renal and hormonal mechanisms involved in electrolyte regulation. Clinical significance and laboratory assessment of electrolyte and mineral disorders. <i>Learning outcomes:</i> Explain regulatory mechanisms governing electrolyte and mineral balance; analyze relevant laboratory parameters; interpret electrolyte and mineral disorders.

	Clinical Biochemistry of Iron and Hemoglobin Iron metabolism and regulation; disorders of iron metabolism; laboratory parameters for assessing functional iron status and body iron stores; laboratory findings in iron deficiency and overload. Hemoglobinopathies and tests for detection. <i>Learning outcomes:</i> Discuss disorders of iron metabolism as well as structural and quantitative hemoglobin abnormalities. Therapeutic Drug Monitoring (TDM) and Effects on Biochemical Analyses Basics of TDM: therapeutic ranges and methods for measuring drug concentrations (immunochemical and chromatographic techniques). Effects of drugs on biochemical parameters: in vivo alterations and in vitro interferences; drug-induced false elevated or decreased laboratory values and their impact on the assessment of organ function.. <i>Learning outcomes:</i> Explain TDM principles; identify drug measurement methods; analyze drug effects on biochemical analyses. Function and Clinical Evaluation of Liver and Pancreas Liver functions: metabolic regulation, synthesis, detoxification; biochemical parameters: AST, ALT, GGT, ALP, bilirubin. Pancreatic endocrine and exocrine functions: insulin, glucagon, amylase, lipase. Clinical assessment of pathophysiological conditions: hepatic diseases, pancreatitis, and disorders of insulin regulation. <i>Learning outcomes:</i> Explain functions of liver and pancreas; analyze laboratory markers used to assess their function; interpret pathophysiological changes associated with diseases of these organs. Clinical Aspects of Water Metabolism Disorders of water homeostasis: overhydration, dehydration, hyper-/hypo-osmolality. <i>Learning outcomes:</i> Acquire knowledge of the biochemical mechanisms underlying disturbances in water homeostasis and understand the resulting physiological and clinical consequences. Clinical Biochemistry of Acid–Base Balance Biochemical processes underlying acid–base homeostasis: Henderson–Hasselbalch equation, hydrogen-ion homeostasis mediated by biological buffer systems, and the mechanisms of respiratory and metabolic acidosis and alkalosis.. <i>Learning outcomes:</i> Understand causes of metabolic and respiratory acidosis and alkalosis, their biochemical features, and compensatory mechanisms. Urinalysis and Renal Diseases Biochemical aspects of renal excretory, regulatory, and endocrine functions. Tests for assessing the glomerular membrane function and tubular function (proximal/distal). Causes of urinary calculi. Urine composition changes due to renal or metabolic diseases. <i>Learning outcomes:</i> Understand mechanisms involved in the

		excretion of waste products, the reabsorption of essential molecules, and water handling across different segments of the nephron; perform and interpret laboratory analyses of serum and urine for the diagnosis, monitoring, and management of renal and metabolic disorders. Use of Tumor Markers in the Clinical Laboratory Definition, characteristics, classification, and application of tumor markers in the management of neoplasms, particularly malignancies. <i>Learning outcomes:</i> Understand biochemical nature and properties of the various molecules used in the diagnosis of tumors and in monitoring therapeutic effectiveness.
13	Interrelation with Other Courses	• Requires prior knowledge from: Biochemistry (IV semester), Pathophysiology (III semester). • Knowledge required for: Fundamentals of Clinical Pharmacy (VII semester), Clinical Pharmacy and Pharmacotherapy (IX semester), and Toxicology (IX semester).
14	Teaching and Working Methods	Teaching Methods: 1. Lectures 2. Interactive classes (discussion of tasks, cases, problems) Working Methods: 1. Laboratory exercises (practical skills) 2. Problem solving (individual/group work to foster analytical skills, teamwork, and application of theory)
15	Total Available Contact Hours	210 hours
16	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 45 hours 16.2. Exercises (laboratory/auditory): 45 hours
17	Other Forms of Activities	17.1. Project tasks/seminars: / 17.2. Independent study: theoretical preparation 80 hours; practical preparation 20 hours 17.3. Exam preparation: 20 hours
18	Requirements for Signature	At least 30 points from the planned activities.
19	Assessment Method	19.1. Final exam (if colloquia are not taken): 25–50 points 19.2. Colloquium 1: 13–25 points 19.3. Colloquium 2: 13–25 points 19.4. Practical exam: 6–10 points 19.5. Seminar/project presentation (written & oral): /
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory Literature

		1. Bishop M.L., Fody E.P., Van Siclen C., Mistler J.M., Moy M. <i>Clinical Chemistry: Principles, Procedures, Correlations</i>, 9th Edition, Jones & Bartlett Learning, 2022 (digital issue). 2. Rifai N., Horvath A.R., Wittwer C.T., Tietz N.W. <i>Tietz Textbook of Clinical Chemistry and Molecular Diagnostics</i>, 6th Edition Elsevier – Health Sciences Division, 2017 (digital issue). 3. Burtis C.A., Bruns D.E., Sawyer B.G., Tietz N.W. <i>Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics</i>, 7th Edition, Elsevier/Saunders, 2014 (digital issue). Additional Literature 1. Marshall W.J., Lapsley M., Day A., Ayling R. <i>Clinical Biochemistry: Metabolic and Clinical Aspects</i>, 3rd Edition, Elsevier – Health Sciences Division, 2014 (digital issue). 2. Lieberman A.M., Marks A, <i>Marks' Basic Medical Biochemistry: A Clinical Approach</i>, 4th Edition, Lippincott Williams & Wilkins, 2012 (digital issue). 3. Laposata M. <i>Laboratory Medicine: The Diagnosis of Disease in the Clinical Laboratory</i>, McGraw-Hill Medical Publishing Division, 2010 (hard copy in the Faculty of Medicine library).

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	ADVANCED PHARMACEUTICAL TECHNOLOGY			
2	Code	FFIFT31			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmaceutical Technology			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	4	Semester:	VII
7	Workload expressed in ECTS credits	8 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Katerina Gorachinova (responsible instructor) Prof. Dr. Marija Glavash Dodov Prof. Dr. Maja Simonoska Crcarevska Prof. Dr. Nikola Geshkovski Asst. Prof. Dr. Ljubica Mihailova Asst. Prof. Dr. Dushko Shalabalija Asst. M.Sc. Teodora Tasevska			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: Course signature in Pharmaceutical Technology II; credit in Pharmaceutical Technology I. Examination requirements: Course signature in Advanced Pharmaceutical Technology; credit in Pharmaceutical Technology II.			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: To ensure students understand core concepts and acquire in-depth knowledge of: • Modified-release (MR) dosage forms and drug-targeting systems (nanomedicines), including types, design approaches, development, and technologies for design and manufacture, applying Quality by Design (QbD) and Design of Experiments (DoE) principles. • Application of competencies for mechanistic understanding and rational, patient-oriented design/selection of MR and targeted systems (nanodrugs, colloidal systems) in use as vaccines, radiopharmaceuticals, theranostics, etc., and patient counselling for their use. • Practical skills to select design approaches, formulate and identify componentry, and evaluate manufacturing processes for pharmaceutical dosage forms in line with QbD principles. Expected Competencies / Learning Outcomes: Upon completion, the student will: • Explain advantages, efficacy/safety concepts, and formulation/manufacturing principles of controlled-release systems across routes (peroral/oral, nasal, pulmonary, parenteral).			

		• Explain principles and concepts of site-specific drug delivery using nanomedicines, including barrier overcoming and targeting strategies. • Identify MR dosage forms and nanomedicines for various routes/indications and advise patients on their use. • Discuss MR development concepts (rate modification; prolonged, delayed, continuous action), select formulation/manufacturing approaches, and rational application by indication. • Analyze and discuss barriers to targeting drugs to tissues/organs/pathogens/cells/subcellular sites; evaluate efficiency of targeting with nanosystems; outline uses of radiopharmaceuticals, medical devices, immunopreparations; describe micro/nanosystems in diagnostics, radiotherapy, and immunotherapy, including toxicological aspects of colloidal systems. • Apply theory and practice to solve real-world problems in industry, clinics, or community pharmacy; through interactive learning, design and formulate CDDS (controlled drug delivery systems) per QbD with direct applicability to R&D of modern dosage forms and therapeutic systems.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1. Modified-Release (MR) Drug Delivery Systems Unit 1: Introduction to Modified Release Content: Advantages and specificities of MR dosage forms; polymers for MR therapeutic systems; classification of MR systems; differentiation by physical state, route of administration, and mechanism/kinetics of drug release; determination of release kinetics. Outcomes: Describe, discuss, and apply knowledge on MR advantages, polymer selection, system classification, and release modeling. Unit 2: Delayed-Release Systems Content: Design objectives; properties of drug candidates; design strategies and functioning of delayed-release systems including enteric polymer coatings; time-programmed (chronotherapeutic) and site-specific GI release (e.g., colon-targeted systems) via pH-dependent or time-dependent approaches; pulsatile systems (PORT, Pulsincap, rupture/eroding systems); chemically controlled systems (prodrug/enzymatic cleavage in the GI tract); temperature-responsive systems; individualized dosage forms via 3D printing. Outcomes: Define design aims and strategies; select candidates and approaches; provide patient counselling for use of these systems. Unit 3: Prolonged and Controlled-Release Systems

		Content: Design objectives; candidate properties; plasma concentration–time profiles across designs; characteristics and design of solvent-activated and diffusional matrix/reservoir systems; release kinetics and clinical examples: ophthalmic inserts, subcutaneous/intrauterine implants, oral systems, osmotic pumps, transdermal patches, microneedle patches, microneedle systems for continuous glucose monitoring (e.g., GlucoWatch), iontophoresis, reverse iontophoresis, electro-osmosis/electromigration; MR systems for GI use containing salts of weak acids/bases. Outcomes: Explain designs/kinetics with clinical exemplars; advise patients on correct use. Chapter 2. Drug Targeting Systems (Site-Specific Delivery) Unit 1: Introduction and Fundamentals of Drug Targeting Content: Passive and active targeting concepts with nanotherapeutic systems; identification of potential targets; barriers nanosystems must overcome; biodistribution of drug-loaded nanosystems and benefits of localization (reduced adverse effects, improved effectiveness/safety, increased stability, prolonged action via controlled release); attributes of passive vs active targeting; cellular internalization routes and subcellular targeting. Outcomes: Describe targeting principles, barriers, biodistribution advantages; discuss passive/active strategies and cellular/subcellular targeting. Unit 2: Carriers / Therapeutic Systems for Targeting and Diagnostics Content: Range of nanoparticulate systems—polymeric nanoparticles, micelles, polymer–drug conjugates, lipid nanoparticles (including structured lipids), liposomes, dendrimers; materials and production methods; characterization; assessment of toxicity, safety, and efficacy; QbD/DoE design for passive/active targeting; overview of products in clinical use; nanosystems to enhance vaccine immune responses; nanotechnology in medical devices; protein/peptide/gene therapy via nanosystems with clinical examples; radiopharmaceuticals and theranostics for diagnostics and therapy. Outcomes: Compare nanosystems and production/characterization methods; design per QbD; appraise clinical applications across therapy and diagnostics.
13	Interrelation with Other Courses	1. Requires prior knowledge from: Physical Chemistry, Pharmacology, Pharmaceutical Technology II. 2. Knowledge required for: Industrial Pharmacy, Drug Analysis, and Legislation.
14	Teaching and Working Methods	Teaching Methods: 1. Lectures 2. Interactive classes (discussion of tasks, cases, problems)

		Working Methods: 1. Laboratory exercises (practical skills) 2. Problem solving (individual/group work to foster analytical skills, teamwork, and application of theory) 3. Project work (independent research on a given topic and presentation skills)
15	Total Available Contact Hours	8 ECTS $\times$ 30 hours = 240 hours
16	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 15 weeks $\times$ 3 h/week = 45 hours 16.2. Exercises (laboratory/auditory): 15 weeks $\times$ 3 h/week = 45 hours
17	Other Forms of Activities	17.1. Project tasks/seminars: 16 hours (individual or team research and solution proposals) 17.2. Independent study: theoretical preparation 90 hours; practical preparation 22.5 hours 17.3. Exam preparation: 22.5 hours (review and systematization before the exam)
18	Requirements for Signature	At least 30 points from planned activities.
19	Assessment Method	19.1. Final exam (if colloquia are not taken): 25–50 points 19.2. Colloquium 1: 13–25 points 19.3. Colloquium 2: 13–25 points 19.4. Practical exam: 6–10 points 19.5. Seminar/project – written & oral presentation: 5 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory Literature 1. Kevin M. G. Taylor, Michael E. Aulton, <i>Aulton's Pharmaceutics: The Design and Manufacture of Medicines</i>, 6th ed., Elsevier, 2021 (electronic). 2. Ivone Perrie, Thomas Rades, <i>Pharmaceutics: Drug Delivery and Targeting</i>, Pharmaceutical Press, 2010 (electronic). 3. Loyd V. Allen (ed.), <i>Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems</i>, 11th ed., Lippincott Williams & Wilkins, 2017 (electronic). Additional Literature 1. Alexander T. Florence, Juergen Siepmann, <i>Modern Pharmaceutics: Applications and Advances</i>, 5th ed., Informa Healthcare, 2009 (electronic).

		2. Adeboye Adejare (ed.), <i>Remington: The Science and Practice of Pharmacy</i>, 23rd ed., Elsevier, 2020 (electronic). 3. Relevant papers in international scientific journals.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHARMACoinFORMATICS			
2	Code	FFIFH32			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmaceutical Chemistry			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	4	Semester:	VII
7	Workload expressed in ECTS credits	4 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Zorica Naumovska (course coordinator) Prof. Dr. Zoran Sterjev Asst. Prof. Dr. Aleksandar Dimkovski Asst. Prof. Dr. Evgenija Mihajloska			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: completed (attended) <i>Pharmaceutical Chemistry 3</i> (Semester VI). Examination requirements: passed <i>Fundamentals of Pharmacology</i> (Semester V), <i>Pharmaceutical Chemistry 1</i> (Semester IV) and <i>Pharmaceutical Chemistry 2</i> (Semester VI).			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: To provide foundational knowledge on principles for searching, appraising and using scientific/professional literature, including types and sources of information, search strategies, and critical evaluation. Students will develop skills to use health and life-science databases, to apply evaluated evidence in scientific writing and in answering questions related to evidence-based, rational use of medicines (EBM), clinical guidelines, and correct citation practices. The course also introduces pharmaceutical marketing, health information technologies in daily practice, and the role of pharmacovigilance and post-marketing studies, including drug utilization studies. Expected Learning Outcomes: Upon completion, students will be able to: • Appropriately use databases, retrieve, evaluate and apply relevant scientific literature and written drug information in scientific writing and in solving clinical problems related to evidence-based pharmacy/medicine and rational pharmacotherapy. • Explain the role of pharmacoinformatics and of drug information centers. • Describe the basics of pharmaceutical marketing and health informatics technologies. • Explain the role of pharmacovigilance and post-marketing studies in monitoring medicine use and			

		safety, and outline the practical role of modern digital health tools in everyday pharmacy practice.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: Using Literature and Databases <i>Content:</i> Sources and databases of scientific/professional information in medical, pharmaceutical and natural sciences; classification of information sources (primary, secondary, tertiary); search strategies; critical evaluation and appropriate application of literature. <i>Outcomes:</i> Perform effective search, selection, appraisal and application of literature; present results appropriately and cite sources correctly. Chapter 2: Role of Pharmacoinformatics and Drug Information Centers <i>Content:</i> Fundamentals of pharmacoinformatics and the mission of drug information centers in providing independent, objective and clinically validated drug information based on EBM to support drug therapy and rational use of medicines. <i>Outcomes:</i> Explain the importance and functions of pharmacoinformatics/DI centers in promoting rational pharmacotherapy. Chapter 3: Written Drug Information <i>Content:</i> Role of summaries, internal guidance documents and other written drug information; preparation in line with the current regulatory framework; advantages/limitations versus verbal communication. <i>Outcomes:</i> Prepare patient-oriented written professional information on medicines in accordance with applicable regulatory requirements. Chapter 4: Pharmacoinformatics in Clinical Studies <i>Content:</i> Critical reading of clinical studies; defining hypotheses and study objectives; sampling; outcome measures; interpretation and evaluation of study results; ethical aspects of clinical research. <i>Outcomes:</i> Read, interpret and critically appraise clinical studies and discuss ethical considerations. Chapter 5: Clinical Application of Statistical Analyses <i>Content:</i> Principles of statistical methods used in studies; evaluating suitability of selected statistics for data interpretation. <i>Outcomes:</i> Understand commonly used statistical methods in clinical trials, interpret/present results, evaluate findings and provide a critical perspective. Chapter 6: Health Information Technology <i>Content:</i> e-Prescription, telemedicine, automated dispensing systems, “smart” pharmaceutical packaging, automated infusion dispensing, etc. <i>Outcomes:</i> Demonstrate practical application of health IT solutions in delivering pharmaceutical care. Chapter 7: Evidence-Based Medicine and Clinical Guidelines <i>Content:</i> Principles of EBM for decision-making in pharmaceutical care; application of clinical guidelines (note:

		pharmacodynamic background referenced for context: drug–receptor interactions, post-receptor effects, modifying factors such as dose, aging, comorbidities and co-medication). <i>Outcomes:</i> Apply EBM principles and guidelines in professional decision-making and patient care. Chapter 8: Rational Use of Medicines <i>Content:</i> Concepts and determinants of rational/irrational medicine use; consequences of irrational use; processes and strategies to overcome it; quantitative and qualitative methods of data collection for identifying problems and building interventions. <i>Outcomes:</i> Evaluate medicine use, apply appropriate methods to detect irrational use and design strategies to improve rational use. Chapter 9: Pharmaceutical Marketing <i>Content:</i> Basics of pharmaceutical marketing; the 4Ps; regulatory framework; tasks of a pharmaceutical marketing department; promotion of pharmaceutical products; ethics and codes. <i>Outcomes:</i> Explain specifics of product, price, place/distribution and promotion in the pharma context and relevant regulatory/ethical requirements. Chapter 10: Pharmacovigilance <i>Content:</i> Organization and functioning of PV systems; monitoring medicine safety; off-label use; medication errors; overdose; abuse/misuse; signal detection and management; risk management plans and risk minimization measures; relevant legislation in the EU and Republic of North Macedonia. <i>Outcomes:</i> Identify and report adverse events in clinical trials and post-marketing; implement appropriate risk minimization measures. Chapter 11: Post-Marketing Studies <i>Content:</i> Types, classification and practical application (detecting safety signals; evaluating effectiveness in clinical practice); use of real-world data/evidence, electronic health data, artificial intelligence and digital health tools. <i>Outcomes:</i> Evaluate study types and RWD/RWE to support high-quality pharmaceutical care. Chapter 12: Drug Utilization Studies (Monitoring Medicine Consumption) <i>Content:</i> Basic qualitative and quantitative methods for monitoring medicine consumption. <i>Outcomes:</i> Apply methods for drug utilization monitoring to support rational planning and supply.
13	Interrelation with Other Courses	1. Prior knowledge required from: Pharmacology; Pharmaceutical Chemistry 1, 2 and 3. 2. Knowledge required for: Clinical Pharmacy and Pharmacotherapy; Pharmacogenetics and Pharmacogenomics.

14	Teaching and Working Methods	Teaching Methods: 1. Lectures 2. Interactive classes (discussion of tasks, cases, problems) Working Methods: 1. Laboratory exercises (practical skills) 2. Problem solving (individual/group work fostering analytical skills, teamwork and application of theory) 3. Project work (independent research and presentation skills)
15	Total Available Contact Hours	120 hours
16	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 30 hours 16.2. Exercises (laboratory/auditory): 22.5 hours
17	Other Forms of Activities	17.1. Project tasks/seminars: 7.5 hours 17.2. Independent study: theoretical preparation 30 hours ; practical preparation 15 hours 17.3. Exam preparation: 15 hours
18	Requirements for Signature	40 points (minimum) from planned activities.
19	Assessment Method	19.1. Final exam (if colloquia are not taken): 25–50 points 19.2. Colloquium 1: 13–25 points 19.3. Colloquium 2: 13–25 points 19.4. Practical exam: 6–10 points 19.5. Seminar/project – written & oral presentation: — (<i>not specified</i>)
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory Literature 1. Patrick Malone, Karen Kier, John Stanovich, <i>Drug Information: A Guide for Pharmacists</i>, McGraw-Hill, 2011 (in translation / electronic or hard copy as applicable). 2. Dixon Thomas (ed.), <i>Clinical Pharmacy Education, Practice and Research</i>, Elsevier, 2019. 3. Marie A. Abate, Matthew L. Blommel, <i>Drug Information and Literature Evaluation</i>, 2nd ed., Pharmaceutical Press, 2023. Additional Literature 1. Relevant papers in international scientific journals (from 2020 onward).

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	FUNDAMENTALS OF CLINICAL PHARMACY			
2	Code	FFIFH33			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy Institute of Pharmaceutical Chemistry			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	4	Semester:	VII
7	Workload expressed in ECTS credits	4 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Zoran Sterjev (course coordinator) Prof. Dr. Ljubica Shuturkova Prof. Dr. Aleksandra Kapedanovska Nestorovska Asst. Prof. Dr. Evgenija Mihajloska Asst. Prof. Dr. Aleksandar Dimkovski			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: attended Pharmaceutical Chemistry 3 (Semester VI). Examination requirements: passed Fundamentals of Pharmacology (Semester V), Pharmaceutical Chemistry 1 (Semester IV), and Pharmaceutical Chemistry 2 (Semester VI).			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: To provide core knowledge of systems for medication therapy assessment and management, interpretation of clinical laboratory tests, application of clinical pharmacokinetics and understanding of how pharmacodynamics influence therapeutic outcomes, including principles and practice of therapeutic drug monitoring (TDM)—especially for narrow-therapeutic-index medicines. Students will also learn specifics of pharmacotherapy in special populations (pediatrics, geriatrics, pregnancy and lactation, renal/hepatic impairment), basics of nutrition support in patients with malnutrition, management of disorders of acid–base balance, and foundational knowledge of adverse drug reactions and drug interactions. Expected Learning Outcomes: Upon completion, students will be able to: • Interpret laboratory data relevant for therapy monitoring and predicting potential adverse effects. • Calculate and individualize doses and dosing regimens based on PK/PD considerations. • Manage pharmacotherapy with emphasis on special populations and on diseases that directly affect pharmacotherapy outcomes.			
12	Detailed Course Content by Chapters and Units, with	Chapter: Medication Therapy Assessment and Management (MTM) <i>Content:</i> Core principles of MTM; conducting medication			

Learning Outcomes for Each Chapter	review; proper documentation; developing a medication therapy plan; implementing interventions/referrals; documenting and monitoring outcomes. <i>Outcomes:</i> Apply the five key MTM elements: medication review; medication record; medication action plan; intervention/referral and documentation; follow-up and evaluation of outcomes. Chapter: Interpretation of Clinical Laboratory Tests <i>Content:</i> Clinical significance of laboratory tests for pharmacy practice; measurement and interpretation of vital signs; reference ranges across populations; common causes of abnormal results; factors causing false-negative/false-positive findings; lab data used to monitor disease states. <i>Outcomes:</i> Identify core tests and reference values, explain clinical significance, recognize causes of abnormal/artefactual results, and use lab data in patient care. Chapter: Pharmacokinetics (Clinical Application) <i>Content:</i> PK processes and variability; estimation of PK parameters; analysis of PK data; clinical application; mechanisms/outcomes/prevention of clinically important PK drug–drug interactions. <i>Outcomes:</i> Apply PK principles clinically; analyze PK parameters; select and adjust drug/dose regimens; optimize therapy in children, older adults, patients with obesity, during pregnancy and lactation, and in hepatic/renal impairment. Chapter: Pharmacodynamics <i>Content:</i> Biochemical, physiological and molecular drug effects; drug–receptor interactions; post-receptor effects; chemical interactions; modifying factors (dose, aging, comorbidities, co-medication). <i>Outcomes:</i> Explain the relationship between dose–receptor occupancy–response; types of pharmacological antagonism vs. non-pharmacological antagonism; define and interpret efficacy, selectivity and therapeutic index. Chapter: Therapeutic Drug Monitoring (TDM) <i>Content:</i> Principles of TDM; influence of PK, PD and pharmacogenetics on outcomes; drug classes commonly requiring TDM; analytical methods. <i>Outcomes:</i> Monitor drug concentrations effectively; use lab tests and PK models to evaluate exposure and optimize dosing; apply TDM to prevent adverse effects and manage interactions. Chapter: Pediatric Pharmacotherapy <i>Content:</i> Pharmaceutical care for pediatric patients; management and monitoring of common pediatric conditions; pediatric dose calculations; evidence-based appraisal; PK principles in neonates/children; effective communication with families and the care team. <i>Outcomes:</i> Provide pediatric-specific pharmaceutical care, interpret patient data, identify DRPs (drug-related problems) and develop evidence-based care plans.

	Chapter: Geriatric Pharmacotherapy <i>Content:</i> Role of clinical pharmacists in geriatric care; optimization of therapy for geriatric diseases; comprehensive care planning in complex patients; age-related PK/PD changes. <i>Outcomes:</i> Provide geriatric-specific pharmaceutical care, interpret data, identify DRPs and develop evidence-based plans. Chapter: Nutrition Support in Malnutrition <i>Content:</i> Energy balance; BMR; thermic effect of food; nutrient energy sources; malnutrition (symptoms, causes, risk factors; screening tools); nutritional assessment (clinical/physical, biochemical/hematologic, anthropometry, body composition, dietary assessment); individualized needs; enteral nutrition (indications/contraindications, formulations incl. immunonutrition, monitoring, complications and management); parenteral nutrition (indications/contraindications, formulations, monitoring, complications incl. refeeding syndrome, hyperalimentation, hyperglycemia); transitional feeding; outcome monitoring; patients with special needs. <i>Outcomes:</i> Perform individualized assessment; plan/initiate enteral or parenteral nutrition; identify, prevent and manage complications; monitor outcomes and optimize supportive nutritional treatment. Chapter: Therapy in Pregnancy and Lactation <i>Content:</i> Use of medicines in pregnancy/lactation; risk classifications; physiological changes modifying PK during pregnancy (absorption, protein binding, distribution, elimination); teratogenicity; physiology of lactation and PK factors influencing distribution/metabolism/elimination during lactation. <i>Outcomes:</i> Explain safe use and risk classification, PK changes in pregnancy, teratogenic risks, and PK principles during lactation. Chapter: Therapy in Hepatic and Renal Impairment <i>Content:</i> Impact of renal/hepatic dysfunction on therapeutic outcomes; interpretation of biochemical markers of dysfunction; PK aspects of therapy; outcome monitoring and management. <i>Outcomes:</i> Manage therapy in renal/hepatic impairment, including dose calculations and regimen adjustments; interpret relevant laboratory parameters. Chapter: Treatment of Disorders Due to Acid–Base Imbalance <i>Content:</i> Principles of assessment and management of acid–base disturbances in clinical practice (metabolic/respiratory acidosis and alkalosis) and implications for pharmacotherapy. <i>Outcomes:</i> Identify acid–base disorders and outline pharmacotherapy/monitoring strategies to correct them. Chapter: Drug Interactions <i>Content:</i> Mechanisms; identification, management and monitoring; beneficial vs. harmful and high-risk interactions; clinical relevance; synergism; chemical, physiological and

		pharmacological antagonism. <i>Outcomes:</i> Explain mechanisms and outcomes of interactions and manage therapy where interaction risk exists.
13	Interrelation with Other Courses	1. Prior knowledge required from: Pharmacology; Pharmaceutical Chemistry 1, 2 and 3. 2. Knowledge required for: Clinical Pharmacy and Pharmacotherapy; Pharmacogenetics and Pharmacogenomics.
14	Teaching and Working Methods	Teaching Methods: 1. Lectures 2. Interactive classes (discussion of tasks, cases, problems) Working Methods: 1. Laboratory exercises (practical skills) 2. Problem solving (individual/group work fostering analytical skills, teamwork and application of theory) 3. Project work (independent research and presentation skills)
15	Total Available Contact Hours	120 hours
16	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 30 hours 16.2. Exercises (laboratory/auditory): 22.5 hours
17	Other Forms of Activities	17.1. Project tasks/seminars: 7.5 hours 17.2. Independent study: theoretical preparation 30 hours; practical preparation 15 hours 17.3. Exam preparation: 15 hours
18	Requirements for Signature	40 points (minimum) from planned activities.
19	Assessment Method	19.1. Final exam (if colloquia are not taken): 25–50 points 19.2. Colloquium 1: 13–25 points 19.3. Colloquium 2: 13–25 points 19.4. Practical exam: 6–10 points 19.5. Seminar/project – written & oral presentation: — (<i>not specified</i>)
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory Literature 1. Dixon Thomas, <i>Clinical Pharmacy: Education, Practice and Research</i>, Elsevier, 2018 (electronic edition). 2. Phil Wiffen et al., <i>Oxford Handbook of Clinical Pharmacy</i>, OUP Oxford, 2012 (electronic edition). 3. Karen J. Tietze, <i>Clinical Skills for Pharmacists: A Patient-Focused Approach</i>, Mosby, 2011 (electronic edition).

		Additional Literature 1. Authorized lecture notes, Faculty of Pharmacy – Skopje, UKIM, current year (electronic copy).

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHARMACEUTICAL CARE			
2	Code	FFIFH34			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	4	Semester:	VII
7	Workload expressed in ECTS credits	3 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Aleksandra Kapedanovska Nestorovska, (course coordinator) Prof. Dr. Maja Simonoska Crcarevska Prof. Dr. Zoran Sterjev Prof. Dr. Aleksandra Grozdanova Prof. Dr. Nikola Geshkovski Prof. Dr. Zorica Naumovska Asst. Prof. Dr. Ljubica Mihailova Asst. Prof. Dr. Evgenija Mihajloska			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Credits from Pharmaceutical Technology 1, Social Pharmacy, and Fundamentals of Pharmacology (5th semester), Signatures from Pharmaceutical Technology 2, Dietetics and Dietotherapy, and Phytotherapy Prerequisite for assessment: Credits from: Pharmacology (6th semester), Social Pharmacy (6th semester), Dietetics and Dietotherapy (7th semester)			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: - To enable students to understand the fundamental concept, processes, steps and methods of providing and documenting pharmaceutical care and its importance in improving overall healthcare. - To develop skills for assessing, identifying and organizing pharmaceutical interventions tailored to individual patient needs within drug therapy. Learning Outcomes: Upon successful completion of the course students will be able to: - Apply the acquired knowledge to improve treatment and therapeutic outcomes through communication and collaboration with patients and healthcare professionals. - Identify, classify and define drug-therapy problems and medication errors; assess unmet patient needs related to			

		therapy; apply principles of medication therapy management. • Demonstrate responsibility for patient-related outcomes in therapy and contribute to continuity of multidisciplinary healthcare through safe, effective and appropriate therapy. • Integrate into preventive healthcare systems and promote rational use of medicines.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	GENERAL PART: FOUNDATIONS OF PHARMACEUTICAL CARE Chapter 1: Introduction to Pharmaceutical Care and Its Role in Healthcare Improvement • Definition, aims and principles of pharmaceutical care • Processes and steps in pharmaceutical care • Practical principles and methods of planning, providing and documenting care Learning outcomes: Students will be able to: 1. Define pharmaceutical care, its aims and guiding principles, and distinguish it from other healthcare services. 2. Describe the pharmaceutical care process, including all necessary steps for effective patient care. 3. Apply practical methods in planning, providing and documenting pharmaceutical care to ensure quality and continuity. 4. Recognize the role of the pharmacist within healthcare teams and its impact on treatment outcomes and healthcare quality. Chapter 2: Ethical Aspects in Implementing Pharmaceutical Care • Ethical principles, ethical code, and application in resolving ethical dilemmas • Importance of building therapeutic relationships (pharmacist–patient; pharmacist–physician) Learning outcomes: Students will be able to: 1. Apply ethical principles in everyday practice 2. Explain the significance of the Code of Ethics for Pharmacists and its application 3. Make informed decisions in ethical dilemmas Chapter 3: Drug-Therapy Problems • Principles of classification of problems and errors in treatment and clinical practice • Therapeutic inertia, compliance, adherence and concordance – assessment, identification, risk factors, management and optimization

		Learning outcomes: Students will be able to: 1. Recognize and classify drug-therapy problems, including clinical practice errors 2. Understand the differences between therapeutic inertia, compliance, adherence and concordance 3. Identify risk factors and apply strategies for therapy optimization Chapter 4: Specific Aspects of Dosage Forms in Pharmaceutical Care • Role and influence of dosage forms on therapeutic efficacy and safety • Evaluation of dosage-form characteristics during pharmaceutical care • Selection of appropriate dosage form • Individualization of dosage forms according to patient needs (age, physical condition, comorbidities) • Guidelines for correct use and storage • Risks of improper handling • Innovative technologies and personalized dosage forms Learning outcomes: Students will be able to: 1. Understand the role of dosage forms in ensuring therapeutic efficacy and safety 2. Select appropriate dosage forms based on patient characteristics 3. Adjust dosage forms when necessary 4. Provide instructions for proper use and storage 5. Apply strategies to reduce risks of improper handling 6. Recommend and apply innovative, patient-oriented dosage technologies Chapter 5: Quality Assessment in Pharmaceutical Care, Research and Innovation • Methods for assessing quality of pharmaceutical care • Application of research for service improvement • New strategies and advanced methods in pharmaceutical practice Learning outcomes: Students will be able to: 1. Assess pharmaceutical-care quality through defined criteria 2. Conduct research and analyze data 3. Develop and implement innovative approaches in practice

		SPECIAL PART: DEVELOPMENT AND DOCUMENTATION OF PHARMACEUTICAL CARE PLANS Chapter 6: Pharmaceutical Care in Multimorbid Patients • Challenges and barriers in care provision • Adverse drug reactions related to prescribing errors (iatrogenic) • Principles of therapy management in polypharmacy • Guidelines and tools (Beers, START/STOPP, PRISMA) Learning outcomes: Students will be able to: 1. Identify challenges in providing care to multimorbid patients and recognize iatrogenic risks 2. Apply principles and tools for therapy rationalization in polypharmacy Chapter 7: Therapy of Cardiometabolic and Endocrine Diseases – Part 1 (Hypertension, Angina Pectoris, Heart Failure, ACS, Myocardial Infarction) Learning outcomes: 1. Identify key therapeutic principles 2. Choose appropriate dosage forms 3. Provide instructions for use, handling and storage for safe and effective therapy Chapter 8: Therapy of Cardiometabolic and Endocrine Diseases – Part 2 (Dyslipidemia, Diabetes, Coagulation Disorders) Learning outcomes: 1. Select suitable dosage forms 2. Apply safe and effective administration techniques 3. Understand the impact of handling and storage on therapeutic efficacy Chapter 9: Therapy of Pulmonary Diseases (Asthma, COPD) Learning outcomes: 1. Identify optimal dosage forms (e.g., inhalation systems) 2. Provide recommendations for correct administration and storage 3. Evaluate therapy safety and efficacy Chapter 10: Therapy of Neurological and Psychiatric Disorders

		(Dementia, Epilepsy, Depression, Parkinson's disease, Bipolar disorders, Schizophrenia) Learning outcomes: 1. Identify suitable dosage forms 2. Provide guidance on proper use and storage 3. Understand the impact of therapy on patient outcomes Chapter 11: Management of Self-Medication and OTC Therapy (GI disorders, urogenital disorders, dermatological conditions, fever, pain) Learning outcomes: 1. Assess problems and select appropriate OTC dosage forms 2. Provide correct instructions for OTC administration, handling and storage Chapter 12: Pharmaceutical Care in Health Promotion (Vaccination, smoking cessation, healthy nutrition) Learning outcomes: 1. Apply pharmaceutical-care principles in preventive health services
13	Interrelation with Other Courses	1. Prior knowledge from Pharmaceutical Technology 1 & 2, Basic Pharmacology, Bromatology and Social Pharmacy is required. 2. Knowledge acquired in this course is necessary for advanced subjects in higher semesters.
14	Teaching and Working Methods	Teaching Methods: • Lectures • Interactive sessions (case discussions, problem-based learning) Working Methods: • Laboratory exercises (practical skills) • Problem solving (individual/group work) • Project work (research and presentation of a selected topic)
15	Total Available Contact Hours	90 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 30 hours 16.2. Exercises (laboratory, auditory): /
17.	Other Forms of Activities	17.1. Project work / seminar: 30 hours 17.2. Independent learning: Preparation for theoretical teaching: 15 hours Preparation for practical teaching: /

		17.3. Examination preparation: 15 hours
18.	Requirements for Course Signature	At least 30 points from the prescribed activities (16.1, 17.1).
19	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: C1 13-25 points and C2 13-25 points 19.3. Practical exam: / 19.4. Written/oral presentation or project: 6–10 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Authorized lectures, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy – Skopje; Ss. Cyril and Methodius University in Skopje, Faculty of Medicine – Skopje, Current year // electronic copy 2. F. Alves da Costa, J.W.F. van Mil, A. Alvarez-Risco. The Pharmacist Guide to Implementing Pharmaceutical Care, Springer, New York, 2018. Additional: 1. Karen Lynn Whalen. Medication Therapy Management, Second Edition. McGraw Hill LLC, 2018. 2. Paul Rutter, Community Pharmacy - E-BOOK Symptoms, Diagnosis and Treatment 6th edition, Elsevier, 2024. 3. Ardalan Mirzaei, Claudia Rijcken, Pharmaceutical Care in Digital Revolution, Academic Press, 2023.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	CLINICAL PHARMACY AND PHARMACOTHERAPY			
2	Code	FFIFH35			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	4	Semester:	VIII
7	Workload expressed in ECTS credits	8 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Aleksandra Kapedanovska Nestorovska (course coordinator) Prof. Dr. Ljubica Shuturkova Prof. Dr. Zoran Sterjev Prof. Dr. Aleksandra Grozdanova Prof. Dr. Zorica Naumovska Asst. Prof. Dr. Evgenija Mihajloska			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Credits from Pathology and Pathophysiology (3 semester), Microbiology (3 semester), Pharmaceutical Chemistry 3 (6th semester), Signatures from Clinical Biochemistry, Fundamentals of Clinical Pharmacy, Pharmaceutical Care, Pharmacoinformatics (all from 7th semester) Prerequisite for assessment: Credits from: Clinical Biochemistry, Fundamentals of Clinical Pharmacy, Pharmaceutical Care, Pharmacoinformatics (all from VII semester)			
11	Course Aims (Competencies) and Learning Outcomes	Course aim: The aim of the course is for students to acquire/develop understanding of: - the key concepts of the pathophysiological approach in defining patient-individualized pharmacotherapy - the integration of evidence-based medicine and pharmacy in optimizing patient-specific therapeutic outcomes - critical thinking in providing high-quality clinical pharmaceutical care Students will be able to apply the acquired knowledge in direct patient care and, as part of a multidisciplinary healthcare team, to assume responsibility in decision-making that ensures effective, safe and cost-effective pharmacotherapy.			

		Learning outcomes: Upon completion of the course, students will be able to responsibly provide medication therapy aimed at achieving patient-individualized therapeutic outcomes that improve quality of life, including treatment, control and alleviation of symptoms, as well as prevention or slowing of disease progression through timely identification of potential or actual drug-therapy problems, their management, and prevention.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: Pharmacotherapy of Cardiovascular Diseases • Fundamentals of clinical presentation and assessment of CVD; treatment protocols and individualized therapeutic approach to: 1. Arterial hypertension 2. Hypertensive crisis and urgency 3. Ischemic heart disease 4. Hyperlipidemia, dyslipidemia, atherosclerosis 5. Acute coronary syndrome 6. Chronic stable angina 7. Arrhythmias 8. Venous thromboembolism 9. Cerebrovascular conditions – transient ischemic attack, ischemic and hemorrhagic stroke 10. Peripheral vascular disease 11. Shock (hemorrhagic, hypovolemic) Chapter 2: Pharmacotherapy of Respiratory Diseases • Fundamentals of clinical presentation and assessment – pulmonary function testing and clinical presentation; individualized therapeutic approach to: 1. Asthma 2. Chronic obstructive pulmonary disease 3. Drug-induced pulmonary disease 4. Cystic fibrosis Chapter 3: Pharmacotherapy of Gastrointestinal Diseases • Fundamentals of clinical presentation and assessment – evaluation of upper and lower GI tract function; individualized therapeutic approach to: 1. Gastroesophageal reflux disease 2. Peptic ulcer 3. Inflammatory bowel disease 4. Cirrhosis 5. Drug-induced liver disease 6. Pancreatitis Chapter 4: Pharmacotherapy of Neurological Diseases • Fundamentals of clinical presentation and assessment; individualized therapeutic approach to:

		1. Multiple sclerosis 2. Parkinson's disease 3. Convulsive disorders – epilepsy and status epilepticus 4. Dementia 5. Migraine Chapter 5: Pharmacotherapy of Psychiatric Disorders • Fundamentals of clinical presentation and assessment; individualized therapeutic approach to: 1. Anxiety disorders 2. Sleep disorders 3. Schizophrenia 4. Major depressive disorder 5. Bipolar disorder 6. Attention-deficit/hyperactivity disorder Chapter 6: Pharmacotherapy of Endocrine and Metabolic Disorders • Fundamentals of clinical presentation and assessment; individualized therapeutic approach to: 1. Thyroid disorders – hypothyroidism, hyperthyroidism, drug-induced thyroid disease 2. Diabetes mellitus – type 1, type 2, diabetic ketoacidosis, drug-induced disturbances in glucose homeostasis 3. Obesity Chapter 7: Pharmacotherapy of Gynecological and Urogenital Disorders • Fundamentals of clinical presentation and assessment; individualized therapeutic approach to: 1. Menstrual cycle disorders – PMS, PMDD, menopause 2. Endometriosis 3. Contraception 4. Benign prostatic hyperplasia 5. Erectile dysfunction 6. Urinary incontinence Chapter 8: Pharmacotherapy of Infectious Diseases • Fundamentals of clinical presentation and assessment; individualized therapeutic approach to infections of: 1. Central nervous system 2. Infective endocarditis 3. Lower and upper respiratory tract 4. Skin and soft tissues 5. Tuberculosis 6. Gastrointestinal tract 7. Parasitic and fungal infections 8. Immunocompromised patients

		9. Sexually transmitted infections 10. HIV 11. Viral infections Chapter 9: Pharmacotherapy of Renal Diseases • Fundamentals of clinical presentation and assessment of renal function; individualized therapeutic approach to: 1. Acute kidney injury 2. Chronic kidney disease 3. Dialysis 4. Drug-induced kidney disease 5. Disease-modified pharmacokinetics and pharmacodynamics of specific drugs and effects of renal disease on drug metabolism Chapter 10: Pharmacotherapy of Dermatological Diseases • Fundamentals of clinical presentation and assessment; individualized therapeutic approach to: 1. Acne vulgaris 2. Psoriasis 3. Atopic dermatitis 4. Drug-induced dermatological conditions Chapter 11: Pharmacotherapy of Rheumatologic Diseases • Fundamentals of clinical presentation and assessment; individualized therapeutic approach to: 1. Osteoarthritis 2. Rheumatoid arthritis 3. Gout and hyperuricemia 4. Selected connective tissue disorders – fibromyalgia, systemic lupus erythematosus Chapter 12: Pharmacotherapy of Neoplastic Diseases • Treatment protocols, individualized therapeutic approach and adverse effects of chemotherapy in: 1. Solid tumors (lung, breast, colorectal cancer) 2. Hematological malignancies (leukemia, multiple myeloma, lymphoma) Learning Outcomes Related to Chapters 1–12: Students will be able to describe the basic characteristics of clinical manifestation and the clinical evaluation process of the diseases. Students will be able to identify and analyze patient-specific drug-therapy problems. Students will be able to define the desired patient-specific therapeutic outcome and, accordingly, propose therapeutic alternatives, design and recommend an optimal pharmaceutical care plan, and propose a plan for follow-

		up and evaluation of outcomes of the clinical-pharmaceutical intervention.
13	Interrelation with Other Courses	1. Prior knowledge from: Pathology and Pathophysiology, Pharmaceutical Chemistry 1, 2 and 3, Microbiology, Clinical Biochemistry, Fundamentals of Clinical Pharmacy, Pharmaceutical Care, Pharmacoinformatic are necessary and related to this course. 2. The knowledge from this course is necessary for following the content of Pharmacogenetics and Pharmacogenomics, Pharmacoeconomics, and Pharmacoepidemiology.
14	Teaching and Working Methods	Teaching Methods: • Lectures • Interactive sessions (case discussions, problem-based learning) Working Methods: • Problem-solving (students work independently or in groups to solve specific problems to stimulate research and analytical skills, teamwork, and application of theoretical knowledge) • Project work (preparation of a project involving research on a given topic aimed at developing independent research abilities and presentation skills)
15	Total Available Contact Hours	240 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 75 hours 16.2. Exercises (laboratory, auditory): 45 hours
17.	Other Forms of Activities	17.1. Project work / seminar: 7.5 hours 17.2. Independent learning: Preparation for theoretical teaching: 75 hours Preparation for practical teaching: 22.5 hours 17.3. Examination preparation: 15 hours
18.	Requirements for Course Signature	At least 30 points from the prescribed activities (16.1, 16.2, 17.1).
19	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: C1 13-25 points C2 13-25 points 19.3. Practical exam: 6–10 points 19.4. Written/oral presentation or project: /
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)

21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Joseph T. DiPiro, Gary C. Yee, L. Michael Posey, Stuart T. Haines, Thomas D. Nolin, Vicki Ellingrod. Pharmacotherapy: A Pathophysiologic Approach, 11th edition, McGraw Hill, 2020, 11th edition. Additional: 1. Authorized lectures, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy – Skopje; Ss. Cyril and Methodius University in Skopje, Faculty of Medicine – Skopje, Current year / electronic copy 2. Official Guidelines and Recommendations for the Treatment of Specific Diseases, International professional associations and expert organizations, Current year / latest edition / electronic copy

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	BIOPHARMACY			
2	Code	FFIFT36			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	4	Semester:	VIII
7	Workload expressed in ECTS credits	7 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Katerina Gorachinova (course coordinator) Prof. Dr. Kristina Mladenovska Prof. Dr. Nikola Geshkovski Asst. Prof. Dr. Ljubica Mihailova Asst. M.Sc. Teodora Tasevska			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Credits from Pharmaceutical Technology I. Signatures from Pharmaceutical Technology II and Advanced Pharmaceutical Technology Prerequisite for assessment: Credits from: Pharmaceutical Technology I, Anatomy and Physiology, Fundamentals of Pharmacology, Pharmaceutical Technology II Signature obtained in: Advanced Pharmaceutical Technology			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: Biopharmacy is a multidisciplinary course aiming to explain the relationships between drug design, in vivo behavior, and therapeutic effectiveness. Primary course aims: - To help students understand and apply basic concepts of biopharmacy and pharmacokinetics in drug design and clinical therapy - To develop students' ability to analyze and solve problems related to bioavailability, safety, and efficacy during the design of pharmaceutical dosage forms (PDFs) and selection of manufacturing processes—both for conventional and for advanced therapeutic systems - To enhance the ability to analyze and resolve clinical therapy problems through understanding biopharmaceutical aspects of drug substances and medicinal products Learning Outcomes:			

		1. Describe and apply different pharmacokinetic models 2. Apply pharmacokinetic parameters to predict the safety and efficacy of therapy 3. Use pharmacokinetic parameters in designing safe and effective medicinal products 4. Identify how physiological, physicochemical, pharmaceutical-technological, and dosage form factors influence bioavailability across different administration routes 5. Predict the behavior of weak acids and bases and their salts in the GIT, pH-dependent solubility changes, precipitation, and bioavailability issues, and propose solutions 6. Determine absolute and relative bioavailability using plasma and urine data 7. Assess, discuss, evaluate, and apply concepts related to bioavailability and bioequivalence in professional practice; distinguish average, population, and individual bioequivalence 8. Understand the Biopharmaceutical Classification System (BCS) and apply it in the design of safe and effective PDFs 9. Select and perform different in vitro or in situ permeability tests and assess other biopharmaceutical characteristics 10. Explain and apply the concept of in vitro–in vivo correlation (IVIVC) for different dosage forms 11. Propose rational drug design based on the biopharmaceutical profile 12. Recognize and discuss factors influencing pharmacokinetic variability (genetics, age, sex, body weight, disease, drug–drug and drug–food interactions, etc.).
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: Pharmacokinetics, Pharmacokinetic Models, and Approaches to Designing Pharmacokinetic Drug Profiles Students will acquire knowledge and will be able to describe, discuss, and apply: • One-compartment and multi-compartment pharmacokinetic models and drug distribution • Calculation of pharmacokinetic parameters for IV bolus, single and multiple dosing, and IV infusion • Calculation of infusion rates to achieve steady state • Dose adjustment in renal or hepatic impairment • Application of pharmacokinetics in clinical cases • Identification and verification of problems arising from nonlinear pharmacokinetics • Pharmacokinetics of oral absorption and calculation of key parameters for single and multiple oral dosing

		- Pharmaceutical-technological approaches for modifying pharmacokinetic profiles ("modulation" of PK parameters) Chapter 2: Biopharmaceutical Factors in the Design of Dosage Forms and Modified / Targeted Delivery Systems Students will acquire knowledge and be able to describe, discuss, and apply: - Assessment of biopharmaceutical aspects contributing to drug quality—safety and therapeutic efficacy - Calculation and application of mean, individual, and population bioequivalence - Calculation and use of nonparametric numbers of the BCS - GI absorption barriers and physiological absorption factors - Calculation of minimal absorbed dose according to the Developability Classification System (DCS) - Analysis and synthesis of physicochemical, pharmaceutical-technological, and biopharmaceutical factors in developing a biopharmaceutical profile - Application of the biopharmaceutical profile for decision-making in designing safe and effective medicinal products - Bioavailability limited by dissolution rate, permeability, and/or equilibrium solubility, and approaches to designing bioequivalent medicines - Prediction and calculation of salt disproportionation in vitro and in vivo and inclusion of these findings in dosage form design - Rational approaches in designing BCS II and BCS IV drug products with high dose numbers and the use of excipients appropriate for each BCS class - Strategies for designing BCS III drug substances and resolving permeability challenges - Calculation of in vitro–in vivo correlation and selection of an in vivo-relevant dissolution method - Selection of dosage form type based on biopharmaceutical and physiological absorption characteristics Chapter 3: Physiological Biopharmacy Students will acquire knowledge and be able to describe, discuss, and apply: - Physiological and pharmacokinetic aspects in designing IV, IM, SC conventional forms and advanced colloidal therapeutic systems

		- Blood–brain barrier transport mechanisms for colloidal systems and formulation approaches to enhance CNS penetration - Transdermal delivery: factors influencing skin permeation, permeation enhancers, colloidal systems, iontophoresis, sonophoresis, and electroporation - Physiological factors affecting nasal administration, pharmacokinetics, and nasal delivery systems - Pulmonary administration: physiological considerations, design of efficient and safe conventional and advanced dosage forms, PK of inhaled systems - Ophthalmic administration: from physiological factors to effective therapeutic systems; distribution, scleral and conjunctival penetration; formulation approaches for modern colloidal delivery systems
13	Interrelation with Other Courses	- Prior knowledge from Pharmaceutical Technology 1 & 2, Basic Pharmacology, Bromatology and Social Pharmacy are required. - Knowledge acquired in this course is necessary for advanced subjects in higher semesters.
14	Teaching and Working Methods	Teaching Methods: - Lectures - Interactive sessions (case discussions, problem-based learning) Working Methods: - Laboratory exercises (practical skills) - Problem solving (individual/group work) - Project work (research and presentation of a selected topic)
15	Total Available Contact Hours	90 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 30 hours 16.2. Exercises (laboratory, auditory): /
17.	Other Forms of Activities	17.1. Project work / seminar: 30 hours 17.2. Independent learning: Preparation for theoretical teaching: 15 hours Preparation for practical teaching: / 17.3. Examination preparation: 15 hours
18.	Requirements for Course Signature	At least 30 points from the prescribed activities (16.1, 17.1).
19	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: C1 13-25 points C2 13-25 points 19.3. Practical exam: / 19.4. Written/oral presentation or project: 6–10 points

20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 3. Authorized lectures, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy – Skopje; Ss. Cyril and Methodius University in Skopje, Faculty of Medicine – Skopje, Current year // electronic copy 4. F. Alves da Costa, J.W.F. van Mil, A. Alvarez-Risco. The Pharmacist Guide to Implementing Pharmaceutical Care, Springer, New York, 2018. Additional: 4. Karen Lynn Whalen. Medication Therapy Management, Second Edition. McGraw Hill LLC, 2018. 5. Paul Rutter, Community Pharmacy - E-BOOK Symptoms, Diagnosis and Treatment 6th edition, Elsevier, 2024. 6. Ardalan Mirzaei, Claudia Rijcken, Pharmaceutical Care in Digital Revolution, Academic Press, 2023.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHARMACEUTICAL BIOTECHNOLOGY			
2	Code	FFIFT37			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	4	Semester:	VIII
7	Workload expressed in ECTS credits	3 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Renata Slaveska Raicki (course coordinator) Asst. Prof. Dr. Dushko Shalabalija Asst. M.Sc. Teodora Tasevska			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Credits from: Pharmaceutical Technology I (V semester), Pharmaceutical Technology II (VI semester), Advanced Pharmaceutical Technology (VII semester). Prerequisite for assessment: Signature from Pharmaceutical Biotechnology (VIII semester)			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: The aim of the course is for students to acquire active and lasting knowledge of modern technologies and methods applied in all phases of development and production of effective and safe biotechnological medicines and therapeutic products, encompassing complex, integrated key concepts, specific processes, and methods in the fast-growing biopharmaceutical industry. An additional educational aim is to familiarize students with current global regulatory frameworks and guidelines across the spectrum of pharmaceutical biotechnology, as well as with the need for introducing new regulations to keep pace with rapid developments in this field. Furthermore, students will gain interdisciplinary competencies necessary for working in teams engaged in biotechnological research focused on products and processes in pharmaceutical biotechnology and pharmacy. Learning Outcomes: Upon successful completion of the course, students will be able to: 1. Interpret scientific principles and concepts of biotechnology applied in the development of products of pharmaceutical interest			

		- Interpret advanced biotechnological concepts necessary for the development of new biotechnological medicines - Resolve problems and challenges related to the manufacture of biotechnological medicines in accordance with Good Manufacturing Practice (GMP) principles and regulatory requirements - Resolve problems and challenges related to purification and selected elements of characterization of biotechnological products intended for therapeutic use - Competently participate in the work of interdisciplinary teams dedicated to research, development, and production of biotechnological medicines, therapeutic products and certain advanced therapy products
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter: Key Scientific Aspects in the Field of Pharmaceutical Biotechnology and Biotechnological Medicines Brief overview of public health priorities, development trends and impact of pharmaceutical biotechnology as a health and scientific discipline within pharmacy; biotechnological medicines and the significant role of the rapidly growing biopharmaceutical industry; applied concepts, technologies, and methods in the selection, design and production of recombinant therapeutic proteins: creation and selection of production systems/hosts for expression; obtaining synthetic DNA; alternative sources for cloned DNA sequences; transfection into production systems/host cells for the purpose of obtaining recombinant therapeutic proteins; RNA- and DNA-based therapeutic molecules; aspects of isolation and purification of recombinant therapeutic proteins from production systems; ethical principles and dilemmas across the spectrum of pharmaceutical biotechnology. Learning outcomes: Students will acquire knowledge about: - Practical application of molecular biotechnology for pharmaceutical purposes - Concepts for in vitro production of therapeutic proteins, including proteins with fully human sequence and structure, which has enabled the rapid growth of biotechnological medicines Chapter: Production and Purification of Biotechnological Products Intended for Therapeutic Use Key aspects of production (upstream) and purification (downstream) of biotechnological products for therapeutic

		use; approaches to selecting expression systems for recombinant proteins of therapeutic interest, with comparative overview; cell banks, systems and media for cultivation; basic purification processes and unit operations; drafting and interpretation of manufacturing flowcharts; single-use systems and technologies; potential sources of contaminants and their importance in biotechnological products for therapeutic purposes; Good Manufacturing Practice (GMP), principles of quality assurance by design for obtaining safe and effective biotechnological products of therapeutic interest, with an overview of core global regulatory requirements (EMA, FDA). Learning outcomes: Students will acquire knowledge about: 1. Typical activities, technologies, processes and methods employed in obtaining biotechnological products of therapeutic interest (from laboratory to industrial scale) 2. Challenges related to production, purification and selected elements of characterization of biotechnological products for therapeutic use, including interpretation of regulatory requirements Chapter: Formulation Aspects of Biotechnological Medicines Overview of key, characteristic and specific aspects of development and rational design of effective and safe biotechnological medicines according to the target product quality profile; challenges and questions inherent to development depending on the predominant and alternative routes of administration; chemical modifications aimed at improving properties of protein molecules for obtaining biotechnological medicines; approaches to the selection of excipients from different categories and with various functions, illustrated by examples of approved biotechnological medicines on the market; concept of biosimilar development and manufacture; packaging and approaches to selecting primary packaging materials, cartridges and other modern systems; principles of proper handling. Learning outcomes: Students will acquire knowledge about: 1. Successful formulation of effective, stable and safe biotechnological medicines in line with the target product quality profile 2. The importance of comprehensive understanding of physical and chemical characterization of the therapeutic molecule in biotechnological medicines

		- Approaches to the selection of excipients for optimal formulation of biotechnological medicines - Addressing development challenges and risk management specific to biotechnological medicines - Materials and contemporary systems used for packaging biotechnological medicines Chapter: Transgenic Animals and Plants, Genetically Modified Cells and Tissues in the Development and Production of Therapeutic Molecules Application of recombinant DNA and omics technologies, as well as genome editing tools, to obtain genetically modified species for potential commercial applications; special focus on the discovery and generation of new therapeutic molecules; the concept of “biofarms”; organoids and 3D cell cultures as new tools of biotechnology and their application in the development process of biotechnological medicines; introduction to “on-a-chip” technologies. Learning outcomes: Students will acquire knowledge about: - Competitive, innovative and superior approaches and processes in pharmaceutical biotechnology for obtaining new therapeutic agents with direct impact on pharmaceutical science, medicine and pharmaceutical care Chapter: Technologies Used in the Production of Advanced Therapy Medicinal Products (ATMPs) Technologies employed in the production of advanced therapy products and key factors for a successful manufacturing process; classification of products according to EU regulatory concepts and other bases; comparative analysis of similarities and differences between advanced therapy products, recombinant proteins, and other biotechnological medicines; categorization of stem cells; technologies and methods for stem cells, induced pluripotent stem cells; technologies and products for gene therapy (ex vivo vs. in vivo); production of viral vectors; non-biological methods; examples of formulations and excipients used in approved advanced therapy products; regulation of advanced therapy products and overview of approved products through case studies. Learning outcomes: - Students will acquire knowledge about: - Modern platforms for the production of advanced therapy medicinal products

		3. Global regulatory aspects and identification of the need for new regulatory approaches.
13	Interrelation with Other Courses	1. Prior knowledge from: Molecular and Cell Biology and Genetics (I semester), Microbiology (III semester), Pharmaceutical Technology (V and VI semester) is required. 2. Knowledge acquired from this course is required as prior knowledge for: Industrial Pharmacy, Pharmacogenetics and Pharmacogenomics.
14	Teaching and Working Methods	Teaching Methods: • Lectures • Interactive sessions (case discussions, problem-based learning) Working Methods: • Problem solving (individual/group work) • Project work (research and presentation of a selected topic)
15	Total Available Contact Hours	90 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 15 hours 16.2. Exercises (laboratory, auditory): /
17.	Other Forms of Activities	17.1. Project work / seminar: 30 hours 17.2. Independent learning: Preparation for theoretical teaching: 15 hours Preparation for practical teaching: / 17.3. Examination preparation: 15 hours
18.	Requirements for Course Signature	At least 30 points from the prescribed activities (16.1, 17.1).
19	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: C1 13-25 points and C2 13-25 points 19.3. Practical exam: / 19.4. seminar work, written/oral presentation or project: 10 + 12 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Dan J.A. Crommelin, Robert D. Sindelar, Bernd Meibohm. Pharmaceutical Biotechnology: Fundamentals and Applications (Macedonian

		translation) ISBN: 978-608-247-875-3. Ars Lamina. 2017, hard copy. 2. Ansel M., Popovich N., Allen L. Pharmaceutical Dosage Forms and Drug Delivery Systems, 8th ed. Williams & Wilkins. 2004, electronic edition. 3. Aulton M. Pharmaceutics: The Science of Dosage Form Design, 2nd ed. Churchill Livingstone. 2002, electronic edition. 4. Remington: The Science and Practice of Pharmacy, 21st ed. Mack Publishing Co. 2005, electronic edition. 5. European Pharmacopoeia 11. Electronic edition. Additional: 1. Relevant papers in international scientific journals. Electronic edition. 2. EMA and FDA official websites.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHARMACOECONOMICS AND PHARMACOEPIDEMIOLGY			
2	Code	FFIFH38			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	4	Semester:	VIII
7	Workload expressed in ECTS credits	4 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Zoran Sterjev (course coordinator) Prof. Dr. Ljubica Shuturkova Prof. Dr. Aleksandra Grozdanova Prof. Dr. Aleksandra Kapedanovska Nestorovska Asst. Prof. Dr. Evgenija Mihajlovska Asst. Prof. Dr. Aleksandar Dimkovski			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Credits from: Mathematics and Applied Statistics in Pharmacy (I semester), Fundamentals of Pharmacology (V semester), Fundamentals of Clinical Pharmacy (VII semester), Pharmacoinformatics (VII semester) Prerequisite for assessment: Credits from: Mathematics and Applied Statistics in Pharmacy (I semester)			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: The aim of the course is to provide specific knowledge in pharmaco-economic and pharmaco-epidemiological studies and analyses, their modelling and implementation, interpretation of their results, and formulation of expert opinions based on these results, in order to improve public health and the performance of health care systems. Learning Outcomes: Upon successful completion of the course students will be able to: • Different types of pharmaco-economic and pharmaco-epidemiological studies • Methods for calculating costs within pharmaco-economic studies • Methods for identifying different types of outcomes (clinical, humanistic, and economic) required to conduct pharmaco-economic studies			

		Practical application of the results of pharmacoeconomic studies and evaluation of such studies
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter: Assessment and Management of Drug Therapy Chapter: Introduction to Pharmacoeconomics History, need for and importance of pharmacoeconomics; pharmacoeconomic terms and definitions; application of pharmacoeconomics within health care systems. Learning outcomes: - Students will acquire knowledge about: - Basic terms, definitions and concepts in pharmacoeconomics - The importance of pharmacoeconomics for improving the performance of health care systems - Practical application of pharmacoeconomics within the health care system Chapter: Costs and Outcomes Types of costs in pharmacoeconomic studies (direct, indirect, and intangible costs); methods for calculating costs; types of outcomes in pharmacoeconomic analyses (clinical, economic, and humanistic), and methods of obtaining outcomes. Learning outcomes: - Students will acquire fundamental knowledge about: - Types of costs and outcomes required to conduct a pharmacoeconomic study - Methods for calculating and quantifying these costs and outcomes Chapter: Basic Pharmacoeconomic Studies Cost-minimization analysis (CMA), cost-benefit analysis (CBA), cost-effectiveness analysis (CEA), and cost-utility analysis (CUA). Learning outcomes: Students will acquire knowledge about: - Basic pharmacoeconomic analyses and their input and output parameters - Interpretation of results from these analyses - Methods for performing basic pharmacoeconomic analyses - The significance and applicability of these analyses in decision-making in health care Chapter: Modelling of Pharmacoeconomic Analyses

		Decision analysis; decision trees; Markov models; evidence-based models; Monte Carlo simulation. Learning outcomes: Students will acquire knowledge about: 1. Formal and rational approaches to decision-making that allow key structural and input assumptions to be transparent and explicit 2. Methodologically transparent structures used to determine the costs of therapy for a given disease and the cost-effectiveness of alternative therapies 3. Application of analytical and visual models in pharmacoeconomics. Chapter: Budget Impact Analysis and Cost-of-Illness Studies Budget impact analysis (BIA) and cost-of-illness studies. Learning outcomes: Students will acquire basic knowledge about: 1. Budget impact analysis (BIA) as an essential tool for budget and resource planning and as a basis for decision-making by health care payers 2. Cost-of-illness studies, which determine the overall economic impact of a disease or health condition on society Chapter: Adoption and Adaptation of New Health Technologies Research that examines the short-term and long-term consequences of adopting, adapting, and implementing a health technology within a health care system. Learning outcomes: Students will acquire knowledge about: 1. The systematic process of adoption and adaptation of new health technologies in a health care system Chapter: Introduction to Pharmacoepidemiology Pharmacoepidemiology as a scientific discipline; principles of pharmacoepidemiology; monitoring the use and effects of medicines in large populations; basic pharmacoepidemiological study designs; methods for designing pharmacoepidemiological studies; data sources for pharmacoepidemiological research; sample size considerations for pharmacoepidemiological studies. Learning outcomes: Students will acquire knowledge about:

		1. Basic aspects of pharmacoepidemiology, including determinants of disease, quality of life, and adherence to treatment 2. Factors used to monitor the use and effects of medicines in large populations 3. Use of information sources and the basic classification of pharmacoepidemiological studies Chapter: Pharmacoepidemiological Studies Basic pharmacoepidemiological study designs: cohort studies, case-control studies, cross-sectional studies, nested case-control studies; use of randomized controlled trials (RCTs) and meta-analyses in pharmacoepidemiology. Definition of approaches to conducting pharmacoepidemiological studies and the importance of these studies for academia, the pharmaceutical industry, regulatory agencies, and the health care system.
13	Interrelation with Other Courses	1. Prior knowledge from the following subjects is necessary and related to this course: Mathematics and Biostatistics, Pharmaceutical Chemistry 1, Pharmaceutical Chemistry 2, Pharmaceutical Chemistry 3.
14	Teaching and Working Methods	Teaching Methods: • Lectures • Interactive sessions (case discussions, problem-based learning) Working Methods: • Classroom (auditorium) exercises – development of practical skills • Problem solving (individual/group work) • Project work (research and presentation of a selected topic)
15	Total Available Contact Hours	120 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 30 hours 16.2. Exercises (laboratory, auditory): 22.5 hours
17.	Other Forms of Activities	17.1. Project work / seminar: 7.5 hours 17.2. Independent learning: Preparation for theoretical teaching: 30 hours Preparation for practical teaching: 15 hours 17.3. Examination preparation: 15 hours
18.	Requirements for Course Signature	40 points
19	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: C1 13-25 points and C2 13-25 points 19.3. Practical exam: 6-10 points

		19.4. Written/oral presentation or project: /
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. K.G. Revikumar. Pharmacoepidemiology and Pharmacoeconomics. K.G. Revikumar. 2. Karen Rascati. Essentials of Pharmacoeconomics. Karen Rascati. 2013, electronic edition. 3. Renee J.G. Arnold. Pharmacoeconomics: From Theory to Practice. CRC Press. 2016, electronic edition. Additional: 1. Authorized lectures, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy – Skopje; Ss. Cyril and Methodius University in Skopje, Faculty of Medicine – Skopje, Current year // electronic copy

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	TOXICOLOGY			
2	Code	FFIPB39			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	5	Semester:	IX
7	Workload expressed in ECTS credits	8 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Tatjana Kadifkova Panovska (course coordinator) Prof. Dr. Tanja Petreska Ivanovska Asst. Prof. Zoran Zivikj Asst. M.Sc. Ana Marija Bajatovska			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: fulfillment of the attendance requirements of Pharmaceutical Chemistry II (V semester) and concurrent enrollment in Clinical Biochemistry (VIII semester). Examination requirements: prior completion of Pharmaceutical Chemistry II (V semester).			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: The aim of the course is to provide fundamental knowledge of toxicological principles, including toxicokinetics (how toxicants are absorbed, distributed, metabolized, and excreted) and toxicodynamics (how they affect biological systems). The course also covers how to evaluate toxic effects on different organs and the overall organism, the methodologies for designing toxicity tests and assessing risk, and the principles of both human and environmental toxicology. The course aims are to provide overview of the types of injury produced in specific organs (e.g., neurotoxicity, immunotoxicity, cardiotoxicity, hepatotoxicity, kidney toxicity), principles of clinical toxicology (characteristic symptoms of acute and chronic poisonings, poisoning treatment and antidotes), and analytical toxicology. Learning Outcomes: Upon successful completion of the course, the student will be able to: • Explain fundamental toxicological concepts (dose-response relationships, LD₅₀, NOAEL, and LOAEL, acute, subacute, subchronic, and chronic toxicity). • Describe toxicokinetics and toxicodynamics.			

		• Explain xenobiotic biotransformation processes. • Explain mechanisms of toxicity and damage repair at molecular and cellular level. • Identify potential hazards and determine the target organs that a chemical might affect. • Explain the principles of genetic and chemical carcinogenesis. Upon successful completion of the course, the student will be able to: • Describe organ-specific toxicities (major types of organ injury, including neurotoxicity, hepatotoxicity, nephrotoxicity, cardiotoxicity, and reproductive toxicity). • Analyze clinical manifestations of poisoning (distinguish between acute and chronic poisoning and describe their characteristic symptom patterns). • Explain principles of poisoning management (general approach and key antidotes). • Describe the role of analytical toxicology in clinical settings. • Correlate clinical symptoms with analytical findings to support diagnosis of poisoning.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter: General Principles of Toxicology Introduction to toxicology; xenobiotics; dose–response relationship; toxicity testing methods; risk assessment; intoxication and detoxification. Learning outcomes: Students will be able to explain basic concepts in toxicology, to characterize the dose–response relationship, and to describe mechanisms of intoxication and detoxification. Chapter: Mechanisms of Toxicity Interactions of poisons with endogenous molecules and resulting toxic effects; mechanisms of damage repair at molecular and cellular level. Learning outcomes: Students will be able to analyze interactions of xenobiotics with biological molecules, to explain mechanisms of toxicity and to understand repairing processes. Chapter: Biotransformation of Xenobiotics Absorption, distribution, and elimination of xenobiotics; chemical and biochemical aspects of the reactions within phase I and phase II biotransformation. Learning outcomes: Students will be able to explain the metabolism of xenobiotics in the body, including the processes of oxidation, reduction, hydrolysis, glucuronidation, and sulfoconjugation. Chapter: Toxicokinetics and Toxicodynamics The dose of the xenobiotic reaching the target site, shaping the magnitude and duration of toxic effects. Biochemical

		and physiological effects of toxic substances and the mechanisms by which these effects occur. Learning outcomes: Students will be able to describe toxicokinetics and toxicodynamics of xenobiotics. Chapter: Genetic and Chemical Carcinogenesis Types and mechanisms of genetic damage; mutations; principles of genotoxicity testing; genotoxic effects; mechanisms and biological characteristics of chemical carcinogenesis; chemical carcinogenesis in humans. Learning outcomes: Students will be able to explain the types and mechanisms of genetic damage and chemical carcinogenesis, to describe genotoxicity testing methods, and to identify chemical agents with genotoxic or carcinogenic potential. Chapter: Neurotoxicity Mechanisms of neurotoxicity; neurobehavioral and functional assessment methods; substances associated with neurotoxicity. Learning outcomes: Students will be able to explain the mechanisms of neurotoxicity, describe neurobehavioral and functional assessment methods, and identify substances associated with neurotoxicity. Chapter: Cardiovascular Toxicity Mechanisms of cardiotoxicity; assessment methods of cardiovascular function; substances associated with cardiotoxic effects. Learning outcomes: Students will be able to explain the mechanisms of cardiovascular toxicity, describe methods for assessment of cardiovascular function and identify substances associated with cardiotoxic effects. Chapter: Nephrotoxicity Mechanisms of renal toxicity; acute and chronic kidney injury and compensatory responses; nephrotoxicity assessment methods; substances associated with renal toxicity. Learning outcomes: Students will be able to explain the mechanisms of renal toxicity, distinguish between acute and chronic kidney injury, describe compensatory and adaptive responses of the kidney, explain nephrotoxicity assessment methods, and identify substances associated with renal toxicity. Chapter: Hepatotoxicity Mechanisms of hepatotoxicity; factors influencing the severity and progression of liver injury; substances associated with hepatotoxicity. Learning outcomes: Students will be able to explain the mechanisms of hepatotoxicity, identify factors influencing severity and

		progression of liver injury, recognize clinical and biochemical indicators of liver injury and identify substances associated with hepatotoxicity. Chapter: Reproductive Toxicity Assessment of male and female reproductive function; principles of developmental and reproductive toxicology; substances associated with reproductive toxicity. Learning outcomes: Students will be able to explain the principles of reproductive and developmental toxicology, describe mechanisms of reproductive toxicity, and identify substances associated with reproductive toxicity. Chapter: Poisons Toxic effects of pesticides, metals, solvents and gases; routes and characteristics of exposure. Learning outcomes: Students will be able to describe the toxic effects and exposure characteristics of pesticides, metals, solvents, and gases. Chapter: Analytical Toxicology Role and significance of analytical toxicology in clinical evaluations; principles and applications of toxicological analyses. Learning outcomes: Students will be able to understand the principles of toxicological analyses and learn how to integrate analytical results with clinical and toxicological information (combine laboratory data with patient history and symptoms to support diagnosis and treatment decisions). Chapter: General Principles of Clinical Toxicology Mechanisms of action of antidotes; clinical presentation, diagnosis, and management of common poisonings caused by medications and other toxic agents. Learning outcomes: Students will be able to explain the mechanisms of action of antidotes and identify the clinical signs and management strategies for common poisonings.
13	Interrelation with Other Courses	Prior knowledge from the following subjects is necessary and related to this course: Pharmaceutical Chemistry 2 (6th semester) and Clinical Biochemistry (7th semester).
14	Teaching and Working Methods	Teaching Methods: • Lectures • Interactive sessions (case discussions, problem-based learning) Working Methods: • Laboratory exercises (practical skills) • Problem solving (individual/group work)
15	Total Available Contact Hours	240 hours

16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 60 hours 16.2. Exercises (laboratory, auditory): 60 hours
17.	Other Forms of Activities	17.1. Project work / seminar: / 17.2. Independent learning: Preparation for theoretical teaching: 80 hours Preparation for practical teaching: 20 hours 17.3. Examination preparation: 20 hours
18.	Requirements for Course Signature	Minimum of 30 points from activities (Sections 16.1 and 16.2)
19	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: C1 13-25 points C2 13-25 points 19.3. Practical exam: 6-10 points 19.4. Written/oral presentation or project: /
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Barile, F.A., <i>Barile's Clinical Toxicology: Principles and Mechanisms</i>, Taylor & Francis Group, 2019 / 3rd edition - digital issue. 2. Olson, K.R., <i>Poisoning & Drug Overdose</i>, McGraw-Hill Education, 2018 / 7th edition – digital issue. 3. Klaasen, C.D., <i>Casarett and Doull's Toxicology: The Basic Science of Poisons</i>, McGraw-Hill Professional, 2008 / 7th edition - digital issue. 4. Burcham, P.C., <i>An Introduction to Toxicology</i>, Springer-Verlag London, 2014 / 1st edition - digital issue. 5. Klaasen, C.D., <i>Casarett and Doull's Toxicology: The Basic Science of Poisons</i>, McGraw-Hill Professional, 2008 / 7th edition - digital issue. 6. Hayes, A.W., <i>Principles and Methods of Toxicology</i>, Taylor & Francis Group, 2001 / 4th edition - hard copy. Additional:

		1. Hodgson, E., <i>A Textbook of Modern Toxicology</i>, John Wiley & Sons, Inc., 2010 / 4th edition - digital issue. 2. Peña-Fernández, A., Evans M.D., Cooke, M.S., <i>Toxicology for the Health and Pharmaceutical Sciences</i>, CRC Press by Talor & Francis Group, 2022 / 1st edition – digital issue. 3. Moffat, C.A., Osselton, M.D., Widdoop, B., <i>Clarke's Analysis of Drugs and Poisons</i>, Pharmaceutical Press, 2011 / 4th edition - hard copy. 4. HGhose, S., Kesharwani, V., <i>Clinical Toxicology</i>, Dominant Publishers, 2023 / 1st edition (revised) - digital issue.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	QUALITY CONTROL OF MEDICINES AND PHARMACEUTICAL LEGISLATION			
2	Code	FFIPHFA40			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	5	Semester:	IX
7	Workload expressed in ECTS credits	8 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Katerina Brezovska (course coordinator) Prof. Dr. Jelena Acevska Prof. Dr. Aneta Dimitrovska Prof. Dr. Suzana Trajkovikj Jolevska Asst. M.Sc. Hrisanta Godzo			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Credits obtained in Analytical Chemistry Applied in Pharmacy, Instrumental Pharmaceutical Analyses, Pharmaceutical Technology 2, and Pharmaceutical Chemistry 3. Prerequisite for assessment: Credits from: Analytical Chemistry Applied in Pharmacy, Instrumental Pharmaceutical Analyses, Pharmaceutical Technology 2, and Pharmaceutical Chemistry 3.			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: • To provide students with knowledge of the fundamental principles of quality control of active substances and pharmaceutical dosage forms, as well as the analytical methods used for this purpose and the regulatory requirements for drug quality monitoring. • To develop theoretical knowledge related to the selection, verification, and validation of analytical methods, as well as practical skills for conducting examinations applicable in drug quality control laboratories. • To enable students to apply acquired understanding of pharmaceutical legislation in the pharmaceutical industry and regulatory authorities. Learning Outcomes: Upon completion of the course, the student will be able to apply the acquired knowledge in drug quality control: 1. To select and apply appropriate analytical methods for analysis of active substances and pharmaceutical			

		dosage forms, examination of impurities, and monitoring of drug stability. 2. To interpret and process analytical data to ensure valid test results. 3. To identify and solve problems in laboratory settings. 4. To interpret and apply regulatory requirements related to drug quality monitoring.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1: Introduction to Drug Analysis Content: • Introduction to the fundamentals of drug analysis and its significance for the pharmaceutical industry and regulatory authorities. • The role of analytical testing in ensuring the quality, safety, and efficacy of medicines. • Definitions of basic concepts related to drug quality control. Learning outcomes: • Students will understand the foundations of drug analysis and explain its role in the pharmaceutical industry and regulatory bodies. • Students will understand how drug analysis is linked to drug development and quality control. Chapter 2: Pharmaceutical Legislation for Drug Quality Content: • National and international regulatory authorities and their role in ensuring drug quality (Agency for Medicines and Medical Devices of N. Macedonia – MALMED; European Medicines Agency – EMA; European Directorate for the Quality of Medicines – EDQM; Official Medicines Control Laboratories Network – OMCL; World Health Organization – WHO; Food and Drug Administration – FDA). • Regulatory frameworks, standards, and guidelines for drug quality (ICH and EMA quality guidelines). • Documentation required for Marketing Authorization (Common Technical Document – CTD). • Good Control Laboratory Practice (GcLP), ISO/IEC 17025:2018 standard for testing laboratory accreditation. Learning outcomes: • Identify key regulatory authorities and their role in ensuring drug quality. • Understand regulatory requirements for drug quality monitoring and essential industry standards and guidelines. • Explain the CTD and its use as the standard format for marketing authorization applications.

		• Understand and apply the basic principles of GcLP and ISO/IEC 17025:2018. Chapter 3: Application of the European Pharmacopoeia Content: • The role of the European Pharmacopoeia (Ph. Eur.) in ensuring drug quality during development, manufacturing, and marketing authorization. • Evaluation of individual monographs for substances and finished products. • Interpretation and application of general notices, official methods, general chapters, and monographs. Learning outcomes: • Understand the role of the Ph. Eur. as a key drug quality standard. • Explain how Ph. Eur. monographs are used for quality control of active substances, excipients, and finished dosage forms. • Apply pharmacopoeial requirements in analytical testing. Chapter 4: Physicochemical Properties of Active Substances Relevant for Analytical Method Development Content: • Physical properties: solubility, polymorphism, melting point, particle size, hygroscopicity, viscosity. • Chemical properties: pKa, partition coefficient, stability (chemical degradation), functional groups and reactivity, stereochemistry. Learning outcomes: • Recognize and explain the main physicochemical properties of active substances. • Understand the significance of these properties for selecting quality control parameters and developing analytical methods. Chapter 5: Quality Specifications for Active Substances and Dosage Forms Content: • Definition, establishment, and application of quality specifications (for chemical and biological active substances). • General and specific quality parameters for active substances and pharmaceutical dosage forms. Learning outcomes: • Define and explain quality specifications.

		• Gain skills for selecting quality control parameters for active substances and different dosage forms. Chapter 6: Identification and Assay in Drug Quality Control Content: • General concept of identification and assay. • Physicochemical constants and chemical reactions for identification. • Spectroscopic and chromatographic identification methods. • Classical and modern instrumental methods for assay determination. Learning outcomes: • Develop knowledge and skills for applying analytical methods for identification and quantitative determination of active substances and pharmaceutical products. Chapter 7: Impurities in Active Substances and Finished Products Content: • Origin and classification of impurities (organic, inorganic, residual solvents). • Impurities in finished products (degradation products). • Impurities as a parameter in quality specifications. • Methods for impurity testing (physicochemical, chemical, gravimetric, spectroscopic, chromatographic). Learning outcomes: • Recognize different types of impurities in active substances and finished products. • Evaluate the importance of impurities as a quality specification parameter. • Select appropriate analytical methods for impurity detection and quantification. Chapter 8: Pharmaceutical–Technological Parameters in Drug Quality Control Content: • Role of technological parameters in ensuring drug quality. • Selection of technological parameters in quality specifications for various dosage forms (disintegration, dissolution, uniformity of dosage units, hardness, friability, particle size, others). • Methods for testing technological parameters. Learning outcomes: • Identify and explain pharmaceutical–technological parameters influencing drug quality.

		• Conduct testing and evaluate results of pharmaceutical–technological parameters. Chapter 9: Biological Tests and Methods in Drug Quality Control Content: • Importance of biological tests for ensuring drug quality, efficacy, and safety. • Microbiological quality of dosage forms (microbial purity and sterility tests). • Testing for pyrogenic substances (pyrogen tests and bacterial endotoxin tests). Learning outcomes: • Understand the basic principles of biological tests used in quality control. • Apply pharmacopoeial requirements and methods for microbiological quality and apyrogenicity. Chapter 10: Validation of Analytical Methods Content: • Principles and application of method validation in accordance with ICH Q2. • Validation parameters. • Performing and documenting validation. Learning outcomes: • Understand the essence of analytical method validation. • Evaluate validation data and conclude on method suitability. Chapter 11: Stability Studies Content: • Stability of active substances and dosage forms (physical, chemical, microbiological, and therapeutic stability). • Stability studies in accordance with ICH stability guidelines. • Quality specifications in stability studies. • Methods for monitoring drug stability. Learning outcomes: • Define stability and identify key aspects of stability studies. • Understand ICH guidelines for conducting stability studies.
13	Interrelation with Other Courses	Prior knowledge from the following subjects is necessary and related to this course: Analytical Chemistry Applied in Pharmacy, Instrumental Pharmaceutical Analyses, Pharmaceutical Technology 2 and Pharmaceutical Chemistry 3.

		Knowledge from this course is required for the course Regulation of Marketing Authorization of Medicinal Products.
14	Teaching and Working Methods	Teaching Methods: • Lectures • Interactive sessions (case discussions, problem-based learning) Working Methods: • Laboratory exercises (practical skills) • Problem solving (individual/group work) • Project work (independent research and presentation of a topic)
15	Total Available Contact Hours	240 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 45 hours 16.2. Exercises (laboratory, auditory): 75 hours
17.	Other Forms of Activities	17.1. Project work / seminar: 7.5 hours 17.2. Independent learning: Preparation for theoretical teaching: 45 hours Preparation for practical teaching: 37.5 hours 17.3. Examination preparation: 30 hours
18.	Requirements for Course Signature	Minimum of 25 out of 30 points from activities in Sections 16.1, 16.2 and 17.1.
19	Assessment Method	19.1. Final exam (if no colloquia): 30–60 points 19.2. Colloquia: / 19.3. Practical exam: 5-10 points 19.4. Seminar work, written/oral presentation or project: /
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Dimitrovska A. et al. Evaluation of Chemical Substances for Pharmaceutical Use According to the European Pharmacopoeia. SOFIA – Bogdanci. 2020, electronic edition. 2. Dimitrovska A. et al. Quality control of medicines and pharmaceutical legislation. Internal script. 2021, electronic edition. 3. Brezovska K. et al. Quality control of medicines and pharmaceutical legislation – Practical Instruction. Peer-reviewed laboratory manual, Faculty of Pharmacy, UKIM. 2016.

		4. Dimitrovska A. et al. Instrumental Pharmaceutical Analyses. UKIM, Skopje, 2021, electronic edition. 5. Watson D. Pharmaceutical Analysis (translation). Elsevier / Ars Lamina. 2017, hard copy. Additional: 1. European Pharmacopoeia Commission. EDQM, Council of Europe. Current electronic edition. 2. ICH Guidelines. ICH. Current edition (electronic, http://www.ema.europa.eu/) 3. EMA QWP Guidelines. EMA. Current edition (electronic, http://www.ich.org/) 4. OMCL Guidelines. EDQM, Council of Europe Current edition (electronic, www.edqm.eu)

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PHARMACOGENETICS, PHARMACOGENOMICS AND INDIVIDUALIZED THERAPY			
2	Code	FFIFH41			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	5	Semester:	IX
7	Workload expressed in ECTS credits	3 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Aleksandar Dimovski (course coordinator) Prof. Dr. Nadica Matevska-Geshkovska Teaching Assistant involved in the practical classes.			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Credits obtained in Anatomy and Physiology; Molecular and Cell Biology and Genetics; Microbiology; Pathology and Pathophysiology; Basics of Pharmacology; Clinical Pharmacy and Pharmacotherapy. Prerequisite for assessment: Credits from: Pathology and Pathophysiology; Basics of Pharmacology.			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: The aim of the course is for students to acquire and develop an understanding of the basic concepts of pharmacogenetics, pharmacogenomics and individualized therapy. The student will be able to understand the application of molecular diagnostics in individualized therapy in everyday clinical practice.			
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	1. Chapter: Structure and Function of the Genome Molecular basis of the structure and function of genes and the genome. Learning outcomes: Students will revise and consolidate their knowledge of the molecular basis of the structure and function of genes and the genome. 2. Chapter: Pharmacogenetics – Fundamentals and Current Status			

		Basic principles of the application of pharmacogenetics in everyday clinical practice. Current status of targeted analyses of pharmacogenetic variants. Learning outcomes: Students will become familiar with the basic principles of applying pharmacogenetics in everyday clinical practice, with particular emphasis on the current status of targeted analyses of pharmacogenetic variants. 3. Chapter: Pharmacogenomics – Genomic Approaches to Drug Response Genome-wide approaches for elucidating variability in drug therapy. Learning outcomes: Students will become familiar with current genome-wide approaches used to clarify interindividual variability in response to drug therapy. 4. Chapter: Gene Mutation Types of gene mutations and specific mechanisms by which gene function is altered in inherited and acquired diseases. Learning outcomes: Students will become familiar with the molecular basis of different types of gene mutations and specific mechanisms of altered gene function in inherited and acquired diseases. 5. Chapter: Approaches to the Analysis of Gene Mutations Methods for the analysis of gene mutations. Learning outcomes: Students will become familiar with different methods used for the analysis of gene mutations. 6. Chapter: Molecular Basis of the Most Common Rare Diseases Molecular basis of the most common rare diseases and approaches to their diagnosis and specific individualized therapy. Learning outcomes: Students will become familiar with the molecular basis of the most common rare diseases and with approaches to their diagnosis and specific individualized therapy. 7. Chapter: Molecular Basis of Malignant Diseases

		Molecular basis of the most common malignant diseases (lung, breast and colorectal cancer, melanoma, lymphoma). Learning outcomes: Students will become familiar with the molecular basis of the most common malignant diseases (lung, breast and colorectal cancer, melanoma, lymphoma) and the use of this knowledge for diagnosis, classification, prognosis and prediction of response to specific therapies. 8. Chapter: Personalized Therapy in Hemato-oncology Current status of the application of molecular diagnostics in the personalized therapeutic approach to the most common neoplasms. Learning outcomes: Students will become familiar with the current status of the application of molecular diagnostics in the personalized therapeutic approach to the most common neoplastic diseases. 9. Chapter: Gene Therapy Basic principles of gene therapy. Current status of the application of gene therapy in everyday clinical practice. Learning outcomes: Students will become familiar with the basic principles of gene therapy and its application in everyday clinical practice. 10. Chapter: Cell Therapy and Transplantation Basic principles of cell therapy and transplantation of tissues and organs. Overview of the current status of the application of these therapeutic approaches in everyday clinical practice. Learning outcomes: Students will become familiar with the basic principles of cell therapy and transplantation of tissues and organs. They will also gain insight into the current status of the application of these therapeutic approaches in everyday clinical practice.
13	Interrelation with Other Courses	1. Prior knowledge from the following subjects is necessary and related to this course: Anatomy and Physiology; Molecular and Cell Biology and Genetics; Biochemistry; Basics of Pharmacology; Pathology and Pathophysiology; Clinical Pharmacy and Pharmacotherapy.

		2. The knowledge acquired in this course will serve as prior knowledge for following the content of subsequent courses.
14	Teaching and Working Methods	Teaching Methods: • Lectures Working Methods: • Seminars/project work (independent research and presentation of a topic)
15	Total Available Contact Hours	90 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 30 hours 16.2. Exercises (laboratory, auditory): /
17.	Other Forms of Activities	17.1. Project work / seminar: 9 hours 17.2. Independent learning: Preparation for theoretical teaching: 30 hours Preparation for practical teaching: / 17.3. Examination preparation: 21 hours
18.	Requirements for Course Signature	Minimum 30 points from activities in Sections 16.1, 16.2 and 17.1.
19	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: / 19.3. Practical exam: / 19.4. Seminar work, written/oral presentation or project: 6-10 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Weber, V. Pharmacogenetics (translated textbook). Oxford University Press. 2015. 2. Review articles published in recent years. Published in the current year or in the few years preceding the course. Additional: 1. Karp, G. Molecular and Cell Biology: Concepts and Experiments (translated textbook). Wiley (translated edition). 2015.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	INDUSTRIAL PHARMACY			
2	Code	FFIFT42			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	5	Semester:	IX
7	Workload expressed in ECTS credits	3 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Nikola Geshkovski (course coordinator) Prof. Dr. Marija Glavash Dodov Prof. Dr. Maja Simonoska Crcarevska Asst. Prof. Dr. Dushko Shalabalija Asst. Prof. Dr. Ljubica Mihailova Asst. M.Sc. Teodora Tasevska			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Credits obtained in Advanced Pharmaceutical Technology. Course signature in Biopharmacy. Prerequisite for assessment: Signature from: Industrial Pharmacy.			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: The aim of this course is for students to become familiar with, and acquire knowledge of, structured approaches to the design and initiation of manufacture of a new product, i.e. concepts for formulation development and introduction of new medicinal products into production that promote quality through the application of statistical and analytical approaches and risk control and management strategies, in accordance with Good Manufacturing Practice (GMP) guidelines within the pharmaceutical quality system. The acquired knowledge and competences provide appropriate preparation and skills for work in formulation and process development departments, production, and GMP-based quality assurance units, as essential components of the system encompassing all aspects of medicinal product quality, which are crucial for ensuring the desired quality, safety and efficacy of the final product.			

		The student will understand and be able to apply the concept of GMP-based quality assurance, as well as the related documentation, in order to ensure continuous traceability of the product, without omitting any segment that might impact product quality. Learning Outcomes: As a result of learning, upon completion of the course the student will be able to: 1. Identify, follow and document GMP-based quality assurance concepts in formulation and process development through the application of Quality by Design (QbD). 2. Identify, follow and document GMP-based quality assurance concepts during product transfer and throughout the manufacturing process. 3. Understand, apply and document approaches for control and monitoring of pharmaceutical processes and manufacturing operations. 4. Understand and participate in the maintenance of a robust quality management system to prevent defects and deviations during product development and during the manufacturing process. The student will also be able to identify potential problems, discuss them, undertake corrective measures and prevent non-compliance with regulatory requirements.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter: Quality Assurance in the Pharmaceutical Industry According to GMP Concepts During Formulation and Process Development Within this chapter, students will acquire the knowledge listed below and, as a result of learning, will be able to describe, discuss and apply their knowledge regarding: The pharmaceutical quality assurance system and the application of Quality by Design during the development of generic medicinal products and development of relevant parts of the medicinal product dossier. Chapter: Quality Assurance in the Pharmaceutical Industry According to GMP Concepts During Transfer of a New Product and During Pharmaceutical Manufacturing Within this chapter, students will acquire the knowledge listed below and, as a result of learning, will be able to describe, discuss and apply their knowledge regarding: Understanding, following and documenting the process of transfer of a new product into industrial manufacture. Understanding, following and documenting industrial manufacturing processes. Chapter: Quality Assurance in the Pharmaceutical Industry According to GMP Concepts During the

		Manufacturing Process – Investigation Management and Proposal of Preventive and Corrective Actions for Elimination of Deviations and Defects Within this chapter, students will acquire the knowledge listed below and, as a result of learning, will be able to describe, discuss and apply their knowledge regarding: Understanding, documenting and following industrial manufacturing processes and developing a critical approach to problem-solving (deviations and defects) through implementation of preventive and corrective actions.
13	Interrelation with Other Courses	1. Prior knowledge from the following subjects is necessary and related to this course: Pharmaceutical Technology I, Pharmaceutical Technology II and Advanced Pharmaceutical Technology. 2. The knowledge acquired in this course is required as prior knowledge for following the teaching content in subsequent courses – the course is scheduled in the 9th semester.
14	Teaching and Working Methods	Teaching Methods: • Lectures • Interactive sessions (case discussions, problem-based learning) Working Methods: • Laboratory exercises (practical skills) • Problem solving (individual/group work) • Project work (independent research and presentation of a topic)
15	Total Available Contact Hours	90 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 15 hours 16.2. Exercises (laboratory, auditory): 15 hours
17.	Other Forms of Activities	17.1. Project work / seminar: / 17.2. Independent learning: Preparation for theoretical teaching: 30 hours Preparation for practical teaching: 7.5 hours 17.3. Examination preparation: 22.5 hours
18.	Requirements for Course Signature	Minimum of 25 out of 30 points from activities in Sections 16.1, 16.2 and 17.1.
19	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: C1 – 13-25 points C2 – 13-25 points 19.3. Practical exam: 6-10 points 19.4. Seminar work, written/oral presentation or project: /
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D)

		76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Wondwossen G. Beyadgo. Foundations of Pharmaceutical Quality Assurance in GxP. 2024 (electronic edition). 2. Joseph D. Nally. Good Manufacturing Practices for Pharmaceuticals, Sixth Edition. Informa Healthcare. 2007 (electronic edition)

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PROFESSIONAL PRACTICE			
2	Code	FFPP			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	5	Semester:	X
7	Workload expressed in ECTS credits	10 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Vice-Dean for Education - Prof. Dr. Ana Poceva Panovska (course coordinator) All academic staff of the faculty participate in the implementation of the course.			
9	Language	English			
10	Prerequisites for attending and passing the course	All courses foreseen by the curriculum up to and including the 9th semester must be completed.			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: Application of previously acquired theoretical knowledge and practical skills in a mentor-supervised training process for work in a community pharmacy. Learning Outcomes: Upon completion of the course, the student will be able to: 1. Apply professional knowledge and skills within the full scope of pharmaceutical practice in a pharmacy setting.			
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	• Preparation of students for professional practice – Pharmacy Game Simulation-based learning replicating real-life pharmacy operations aimed at enhancing practical, decision-making, and communication skills. • Organization of work in a pharmacy, pharmacy station, and mobile pharmacy; Administrative procedures; technical instructions and pharmacy forms; maintenance of electronic and paper-based documentation. • Good Pharmacy Practice (GPP); Professional standards; Standard Operating Procedures (SOPs); risk-management systems. • Professional ethics; legal and ethical principles; sanctions. • National legislation (laws and bylaws) on medicinal products and medical devices.			

		• Health services provided in pharmacies. • Regulations governing prescribing, dispensing, and sale of medicinal products in the Republic of North Macedonia (BR, R, Z, BR* medicines); prescriptions for foreign insured persons. • Regulations on prescribing and dispensing of medicinal products containing substances and plants classified under Schedules II and III. • Generic medicines and pharmaceutical dosage forms. • List of medicines reimbursed by the Health Insurance Fund of the Republic of North Macedonia (medicines without co-payment, dispensed on prescription in primary care pharmacies). • National medicinal product coding system (Šifarnik). • Medicines that may be prescribed by physicians on duty/emergency service. • SOPs for dispensing of medicines and processing of prescriptions. • Medicinal products prepared in community pharmacies (magistral preparations). • Dispensing Over-the-Counter (OTC) medicines: appropriate use, limitations and risks, contraindications, dosing, adverse effects, interactions, and evaluation of equivalent and/or similar products from different manufacturers. • Counselling on medical cosmetics and dietary supplements. • Dispensing of medical devices and other products; materiovigilance. • Pharmacotherapeutic groups of prescription-only medicines (medicines for prevalent diseases; providing information and instructions for use, indications, contraindications; identifying interactions; adverse effect reporting; risks related to medicine use). • Management of medication errors and pharmaceutical errors. • Legal regulations governing the monitoring and control of production and distribution of precursors; handling, storage, record-keeping, and dispensing of flammable and volatile substances. • Substandard medicinal products; guidelines for identifying falsified medicines and measures for their handling. • Procurement of medicines and other pharmacy products

		(acquisition, storage, handling, expiry control, stock management). • Donations of medicinal products imported into the Republic of North Macedonia. • Procedures for disposal of pharmaceutical waste. • Pharmacography. • Use of databases and information technologies. • Guidelines for practicing evidence-based medicine and pharmacy; relevant electronic drug databases. • Communication skills: communicating with patients, patient representatives, healthcare team members; providing drug information; self-medication counselling; dissemination of medicine-related information. • Disease prevention programs, health promotion, and public health initiatives (national and global).
13	Interrelation with Other Courses	/
14	Teaching and Working Methods	• Practical training • Independent assignments • Problem-based / case-based learning • Independent study
15	Total Available Contact Hours	300 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): / 16.2. Exercises (Pharmacy game): 60 hours
17.	Other Forms of Activities	17.1. Project work / seminar: / 17.2. Independent learning: Independent tasks; problem-based / case-based learning – 100 hours 17.3. Examination preparation: /
18.	Requirements for Course Signature	Minimum of 25 out of 30 points from activities in Sections 16.1, 16.2, 17.1, 17.2 and 17.3.
19	Assessment Method	19.1. Final exam (if no colloquia): / 19.2. Colloquia: / 19.3. Practical exam: / 19.4. Seminar work, written/oral presentation or project: /
20	Grading Criteria	• Work under supervision of an educator–pharmacist; • Signature in the work diary confirming successful completion of the program.
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Group of Authors. Guide for Professional Practice of Pharmacists, Faculty of Pharmacy, UKIM.

Elective courses:

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	CHEMISTRY OF BIOLOGICALLY ACTIVE ELEMENTS			
2	Code	FFIP L01			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	3	Semester:	VI
7	Workload expressed in ECTS credits	4 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Liljana Anastasova (course coordinator) Prof. Dr. Rumenka Petkovska Prof. Dr. Ana Poceva Panovska			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Credits obtained in Inorganic Chemistry Applied in Pharmacy and Organic Chemistry Applied in Pharmacy Prerequisite for assessment: /			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: The aim of the course is to deepen students' knowledge about the role and function of essential chemical elements (biologically active elements) in living organisms. The selected topics enable the study of the behavior of biogenic chemical elements in biological systems, understanding the processes of formation of coordination complexes between metal ions and biomolecules (chelates), as well as advanced knowledge of structural characteristics of metal complexes directly related to their biological activity. Learning Outcomes: Upon successful completion of the course, the student will acquire advanced knowledge of: - the chemical principles underlying the biological/physiological function of biogenic elements, - the structure and function of metalloenzymes, - mechanisms of interaction between metal ions and biomolecules, - mechanisms of action of metal complexes used in diagnostics and therapy.			

12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Detailed Course Content: • Essential chemical elements: classification and physiological function in living systems; metals in biological systems • Physiological function, transport, uptake and homeostasis of biogenic ions • Interactions between metal ions and biological ligands (chemical properties of metal ions, biological ligands, metal–protein interactions, factors affecting stability of metal–biomolecule complexes) Students will become familiar with the fundamental principles of coordination chemistry as applied to living organisms. • Biogenic elements as structural and signaling components of biomolecules (proteins, nucleic acids) • Metalloproteins (oxygen transport, electron transport, metalloenzymes, hydrolases) • Interaction of biologically relevant metal complexes with nucleic acids • Metal complexes in diagnostics and therapy Students will understand the key interactions governing the stability and biological activity of metal–biomolecule complexes. This understanding may be applied to the development of new drugs and biomaterials.
13	Interrelation with Other Courses	1. Prior knowledge from the following subjects is necessary and related to this course: Inorganic Chemistry Applied in Pharmacy and Organic Chemistry Applied in Pharmacy. 2. The knowledge acquired in this course will serve as prior knowledge for following the content of Medicinal Chemistry and Pharmaceutical Chemistry
14	Teaching and Working Methods	Teaching Methods: • Lectures Working Methods: • Seminars/project work (independent research and presentation of a topic)
15	Total Available Contact Hours	120 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 30 hours 16.2. Exercises (laboratory, auditory): /
17.	Other Forms of Activities	17.1. Project work / seminar: 15 hours 17.2. Independent learning: Preparation for theoretical teaching: 45 hours Preparation for practical teaching: / 17.3. Examination preparation: 30 hours

18.	Requirements for Course Signature	Minimum 24 points from the planned activities.
19	Assessment Method	19.1. Final exam (if no colloquia): 26–50 points 19.2. Colloquia: / 19.3. Practical exam: / 19.4. Seminar work, written/oral presentation or project: 10-20 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Robert Crichton. Biological Inorganic Chemistry: An Introduction. Elsevier. 2019 (electronic edition). 2. Rosette Roat Malone. Bioinorganic Chemistry: A Short Course. Wiley–Blackwell. 2007. Additional: 1. Relevant papers in international scientific journals.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	“GREEN” CHEMISTRY IN PHARMACEUTICAL ANALYSIS			
2	Code	FFIP_L02			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	3 / 4	Semester:	VI / VIII
7	Workload expressed in ECTS credits	4 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Natalija Nakov (course coordinator) Prof. Dr. Jasmina Tonikj Ribarska Asst. Prof. Dr. Blagoj Achevski			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Signatures obtained in Analytical Chemistry Applied in Pharmacy (III semester) and Instrumental Pharmaceutical Analyses (IV semester). Prerequisite for assessment: /			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: The aim of the course is to provide students with an understanding of the principles of “green” analytical chemistry, the knowledge required for development of environmentally friendly instrumental methods, and their application in pharmaceutical analysis. Students will develop skills for applying techniques that reduce the use of toxic chemicals, minimize laboratory energy consumption, and utilize new technologies that support sustainable development in pharmaceutical analytics. Learning Outcomes: Upon completion of the course, the student will be able to: • Demonstrate knowledge of the principles of green analytical chemistry and apply them in pharmaceutical industry laboratories. • Implement green chemistry practices in the development of sustainable and environmentally benign analytical methods in pharmaceutical analyses, including the ability to evaluate the “greenness” of analytical methods.			

12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter: Introduction to Green Analytical Chemistry (GAC) • Principles of green analytical chemistry • Environmentally friendly solvents • Energy-saving strategies in analytical laboratories Learning Outcomes: • Students will gain knowledge of the fundamental principles of green chemistry, including reduction of toxicity in analytical procedures, energy efficiency of processes, and minimization of chemical waste. Chapter: Environmentally Friendly Sample Preparation Techniques • Solid-phase microextraction (SPME) • Liquid–liquid microextraction (LLME) • Supercritical fluid extraction Learning Outcomes: • Students will learn the application of modern sample preparation techniques that reduce chemical waste generation. Chapter: Environmentally Friendly Instrumental Methods • Vibrational spectroscopic methods for direct sample analysis • Green liquid chromatography • Electroanalytical methods aligned with GAC principles Learning Outcomes: • Students will acquire knowledge on optimizing instrumental methods to improve analytical performance while enhancing environmental sustainability and cost-effectiveness of the method. Chapter: Evaluation of the Environmental Friendliness of an Analytical Method • Eco-scale index; Analytical Method Greenness Score (AMGS); Analytical Greenness Metrics (AGREE) • Sustainability assessment of analytical methods (Whiteness assessment algorithm) Learning Outcomes: • Students will develop skills to apply various tools for assessing the environmental impact of analytical methods and propose improvements to reduce the ecological footprint.
13	Interrelation with Other Courses	Knowledge from this course is related to: Analytical Chemistry for Pharmacists, Instrumental Pharmaceutical Analyses, Quality control of medicines and pharmaceutical legislation and Bioanalytical Chemistry.

14	Teaching and Working Methods	Teaching Methods: • Lectures • Interactive classes including discussion of selected problems, tasks and case studies Working Methods: • Problem solving (students work individually or in groups to solve specific problems aimed at developing research and analytical skills, teamwork and application of theoretical knowledge) • Seminar work (preparation of a project involving research of a selected topic to develop independent research abilities and presentation skills)
15	Total Available Contact Hours	120 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 30 hours 16.2. Exercises (laboratory, auditory): /
17.	Other Forms of Activities	17.1. Project work / seminar: 22.5 hours 17.2. Independent learning: Preparation for theoretical teaching: 45 hours Preparation for practical teaching: / 17.3. Examination preparation: 22.5 hours
18.	Requirements for Course Signature	Minimum of 30 points from the planned activities (16.1, 17.1)
19	Assessment Method	19.1. Final exam (if no colloquia): 26–50 points 19.2. Colloquia: / 19.3. Practical exam: / 19.4. Seminar work, written/oral presentation or project: 5-20 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Miguel de la Guardia, Salvador Garrigues. Handbook of Green Analytical Chemistry. John Wiley & Sons, Ltd., West Sussex, United Kingdom. 2. Miguel de la Guardia, Salvador Garrigues. Challenges in Green Analytical Chemistry, 2nd Edition. The Royal Society of Chemistry, London, UK Additional: 1. Nakov N., Acevska J., Brezovska K., Kavakovski Z., Dimitrovska A. Green Strategies toward Eco-Friendly HPLC Methods in Pharma Analysis. <i>In</i>: High

		Performance Liquid Chromatography – Recent Advances and Applications. IntechOpen, London, UK, 2020.
		2. Relevant scientific papers from international scientific journals.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	ETHNOPHARMACOLOGICAL APPROACH IN THE DEVELOPMENT OF NEW HERBAL PREPARATIONS			
2	Code	FFIP L03			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	3 / 4 / 5	Semester:	VI / VII / VIII and IX
7	Workload expressed in ECTS credits	4 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Biljana Bauer (course coordinator) Prof. Dr. Gjoshe Stefkov Asst. Prof. Dr. Ana Trajkovska Matevska Asst. Prof. Dr. Veronika Stoilkovska Gjorgievska			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Signature obtained in Pharmaceutical Botany and Biology (II semester). Prerequisite for assessment: Credits obtained in Pharmaceutical Botany and Biology.			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: The aim of the course is to introduce students to the concepts of ethnobotany and ethnopharmacology, fieldwork and data-collection methodologies, as well as laboratory approaches for evaluation and validation of traditional use, as a basis for the development of contemporary herbal medicinal products and design of new, conventional medicines. Part of the program provides insight into the history, demography and cultural context of medicinal plant use and aims to familiarize students with intellectual property rights relevant to this field. Learning outcomes: Students will acquire knowledge and understanding related to:			

		• the history, demography and cultural context of medicinal plant use • the use of medicinal plants in other cultures • the significance of ethnobotany, ethnopharmacognosy, ethnopharmacy and ethnopharmacology as disciplines covering different aspects of medicinal plant use throughout history and today • the role of ethnopharmacology as a basis for new drug development • the impact of ethnopharmacology on the safety and rational use of herbal medicines • global trends in commercialization of traditional medicines from traditional medical systems (Ayurveda, TCM, etc.) • intellectual property rights related to traditional uses of medicinal plants
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	The course content consists of three chapters, divided into several thematic units: Chapter 1: Introduction to Ethnopharmacology, Basics of Traditional Medicine, Research Methods, Biopiracy and Ethical Aspects • Definition of rational use of medicines • Historical development of herbal medicine • The role of ethnopharmacology in modern science • Ethnopharmacology as a bridge between traditional and modern medicine • Traditional medical systems: Ayurveda, Traditional Chinese Medicine, African and Indigenous systems • Medicinal plants in cultural and historical context • Basic principles for selecting plants for ethnopharmacological research • Preservation and documentation of traditional knowledge • Field research: interviews, surveys, observations • Ethnobotanical approach to selecting potential plants • Chemical analyses of herbal extracts • Bioactivity and screening of medicinal plants • What is biopiracy and why must it be avoided? • Agreements and policies for protection of traditional knowledge (CBD – Convention on Biological Diversity) • Principles of fair and equitable benefit-sharing • Ethical aspects of work with local communities Learning outcome: Students gain knowledge on ethnopharmacology, fundamentals of traditional medicine, research methodologies, biopiracy and ethical considerations. Chapter 2: Bioactive Compounds in Medicinal Plants, Development of New Herbal Preparations,

		Ethnopharmacology and Systems Medicine, Regulatory Aspects • Methods for extraction and isolation of bioactive compounds • Biological activity screening and identification of pharmacological potential • Modern analytical technologies: LC–MS, GC–MS, NMR • From ethnopharmacological information to product development • Challenges in extract standardization • Formulation and stability of new preparations • Criteria for clinical evaluation of novel herbal preparations • Holistic approaches in ethnopharmacology • Effects of herbal extracts on multi-target pathologies • Ethnopharmacology and individualized therapeutic approaches • Examples of successful herbal products based on traditional knowledge • International regulations for development and marketing of herbal products • Registration and patenting of new preparations • Role of the pharmacopoeia in standardization of ethnopharmacological products • Application of ISO standards for herbal products Learning outcome: Students acquire knowledge on bioactive constituents in medicinal plants, development of new herbal preparations, systems medicine, and regulatory aspects. Chapter 3: Examples of Successful Ethnopharmacological Products, Modern Trends and Innovations, Practical Training and Final Evaluation • Overview of successful medicines and preparations based on ethnopharmacological research (e.g., artemisinin, salicylic acid) • Analysis of traditional remedies transformed into modern therapies • Innovative examples of commercialization of ethnopharmacological products • Role of advanced technologies in ethnopharmacological research • Systems biology and its application in ethnopharmacology • Integration of ethnopharmacology into personalized medicine • Sustainable development and biodiversity conservation • Analysis of traditional formulations and their modern interpretation

		• Evaluation of biological activity of herbal extracts • Simulated ethnobotanical research • Case studies: identification of new herbal products • Group project: development of a herbal preparation based on ethnopharmacological data • Final theoretical test • Practical task: simulation of the complete process from ethnopharmacological idea to product Learning outcome: Students gain understanding of successful ethnopharmacological products, contemporary trends, innovations, and practical application.
13	Interrelation with Other Courses	1. Prior knowledge from the following subjects is necessary and related to this course: Pharmaceutical Botany and Biology, Phytochemistry, Pharmacognosy, Phytotherapy 2. Knowledge gained in this course is not a prerequisite for any other specific course.
14	Teaching and Working Methods	Teaching Methods: • Lectures • Interactive classes (discussion of tasks, cases, problems) Working Methods: • Laboratory exercises (practical skills) • Problem-solving (individual or group work to develop analytical skills, teamwork, and application of theoretical knowledge) • Project work (research-based project and oral presentation)
15	Total Available Contact Hours	120 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 30 hours 16.2. Exercises (laboratory, auditory): 15 hours
17.	Other Forms of Activities	17.1. Project work / seminar: 7.5 hours 17.2. Independent learning: Preparation for theoretical teaching: 45 hours Preparation for practical teaching: / 17.3. Examination preparation: 22.5 hours
18.	Requirements for Course Signature	Minimum of 30 points from activities (16.1, 16.2, 17.1).
19	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: / 19.3. Practical exam: 6–10 points 19.4. Seminar work, written/oral presentation or project: 1-5 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D)

		76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Kulevanova S., Stefkov Gj., Karapandzova M. Pharmacognosy – Natural Medicinal and Aromatic Raw Materials. UKIM (peer-reviewed textbook). 2011 (hard copy). 2. Kulevanova S., Stefkov Gj., Karapandzova M., Cvetkovikj Karanfilova I. Pharmacognosy – Natural Medicinal and Aromatic Raw Materials. UKIM (peer-reviewed textbook). 2023 (hard copy). 3. A. B. Cunningham. Applied Ethnobotany: People, Wild Plant Use & Conservation. Earthscan Publications Ltd. 2001 (electronic edition). Additional: 1. C. Wiart. Ethnopharmacology of Medicinal Plants – Asia and the Pacific. Humana Press. 2006 (hard copy). 2. A. Singh. Herbalism, Phytochemistry and Ethnopharmacology. Science Publishers. 2011 (electronic edition). 3. G. J. Martin. Journal of Ethnopharmacology / Frontiers in Pharmacology. Chapman & Hall. 1995 (electronic edition).

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	BIOANALYTICAL CHEMISTRY			
2	Code	FFIP L04			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	4 / 5	Semester:	VII / IX
7	Workload expressed in ECTS credits	4 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Jasmina Tonikj Ribarska (course coordinator) Prof. Dr. Natalija Nakov			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Credits obtained in Analytical Chemistry Applied in Pharmacy (III semester). Signature obtained in Instrumental Pharmaceutical Analyses (IV semester) Prerequisite for assessment: /			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: The objective of the course is for students to acquire knowledge on the principles and application of modern techniques and procedures for preparation of biological samples, to become familiar with new trends and analytical methods in bioanalysis, and to gain knowledge on the principles and application of analytical methods for the analysis and stability monitoring of biopharmaceutical products as a new therapeutic concept in disease treatment. Students will be able to apply the acquired knowledge in various pharmaceutical fields (e.g., bioanalytical laboratories, therapeutic drug management, quality control of biopharmaceutical products). Learning outcomes: Upon successful completion of the course, students will acquire: • Knowledge of the principles and application of modern techniques and procedures for preparation of biological samples for analysis • Knowledge of analytical methods used in bioanalysis and their application • Skills to define a bioanalytical problem and apply appropriate strategies for its resolution • Ability to develop new bioanalytical methods and			

		validate them • Knowledge of method selection and its application for analysis of biopharmaceutical preparations At the end of the course, students will be able to apply the acquired knowledge to solve bioanalytical problems, perform bioanalyses, and evaluate obtained analytical results.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter: Introduction to Bioanalytical Chemistry • Basic principles, aims, and tasks of bioanalytical chemistry Learning outcomes: • Students will gain knowledge of the aims and tasks of bioanalytical chemistry and will be able to identify its importance in pharmacy. Chapter: Techniques for Preparation of Biological Samples for Analysis Learning outcomes: • Students will gain knowledge of the principles and application of modern techniques and procedures for preparation of biological samples for analysis. Chapter: Principles and Application of Analytical Methods in Bioanalysis Learning outcomes: • Students will gain knowledge of new trends and application of analytical methods in bioanalysis. Chapter: Development and Validation of Bioanalytical Methods Learning outcomes: • Students will gain knowledge on defining a bioanalytical problem, developing new bioanalytical methods, and performing their validation. Chapter: Application of Bioanalytical Methods for Monitoring Drug and Metabolite Concentrations During Therapy Learning outcomes: • Students will gain knowledge of the role and importance of bioanalytical methods in monitoring drug and metabolite concentrations during therapy, evaluating results, and supporting therapeutic drug management. Chapter: Application of Bioanalytical Methods in Quality Control of Biopharmaceutical Products Learning outcomes: • Students will gain knowledge of selecting appropriate

		analytical methods and their application in analysis and stability monitoring of biopharmaceutical products.
13	Interrelation with Other Courses	Knowledge from this course is related to: Analytical Chemistry Applied in Pharmacy, Instrumental Pharmaceutical Analyses, Fundamentals of Clinical Pharmacy, Clinical Pharmacy and Pharmacotherapy, Drug Analytics and Legislation.
14	Teaching and Working Methods	Teaching Methods: • Lectures • Interactive classes (discussion of tasks, cases, problems) Working Methods: • Problem-solving (individual or group work to develop analytical skills, teamwork, and application of theoretical knowledge) • Project work (research-based project and oral presentation)
15	Total Available Contact Hours	120 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 30 hours 16.2. Exercises (laboratory, auditory): /
17.	Other Forms of Activities	17.1. Project work / seminar: 30 hours 17.2. Independent learning: Preparation for theoretical teaching: 45 hours Preparation for practical teaching: / 17.3. Examination preparation: 15 hours
18.	Requirements for Course Signature	Minimum of 30 points from activities (16.1, and 16.2).
19	Assessment Method	19.1. Final exam (if no colloquia): 26–50 points 19.2. Colloquia: / 19.3. Practical exam: / 19.4. Seminar work, written/oral presentation or project: 20 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Susan R. Mikkelsen, Eduardo Cortón. Bioanalytical Chemistry, 2nd Edition. John Wiley & Sons, Ltd. 2016. 2. Steen Honoré Hansen, Stig Pedersen-Bjergaard. Bioanalysis of Pharmaceuticals: Sample Preparation,

		Separation Techniques, and Mass Spectrometry. John Wiley & Sons, Ltd. 2015. 3. Richard F. Venn. Principles and Practice of Bioanalysis, 2nd Edition. CRC Press. 2008. 4. Roberto R. Diaz, Tim Wehr, Stephen Tuck. Analytical Techniques for Biopharmaceutical Development. CRC Press. 2005. Additional: 1. Relevant papers in international scientific journals. 2020-ongoing.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	NANOTECHNOLOGIES IN PHARMACEUTICAL TECHNOLOGY			
2	Code	FFIP_L05			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	4 / 5	Semester:	VII and IX
7	Workload expressed in ECTS credits	4 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Asst. Prof. Dr. Dushko Shalabalija (course coordinator) Prof. Dr. Nikola Geshkovski Prof. Dr. Katerina Gorachinova Prof. Dr. Marija Glavash Dodov Prof. Dr. Maja Simonoska Crcarevska Asst. Prof. Dr. Ljubica Mihailova Asst. M.Sc. Teodora Tasevska			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Credits obtained in Pharmaceutical Technology I. Signature obtained in Pharmaceutical Technology II. Prerequisite for assessment: Signature from Nanotechnologies in Pharmaceutical Technology.			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: • The aim of the course is for students to understand fundamental concepts and acquire knowledge regarding: • The application and design of nanopharmaceutical formulations for diagnosis and treatment of infectious diseases, parasitic diseases, autoimmune and inflammatory diseases, other immune system disorders, coronary vascular diseases, and neurodegenerative diseases. • Basic principles of formulation and preparation of nanosystems for administration to the eye, skin and wound treatment, lungs, gastrointestinal tract, cardiovascular system and CNS. • Aspects of efficacy, biocompatibility, toxicological profile and clinical application of nanopharmaceutical products. Learning outcomes: Upon completion of the course, the student will acquire specific knowledge and fully master the			

		concepts of designing nanopharmaceuticals for different disease conditions and routes of administration, as well as their advantages in clinical therapy and diagnostics. Students will be able to: • Critically evaluate the differences between conventional therapy and nanotechnology-based therapeutic approaches, and consequently make patient-oriented decisions regarding their application. • Understand design concepts and production aspects of nanopharmaceuticals and participate in the development and standardization of nanopharmaceutical dosage forms. • Understand the concepts of quality, safety and efficacy and participate in the implementation of quality standards for nanopharmaceuticals.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Methodological units included in the program: • Nanopharmaceuticals for the treatment of ocular diseases • Nanopharmaceuticals for skin diseases and wound management • Nanopharmaceuticals for CNS disorders • Nanopharmaceuticals for cardiovascular diseases • Nanopharmaceuticals for gastrointestinal diseases • Nanopharmaceuticals for pulmonary diseases • Nanopharmaceuticals for viral, bacterial and parasitic infections • Defining the toxicological profile, safety and efficacy of nanopharmaceuticals Within the above units, the course will elaborate design concepts, formulation approaches and quality assurance aspects. The student will gain detailed knowledge regarding: • The role of pathophysiology and route of administration in selecting the appropriate nanopharmaceutical design concept • Approaches for preparing effective and safe nanosystems through optimized and reproducible methods • Specific aspects of characterization and quality assurance of nanopharmaceuticals.
13	Interrelation with Other Courses	1. Prior knowledge from the following subjects is necessary and related to this course: Anatomy with Physiology and Pharmaceutical Technology II. 2. The knowledge gained is relevant for following the content of other elective courses.
14	Teaching and Working Methods	Teaching Methods: • Lectures

		• Interactive classes (discussion of tasks, cases, problems) Working Methods: • Laboratory exercises (practical skills) • Problem-solving (individual or group work to develop analytical skills, teamwork, and application of theoretical knowledge) • Project work (research-based project and oral presentation)
15	Total Available Contact Hours	120 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 30 hours 16.2. Exercises (laboratory, auditory): 15 hours
17.	Other Forms of Activities	17.1. Project work / seminar: 7.5 hours 17.2. Independent learning: Preparation for theoretical teaching: 45 hours Preparation for practical teaching: 45 hours 17.3. Examination preparation: 15 hours
18.	Requirements for Course Signature	Minimum of 30 points from activities (16.1, 16.2, 17.1).
19	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: C1: 13–25 points C2: 13–25 points 19.3. Practical exam: / 19.4. Seminar work, written/oral presentation or project: 6–10 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Mahendra Rai, Carolina Alves dos Santos. Nanotechnology Applied to Pharmaceutical Technology. Springer. 2017 (electronic edition). 2. Ivone Perrie, Thomas Rades. Pharmaceutics: Drug Delivery and Targeting. Pharmaceutical Press. 2010 (electronic edition). 3. Loyd V. Allen. Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems, 11th Ed. Lippincott Williams & Wilkins. 2017 (electronic edition). Additional: 1. Relevant articles in international scientific journals (electronic edition).

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	PREVENTION AND TREATMENT OF POISONING			
2	Code	FFIP L06			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	3 / 4	Semester:	VI and VIII
7	Workload expressed in ECTS credits	4 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Tatjana Kadifkova Panovska (course coordinator) Prof. Dr. Tanja Petreska Ivanovska Asst. Prof. Dr. Zoran Zivikj			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Credits obtained in Pathology and Pathophysiology (3rd semester) and Biochemistry (4th semester). Prerequisite for assessment: <u>Signature from Prevention and Treatment of Poisoning.</u>			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: The aim of this course is to provide students with practical understanding of the prevention, recognition, and management of poisoning. The course includes clinical aspects of toxic exposures, mechanisms of toxicity, risk factors, and routes of exposure across natural, agricultural, industrial, medical, and household settings. Further aim is to equip students with competencies in identifying and managing adverse effects from pharmaceutical misuse, substance withdrawal, and acute and chronic poisonings. Learning outcomes: Upon successful completion of the course, the student will be able to: • Explain the principles of prevention and clinical management of poisoning across various exposure settings; • Identify and evaluate routes of exposure and risk factors associated with toxic substances in natural, agricultural, industrial, medical, and household settings; • Explain epidemiological aspects of poisoning and the importance of preventive measures; • Recognize clinical signs of poisoning, potential toxin sources, and management approaches; • Develop treatment plans for poisoning cases, including first aid measures, decontamination methods, supportive care, and antidotal therapies;			

		• Develop practical strategies for prevention, education, and intervention in cases of toxin exposure.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter: Introduction to Poisoning Covers general principles of prevention, treatment, and assessment of poisoning. Learning outcomes: Students will be able to understand and explain the concepts related to prevention and management of poisoning, to classify types of toxic exposures, and to identify common sources and settings of toxic exposures. Chapter: Poisoning from Pharmaceuticals and Drug Misuse Includes potential toxicity of analgesics, antipyretics, anti-inflammatory drugs, anesthetics, depressants, drugs acting on the autonomic nervous system, antiseptics, cardiovascular drugs, anti-infectives, stimulants, antidepressants, antimanic drugs, anticonvulsants, antipsychotics, rubefacients, laxatives, endocrine-active drugs, and various therapeutic and diagnostic agents. Learning outcomes: Students will be able to identify common patterns of pharmaceutical overdose and misuse, evaluate adverse effects, toxic interactions, and high-risk medications, manage acute overdose cases using clinical guidelines, and recommend preventive and therapeutic measures (emergency, general, and personal interventions). Chapter: Agricultural and Industrial Poisons Includes potential toxicity of nitrogen compounds, halogenated hydrocarbons, pesticides, heavy metals, corrosive substances, cyanides, and sulfides. Learning outcomes: Students will be able to identify major agricultural and industrial toxicants, evaluate adverse effects, recommend preventive and therapeutic interventions, and explain regulatory and safety requirements for workers. Chapter: Household Poisoning Includes potential toxicity of cosmetic products, various household chemicals, and foodborne poisoning. Learning outcomes: Students will be able to identify risks associated with cleaning agents, cosmetics, alcohols, and domestic products, evaluate adverse effects, outline common

		accidental exposures in children and adults, recommend preventive and therapeutic measures, and educate the public on safe handling and storage. Chapter: Natural Toxins and Environmental Hazards Includes toxic agents originating from plants, animals, fungi, and microorganisms, as well as hazards arising from environmental contamination. Learning outcomes: Students will be able to identify toxic risks from plants, animals, fungi, and environmental pollutants, assess the clinical significance of environmental contamination events, evaluate adverse effects, and recommend measures for prevention.
13	Interrelation with Other Courses	Prior knowledge from Pathology and Pathophysiology (3rd semester) and Biochemistry (4th semester) is required and directly related to this course.
14	Teaching and Working Methods	Teaching Methods: • Lectures • Interactive classes (discussion of tasks, cases, problems) Working Methods: • Problem-solving (individual or group work to develop analytical skills, teamwork, and application of theoretical knowledge) • Project work (research-based project and oral presentation)
15	Total Available Contact Hours	120 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 30 hours 16.2. Exercises (laboratory, auditory): /
17.	Other Forms of Activities	17.1. Project work / seminar: 15 hours 17.2. Independent learning: Preparation for theoretical teaching: 60 hours Preparation for practical teaching: / 17.3. Examination preparation: 15 hours
18.	Requirements for Course Signature	Minimum of 25 points from activities (16.1, 17.1).
19	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: / 19.3. Practical exam: / 19.4. Seminar work, written/oral presentation or project: 10–20 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)

21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Dreisbach, R.H., True, B-L., <i>Handbook of Poisoning: Prevention, Diagnosis and Treatment</i>, CRC Press, 2001 / 13th edition - digital issue. 2. Landis, W.G., Sofield, R.M., Yu, M-H., <i>Introduction to Environmental Toxicology</i>, CRC Press, 2011 / 4th edition - digital issue. 3. Winder, C., Stacey, N.H., <i>Occupational Toxicology</i>, CRC Press, 2004 / 2nd edition - digital issue. 4. Nordberg, G.F., Fowler, B.A., Nordberg, M., Friberg, L.T., <i>Handbook on the Toxicology of Metals</i>, Academic Press Elsevier, 2007 / 3rd edition - digital issue. 5. Püssa, T., <i>Principles of Food Toxicology</i>, CRC Press, 2014 / 2nd edition - digital issue. Additional: 1. Barile, F.A., Barile's Clinical Toxicology: Principles and Mechanisms, Taylor & Francis Group, 2019 / 3rd edition - digital issue. 2. Klaasen, C.D., <i>Casarett and Doull's Toxicology: The Basic Science of Poisons</i>, 2008 / 7th edition - digital issue.

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	MAGISTRAL AND GALENICAL MEDICINAL PRODUCTS			
2	Code	FFIP_L07			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	3 / 4	Semester:	VI and VIII
7	Workload expressed in ECTS credits	4 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Maja Simonoska Crcarevska (course coordinator) Prof. Dr. Katerina Gorachinova Prof. Dr. Kristina Mladenovska Prof. Dr. Renata Slavevska Raicki Prof. Dr. Marija Glavash Dodov Prof. Dr. Nikola Geshkovski Asst. Prof. Dr. Ljubica Mihailova Asst. Prof. Dr. Dushko Shalabalija Asst. M.Sc. Teodora Tasevska			
9	Language	English			
10	Prerequisites for attending and passing the course	Prerequisite for attending the course: Signature obtained in Pharmaceutical Technology I. Prerequisite for assessment: Signature from Magistral and Galenical Medicinal Products.			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: The aim of the course is for students to gain knowledge of the fundamental concepts of magistral and galenical medicinal products for human and veterinary use, their significance in the healthcare system, and their practical application, including preclinical and clinical studies. Students will become familiar with regulatory requirements and recommendations on good practices for preparation of these medicinal products in healthcare institutions and study centres, ensuring quality, personnel, infrastructure and equipment, documentation, production, quality control, dispensing, use, complaints and product recalls, and self-inspection. They will learn the standards required for the preparation of sterile and non-sterile magistral and galenical medicinal products for both human and veterinary use. Students will develop skills in formulation, preparation, quality control, dispensing, and use of conventional and homeopathic magistral and galenical medicinal products,			

		as well as knowledge of the principles for determining storage conditions and shelf-life. Students will acquire competencies for managing technological aspects of production in various environments (community pharmacy, hospital pharmacy, galenical laboratories, study centers), and will become familiar with the most commonly prepared products in different dosage forms. Learning outcomes: Upon successful completion of the course, students will be able to: • Demonstrate thorough knowledge of basic concepts of magistral and galenical medicinal products for human and veterinary use, and their importance in the healthcare system. • Demonstrate understanding of regulatory requirements and good practices for preparation, including quality assurance and control of personnel, infrastructure, equipment, and documentation. • Understand standards for the preparation of sterile and non-sterile magistral and galenical medicinal products. • Analyze and evaluate conventional and homeopathic magistral and galenical medicinal products with respect to formulation, quality, stability, storage, shelf-life, dispensing, and use. • Identify and solve problems related to potential deficiencies in manufacturing and quality control. • Acquire practical skills for formulation, preparation, quality control, dispensing, and use of magistral and galenical medicinal products. • Demonstrate competencies for determining storage conditions and shelf-life. • Work effectively in teams to solve challenges related to preparation and application of these products. • Manage technological aspects of production in community and hospital pharmacies, galenical laboratories, and study centres. • Integrate knowledge into practical and regulatory scenarios to ensure effective, safe, and compliant products.
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter 1. Regulatory Requirements for Preparation of Magistral and Galenical Medicinal Products Covers basic concepts and definitions of magistral and galenical products for human and veterinary use (conventional and homeopathic), historical development, and their significance in the healthcare system. Students will become familiar with regulatory documents, good preparation practices (personnel, infrastructure, equipment, documentation), dispensing and use, quality

		management, complaints, product recalls, and self-inspection. Learning Outcomes: Upon completion of this chapter, students will be able to: • Demonstrate understanding of fundamental concepts and regulatory requirements for magistral and galenical products. • Analyse and interpret documents on good preparation practices. • Understand quality management methods and procedures for handling complaints and recalls. • Recognize and apply self-inspection procedures as part of quality assurance. Chapter 2. Formulation and Preparation of Magistral and Galenical Medicinal Products Covers formulation principles, selection of excipients, effect of formulation parameters on stability and quality, methodologies, equipment, and technologies for preparation of sterile and non-sterile products. Includes practical examples, packaging selection, quality control methods, stability, storage conditions, shelf-life, dispensing, and use. Learning Outcomes: Upon completion of this chapter, students will be able to: • Understand fundamental formulation principles. • Select appropriate excipients and packaging. • Apply technologies and methodologies for preparation of sterile and non-sterile products. • Analyse and evaluate stability and storage conditions. • Assess and control product quality. • Demonstrate competence in dispensing and patient counselling. Chapter 3. Technological Aspects of Production in Various Settings Covers organizational and technological principles (conventional and advanced—e.g., 3D printing, machine learning, artificial intelligence) for production in community pharmacies, hospital pharmacies, galenical laboratories, and study centres. Students learn specific requirements and adaptation of processes to dosage forms and environments. Learning Outcomes: Upon completion, students will be able to: • Manage technological aspects in various production environments.

		• Understand specific requirements per setting. • Adapt conventional and advanced technological processes for different types of products. • Apply technological principles in real-world practice. Chapter 4. Practical Case Studies and Projects Covers practical aspects of preparation, dispensing, and application of magistral and galenical products, including special patient populations. Students analyse case studies, work on group projects, and develop optimization solutions. Learning Outcomes: Upon completion, students will be able to: • Integrate regulatory standards into practical scenarios. • Analyse real examples of formulation, preparation, and quality control. • Design and implement optimization projects (conventional and advanced technologies). • Work effectively in teams to address practical issues in dispensing and use. • Plan and execute team tasks efficiently.
13	Interrelation with Other Courses	1. Prior knowledge from Pharmaceutical Technology I is required. 2. Knowledge from this course is relevant for elective course progression.
14	Teaching and Working Methods	Teaching Methods: • Lectures • Interactive classes (discussion of tasks, cases, problems) Working Methods: • Laboratory exercises (practical skills) • Problem-solving (individual or group work to develop analytical skills, teamwork, and application of theoretical knowledge) • Project work (research-based project and oral presentation)
15	Total Available Contact Hours	120 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 15 hours 16.2. Exercises (laboratory, auditory): 30 hours
17.	Other Forms of Activities	17.1. Project work / seminar: 15 hours 17.2. Independent learning: Preparation for theoretical teaching: 22.5 hours Preparation for practical teaching: 15 hours 17.3. Examination preparation: 22.5 hours
18.	Requirements for Course Signature	Minimum of 25 points from activities (16.1, 16.2 and 17.1).
19	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points

		19.2. Colloquia: C1: 13–25 points C2: 13–25 points 19.3. Practical exam: 6-10 points 19.4. Seminar work, written/oral presentation or project: 5 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory: 1. Mark Jackson, Andrew Lowey. Handbook of Extemporaneous Preparation: A Guide to Pharmaceutical Compounding. Pharmaceutical Press. 2010 (electronic edition). 2. John F. Marriott, Keith A. Wilson, Chris Langley, Dawn Belcher. Pharmaceutical Compounding and Dispensing. Pharmaceutical Press. 2010 (electronic edition). 3. PIC/S Secretariat. PIC/S Guide to Good Practices for the Preparation of Medicinal Products in Healthcare Establishments. PIC/S. 2014 (electronic edition). 4. Council of Europe. Resolution CM/Res(2016)1 on Quality and Safety Assurance Requirements for Medicinal Products Prepared in Pharmacies. 2014 (electronic edition). 5. Raymond C. Rowe, Paul J. Sheskey, Marian E. Quinn. Handbook of Pharmaceutical Excipients. Pharmaceutical Press. 2009 (electronic edition). 6. European Pharmacopoeia (electronic edition). 7. British Pharmacopoeia (electronic edition). 8. British National Formulary (electronic edition). 9. United States Pharmacopeia (electronic edition). 10. Gordana Vuleta, Jela Milic. Magistralne formule. Pharmaceutical Society of Serbia. 2010 (hard copy). 11. Marica Medić-Šarić. Formulae magistrales Croaticae. Croatian Pharmaceutical Chamber. 2010 (electronic edition). 12. Pharmaceutical legal acts and regulations. (electronic edition). Additional: 1. Relevant scientific papers published in international journals. (electronic edition).

Appendix No.3		Course syllabus from the first cycle of studies			
1	Title of the Course	BIOCHEMICAL ANALYSES WITH SPECIFIC CLINICAL APPLICATION			
2	Code	FFIP_Z08			
3	Study Program	MASTER OF PHARMACY			
4	Organizing Unit (faculty, institute, department, section)	University 'Ss. Cyril and Methodius' – Skopje Faculty of Pharmacy			
5	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6	Academic Year / Semester	Year:	4 / 5	Semester:	VIII, and IX
7	Workload expressed in ECTS credits	4 ECTS credits			
8	Instructor(s) (in case of multiple instructors, indicate the course coordinator first)	Prof. Dr. Marija Hiljadnikova-Bajro (course coordinator) Prof. Dr. Tatjana Kadifkova Panovska			
9	Language	English			
10	Prerequisites for attending and passing the course	Enrollment requirements: completed credits in Pathophysiology (III semester) and Biochemistry (IV semester). Examination requirements: compliance with the attendance requirements of this course.			
11	Course Aims (Competencies) and Learning Outcomes	Course Aims: The aim of the course is to enable students to build upon their foundational knowledge in Clinical Biochemistry through understanding of specific biomarkers and sophisticated analytical tests. Students will comprehend the role of laboratory diagnostics in the diagnosis, prognosis, and monitoring of endocrine, cardiovascular, and other specific diseases, as well as in the assessment of treatment effectiveness. Learning outcomes: Students are expected to acquire solid theoretical knowledge that they will be able to apply in the interpretation of cases/results from real clinical laboratory practice.			
12	Detailed Course Content by Chapters and Units, with Learning Outcomes for Each Chapter	Chapter: Laboratory Analysis of Pituitary and Thyroid Hormone Disorders Content: – Biochemical aspects of laboratory endocrinology in conditions of excessive or insufficient secretion of tropic hormones, growth hormone, vasopressin, prolactin, melatonin, and pathological thyroid hormone secretion. Learning outcomes: – Students will understand the biochemical mechanisms			

		involved in dysregulated pituitary and thyroid hormone secretion and related metabolic disturbances. – They will be able to apply this knowledge in recognizing structural or functional abnormalities of these endocrine glands. Chapter: Laboratory Analysis of Sex Hormones and Adrenal Hormones Content: – Tests for evaluation of reproductive physiology/pathology; assessment of endocrine function of the adrenal cortex and medulla. Learning outcomes: – Students will acquire knowledge of biochemical aspects of different reproductive life phases in males and females, biochemical analyses during pregnancy, assessment of reproductive potential, and diagnosis/monitoring of disorders associated with altered hormonal activity. Chapter: Biochemical Tests for Cardiovascular and Hematological Disorders Content: – Modern analyses for diagnosis of emergency conditions and monitoring of chronic cardiovascular diseases; diagnostic significance of biochemical tests in hematology and transfusion medicine. Learning outcomes: – Students will understand the role of the clinical laboratory in diagnosis, monitoring, and prognosis of myocardial and vascular diseases. – They will understand the components and interpretation of the complete blood count with differential, blood smear, cellular indices, and analyses for detection and monitoring of coagulation disorders. Chapter: Oxidative Stress and Antioxidant Defense Content: – Biochemical aspects of oxidative stress; its role in the pathogenesis of chronic diseases (cardiovascular, neurodegenerative, metabolic). – Mechanisms of enzymatic antioxidants (superoxide dismutase, catalase, glutathione peroxidase) and non-enzymatic antioxidants (vitamins E and C, glutathione). – Laboratory methodologies for assessment of oxidative stress and antioxidant capacity, clinical application, and therapeutic interventions with antioxidant supplements.

		Learning outcomes: – Students will understand the biochemical mechanisms of oxidative stress and its biological impact. – They will apply knowledge to assess the imbalance between oxidative stress and antioxidant defense and develop skills for interpreting laboratory data relevant to diagnosis and therapy.
13	Interrelation with Other Courses	The course is related to and builds upon prior knowledge from: – Biochemistry (IV semester) – Pathology with Pathophysiology (III semester)
14	Teaching and Working Methods	Teaching Methods: • Lectures • Interactive classes (discussion of tasks, cases, problems) Working Methods: • Clinical biochemistry laboratory placement and case analysis from clinical practice • Problem-solving (individual or group work to develop analytical skills, teamwork, and application of theoretical knowledge) • Preparation of a project assignment
15	Total Available Contact Hours	120 hours
16.	Forms of Teaching	16.1. Lectures (theoretical instruction): 25 hours 16.2. Exercises (laboratory, auditory): 10 hours
17.	Other Forms of Activities	17.1. Project work / seminar: 15 hours 17.2. Independent learning: Preparation for theoretical teaching: 50 hours Preparation for practical teaching: / 17.3. Examination preparation: 20 hours
18.	Requirements for Course Signature	Minimum of 30 points from activities (16.1, 16.2 and 17.1).
19	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: / 19.3. Practical exam: 10-20 points 19.4. Seminar work, written/oral presentation or project: 25-30 points
20	Grading Criteria	Up to 60 points – Grade 5 (F) 60–66 points – Grade 6 (E) 67–75 points – Grade 7 (D) 76–84 points – Grade 8 (C) 85–93 points – Grade 9 (B) 94–100 points – Grade 10 (A)
21	Method for Monitoring Teaching Quality	Open discussion and anonymous student survey conducted after course completion.
22	Literature	Mandatory:

		1. Laposata M. Laboratory Medicine: The Diagnosis of Disease in the Clinical Laboratory. McGraw-Hill Medical Publishing Division, 2010 (hard copy available at the Faculty of Medicine Library). 2. Straus B. Medicinska Biokemija. Medicinska Naklada, Zagreb, 1992. 3. Michael Breitenbach, Peter Eckl. Oxidative Stress in Health and Disease. MDPI, 2016 (electronic edition). Additional: 1. Bishop LM, Fody PE, Schoeff EL. Clinical Chemistry: Principles, Procedures, Correlations. Prosvetno Delo AD, Skopje, 2009 (hard copy). 2. Devlin MT. Textbook of Biochemistry with Clinical Correlations, 7th Edition. Ars Lamina, Skopje; Biblioteca Braća Miladinovci. 3. Relevant scientific papers published in international journals. (electronic edition).

Appendix No.3		Course syllabus from the first cycle of studies
No.	Field	Content
1.	Title of the Course	DIETARY SUPPLEMENTS AND NUTRIVIGILANCE
2.	Code	FFIP Z09
3.	Study Programme	MASTER OF PHARMACY
4.	Organising Unit (Faculty, Institute, Department, Section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Applied Biochemistry
5.	Level (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Year: 4th, 5th Semester: VII and IX
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturers (the course coordinator listed first)	Asst. Prof. Dr. Zoran Zivikj (course coordinator) Prof. Dr. Tanja Petreska Ivanovska
9.	Language of Instruction	English
10.	Prerequisites for Attending and Passing the Course	Prerequisite for attending the course: Credit in Biochemistry (IV semester) Prerequisite for assessment: Signature from Dietary Supplements and Nutrivigilance
11.	Course Objectives (Competences) and Learning Outcomes	Course Aims: The aim of this course is gaining knowledge and skills for critical evaluation of the quality, efficacy, and safety of dietary supplements and application of nutrivigilance principles in identifying, assessing, and preventing adverse effects associated with their use. Learning Outcomes: Upon successful completion of the course, students will be able to: • Explain the key concepts related to the quality, efficacy, and safety of dietary supplements; • Understand regulatory criteria for marketing authorization of dietary supplements; • Assess potential health benefits and risks associated with supplement use, including interactions, contamination, and inappropriate dosing; • Apply nutrivigilance principles and methodologies to monitor, document, and analyze adverse events; • Develop evidence-based recommendations to minimize risks and ensure responsible use of dietary supplements.
12.	Detailed Course Content by Chapters and Learning Outcomes	Chapter: Introduction to Dietary Supplements Definitions, categories, and regulatory distinctions. Overview of market trends and consumer use. Active ingredients and claimed health benefits. Learning outcomes: Students will be able to describe the categories of dietary supplements, formulation types, and intended uses, identify the active ingredients, recognize the claimed health benefits of major classes of dietary supplements, analyze the factors influencing supplement quality, stability, and bioavailability, and evaluate consumer trends and patterns

		of dietary supplement use. Chapter: Vitamins Quality, efficacy, and safety of dietary supplements containing vitamins, and the benefits and risks associated with their use. Learning outcomes: Students will be able to explain the quality, efficacy, and safety requirements for vitamin-containing supplements. Chapter: Minerals Quality, efficacy, and safety of dietary supplements containing minerals, and the benefits and risks associated with their use. Learning outcomes: Students will be able to explain the quality, efficacy, and safety requirements for mineral-containing supplements. Chapter: Probiotics and Prebiotics Quality, efficacy, and safety of dietary supplements containing probiotics and prebiotics, and the benefits and risks associated with their use. Learning outcomes: Students will be able to explain the quality, efficacy, and safety requirements for probiotic and prebiotic supplements. Chapter: Protein Derivatives Quality, efficacy, and safety of dietary supplements containing protein derivatives, including performance-enhancing supplements; benefits and risks of their use. Learning outcomes: Students will be able to explain the quality, efficacy, and safety requirements for protein-based supplements, including those for improving athletic performance. Chapter: Drug–Supplement Interactions Potential risks arising from drug–supplement interactions, their impact on nutritional status, implications on therapeutic outcomes of the drugs, evidence-based strategies for identifying and preventing high-risk interactions. Learning outcomes: Students will be able to identify risks related to drug–supplement interactions, explain their impact on nutritional status and therapeutic outcomes, and develop evidence-based strategies for identifying and preventing high-risk interactions. Chapter: Nutrivigilance Definition, scope, and significance of nutrivigilance. Learning outcomes: Students will be able to explain the scope and objectives of nutrivigilance in the context of dietary supplement use and public health and discuss the role of nutrivigilance in ensuring consumer safety.
13.	Course Interrelation	Prior knowledge from the course Biochemistry (IV semester) is required/related to this course.
14.	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive sessions including discussions of specific cases, tasks, and problems.

		Working methods: 1. Problem-solving (students work individually or in groups to enhance research, analytical skills, teamwork, and application of theoretical knowledge). 2. Project work (developing a research project to foster independent research abilities and presentation skills).
15.	Total Workload	120 hours
16.	Forms of Teaching Activities	16.1. Lectures (theoretical instruction): 30 hours 16.2. Exercises (laboratory, auditory): /
17.	Other Forms of Activities	17.1. Project work / seminar: 15 hours 17.2. Independent learning: Preparation for theoretical teaching: 60 hours Preparation for practical teaching: / 17.3. Examination preparation: 15 hours
18.	Requirments for Course Signature	At least 25 points from the prescribed activities (16.1, 17.1).
19.	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: / 19.3. Practical exam: / 19.4. Written/oral presentation or project: 10–20 points
20.	Grading Criteria (points/grade)	Up to 60 pts – 5 (F) 60–66 pts – 6 (E) 67–75 pts – 7 (D) 76–84 pts – 8 (C) 85–93 pts – 9 (B) 94–100 pts – 10 (A)
21.	Method for Quality Assurance of Teaching	Open discussion and anonymous student survey conducted after course completion.
22.	Literature	22.1. Mandatory Literature 1. Gupta, R. C. – <i>Nutraceuticals: Efficacy, Safety and Toxicity</i> , Academic Press (Elsevier), 2016 (electronic version) 2. Berginc, K. & Kreft, S. – <i>Dietary Supplements: Safety, Efficacy and Quality</i> , Woodhead Publishing (Elsevier), 2015 (electronic version) 3. Boullata, J. I. & Armenti, V. T. – <i>Handbook of Drug–Nutrient Interactions</i> , Humana Press, 2010 (2nd edition, electronic) 4. Pintauro, S. J. – <i>The Regulation of Dietary Supplements</i> , Taylor & Francis Group, 2019 (electronic version) 22.2. Additional Literature 1. Wildman, R. E. C., Bruno, R. S. – <i>Handbook of Nutraceuticals and Functional Foods</i> , Taylor & Francis Group, 2020 (3rd edition, electronic) 2. Coates, P. M. et al. – <i>Encyclopedia of Dietary Supplements</i> , Informa Healthcare, 2010 (electronic) 3. Egbuna, C. & Dable-Tupas, G. – <i>Functional Foods and Nutraceuticals</i> , Springer, 2020 (electronic)

Appendix No.3		Course syllabus from the first cycle of studies
1.	Title of the Course	RATIONAL USE OF HERBAL PREPARATIONS
2.	Code	FFIP Z10
3.	Study Programme	MASTER OF PHARMACY
4.	Organising Unit (Faculty, Institute, Department, Section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Pharmacognosy
5.	Level (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Year: Fourth, Fifth Semester: VII, IX
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturers (the course coordinator listed first)	Prof. Dr. Gjoshe Stefkov (course coordinator) Prof. Dr. Marija Karapandžova Asst. Prof. Dr. Ivana Cvetkovikj Karanfilova Asst. Prof. Dr. Ana Trajkovska Asst. Prof. Dr. Veronika Stoilkovska Gjorgievska
9.	Language of Instruction	English
10.	Prerequisites for Attending and Passing the Course	Prerequisite for attending: obtained signature in Phytochemistry (IV semester), Pharmacognosy (V semester) and Phytotherapy (VI semester). Prerequisite for assessment: none.
11.	Course Objectives (Competences) and Learning Outcomes	Course Objectives To familiarise students with the rational use of herbal medicines, their pharmacology, interactions and safety; clinical approaches to rational use; and regulatory, cultural and ethical aspects. Learning Outcomes – Students will acquire knowledge regarding: • the concept of rational use of herbal medicines, historical development, and the importance of education for rational use; • botanical and phytochemical foundations, extraction methods and formulation of herbal preparations; • pharmacology of herbal preparations, therapeutic potential and limitations; • interactions and safety of herbal preparations; • clinical approaches to rational use; • regulatory, cultural and ethical aspects.
12.	Detailed Course Content by Chapters and Learning Outcomes	The course comprises 5 chapters delivered through theoretical and practical teaching, divided into several units: Chapter 1: Introduction to the Rational Use of Herbal Preparations • Definition of rational use of medicines. • Historical development of herbal medicine. • Contemporary application of herbal preparations in pharmacy. • Importance of education for rational use. Learning outcomes: Students define rational use of herbal preparations, explain historical development and modern application, and articulate their significance.

		Chapter 2: Pharmacology of Herbal Preparations • Basics of pharmacokinetics and pharmacodynamics of herbal preparations. • Effects on organ systems: cardiovascular, digestive, nervous, immune. • Therapeutic potentials and limitations. Learning outcomes: Students explain PK/PD specifics of herbal preparations, system-level effects, therapeutic potential and limitations. Chapter 3: Interactions and Safety • Interactions between herbal preparations and conventional medicines. • Contraindications and possible adverse effects. • Toxicological profile of herbal preparations. • Regulatory requirements for herbal preparations. Learning outcomes: Students identify interactions, contraindications, toxicological characteristics and regulatory requirements for this group of medicines. Chapter 4: Clinical Approach to Rational Use • Indications for use of herbal preparations. • Dosing and formulations: teas, tinctures, capsules, oils. • Evaluation of clinical evidence of efficacy. • Patient management and monitoring during use. • Growing popularity of personalised herbal medicine. Learning outcomes: Students explain indications, dosing and available formulations; evaluate clinical efficacy and plan patient monitoring during therapy with herbal preparations. Chapter 5: Cultural and Ethical Aspects • Global differences in approaches to herbal preparations. • Traditional medicine vs. contemporary science. • Ethical aspects of recommending/prescribing herbal preparations. Learning outcomes: Students differentiate between traditional medicine and contemporary science and discuss ethical issues in recommending herbal preparations.
13.	Course Interrelation	1) Prior knowledge in: Pharmaceutical Botany and Biology, Phytochemistry, Pharmacognosy and Phytotherapy is required/related. 2) Knowledge from this course is required for: none.
14.	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive sessions including discussions of specific tasks, cases and problems Working methods: 1. Laboratory exercises (practical skills) 2. Problem-solving (individual/group work to develop research and analytical skills, teamwork and application of theoretical

		knowledge) 3. Project work (developing a project involving research on a given topic to build independent research and presentation skills).
15.	Total Workload	120 hours
16.	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 30 hours 16.2. Exercises (laboratory, auditory): 15 hours
17.	Other Forms of Activities	17.1. Project/seminar tasks: 5 hours 17.2. Independent learning: 45 hours 17.3. Examination preparation: 25 hours
18.	Requirments for Course Signature	At least 30 points from the prescribed activities (16.1, 16.2, 17.1).
19.	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquium: / 19.3. Practical exam: 6–10 points 19.4. Written/oral seminar or project presentation: 1–5 points
20.	Grading Criteria (points/grade)	Up to 60 pts – 5 (F) 60–66 pts – 6 (E) 67–75 pts – 7 (D) 76–84 pts – 8 (C) 85–93 pts – 9 (B) 94–100 pts – 10 (A)
21.	Method for Quality Assurance of Teaching	Open discussion and anonymous student survey conducted after completion of the course.
22.	Literature	22.1. Mandatory Literature 1. Kulevanova, S.; Stefkov, Ğ.; Karapandžova, M.; Cvetkovikj Karanfilova, I. – <i>Pharmacognosy: Natural Medicinal and Aromatic Raw Materials</i> , UKIM (peer-reviewed textbook), 2023 (electronic edition). 2. Kulevanova, S. – <i>Fundamentals of Phytotherapy</i> , Ss. Cyril and Methodius University in Skopje, 2021 (electronic edition). 22.2. Additional Literature 1. Williamson, E.; Driver, S.; Baxter, K. – <i>Stockley's Herbal Medicines Interactions: A Guide to the Interactions of Herbal Medicines</i> , Pharmaceutical Press, 2013 (electronic edition). 2. Schulz, V.; Hänsel, R.; Tyler, V. – <i>Rational Phytotherapy: A Physicians' Guide to Herbal Medicine</i> , Springer Berlin Heidelberg, 2012 (electronic edition).

Appendix No.3		Course syllabus from the first cycle of studies
1.	Title of the Course	THERAPEUTIC DRUG MONITORING (TDM)
2.	Code	FFIP_Z11
3.	Study Programme	MASTER OF PHARMACY
4.	Organising Unit (Faculty, Institute, Department, Section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Pharmaceutical Chemistry
5.	Level (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Year: 5th Semester: IX
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturers (the course coordinator listed first)	Prof. Dr. Aleksandra Kapedanovska Nestorovska (course coordinator) Prof. Dr. Zoran Sterjev Prof. Dr. Kristina Mladenovska Prof. Dr. Nadica Matevska Geshkovska Prof. Dr. Jasmina Tonikj Ribarska Prof. Dr. Ana Poceva Panovska Asst. Prof. Dr. Evgenija Mihajloska
9.	Language of Instruction	English
10.	Prerequisites for Attending and Passing the Course	For attending: (completed) Clinical Pharmacy, VIII semester; Biopharmaceutics, VIII semester; (enrolled) Pharmacogenetics and Pharmacogenomics – Individualisation of Therapy. For assessment: (passed) Basics of Clinical Pharmacy, VII semester; Pharmaceutical Care, VII semester; Clinical Pharmacy, VIII semester; Biopharmaceutics, VIII semester.
11.	Course Objectives (Competences) and Learning Outcomes	Objectives To develop understanding of the principles of Therapeutic Drug Monitoring (TDM) through application of clinical pharmacokinetics and skills for individualising dosing regimens to achieve and optimise desired patient-oriented therapeutic outcomes. Students will apply the acquired knowledge and skills to obtain and interpret pharmacokinetic results; analyse and solve problems related to drug selection and dosing optimisation; and, in collaboration with the multidisciplinary healthcare team, make decisions for safe and effective pharmacotherapeutic dosing regimens in clinical practice. Learning Outcomes – Upon completion, the student will be able to: • Define and distinguish the principles and aims of TDM in correlation with pharmacokinetics and clinical pharmacokinetics. • Recognise benefits of implementing TDM for specific drug classes as a clinical-pharmacy service.

		• Understand effects of pre-analytical variables in TDM. • Identify and resolve challenges in implementing TDM. • Demonstrate practical dose and regimen optimisation using appropriate PK/PD models for patient-specific dosing problems.
12.	Detailed Course Content by Chapters and Learning Outcomes	GENERAL PART: INTRODUCTION TO TDM Chapter 1: Introduction to Therapeutic Drug Monitoring (TDM) • Fundamentals of pharmacokinetics, clinical pharmacokinetics and TDM; monitoring unbound vs. total drug concentrations; PK consequences of protein binding. • Rationale and clinical benefits of TDM for selected drug classes: anticonvulsants, cardioactive drugs, anti-asthmatics, antidepressants, immunosuppressants, antiretrovirals, antineoplastics and other clinically significant classes. • Pathophysiological states and other factors affecting drug concentrations – genetic variations in drug metabolism and their impact on TDM; effects of age, sex, pregnancy, body weight, renal function; drug–herbal supplement interactions and their significance for interpretation. • Disposition in uraemia, hepatic disease, cardiovascular disease, thyroid dysfunction. • Clinical aspects of TDM across therapeutic classes. Chapter 2: Practical Aspects of TDM • Understanding and minimising measurement uncertainty in the clinical laboratory – effects of pre-analytical variables; sample type (serum vs. plasma); in vivo/in vitro alterations in protein binding; potential errors. • Sampling: site, method and timing; sample volume; suitability of collection materials; sample preparation steps. • Dose adjustment using PK models – Bayesian estimation (principles); impact of analytical techniques on measured concentrations; deriving population PK parameters; limited sampling strategies; reference values; validation and performance predictability; clinical transferability examples – aminoglycosides, tacrolimus in transplantation. Chapter 3: Analytical and Immunochemical Techniques for TDM • Sample preparation from biological matrices; principles and application of analytical methods for TDM. • Immunoassays – design principles and commonly used TDM platforms: enzyme-based and non-enzyme assays, fluorescence-based, turbidimetry and nephelometry. • Advantages/limitations of analytical methods for selected drug classes; alternative matrices; method selection; examples of clinical application and transferability.

		Chapter 4: Pharmacogenomic Techniques and Methods for TDM • Advanced technologies for human exome/genome analysis generating big data – microarrays, next-generation sequencing; library preparation based on hybridisation/capture of target regions or amplicon approaches. • Handling and analysis of big data; machine learning; use of information generated by advanced technologies. • Advantages/limitations of the pharmacogenomic approach for selected classes; examples of clinical application and transferability. Chapter 5: Pharmacodynamic Biomarkers for TDM of Immunosuppressants and Antineoplastic Drugs • Utility of biomarkers in drug monitoring; biomarkers of efficacy for immunosuppressants (e.g., target enzyme differences; NFAT-regulated expression in lymphocytes; CD8+ IL-2-producing T cells; activation markers; tolerance biomarkers). • Biomarkers of efficacy for antineoplastics (e.g., activation/inactivation enzymes; receptor binding/expression; constitutive signalling pathway activation; mutation burden). Chapter 6: PK/PD Principles in Dose Selection and Optimisation • PK modelling (compartmental; physiologically based), population PK (parametric/non-parametric); PD modelling (MIC; in vitro/in vivo; Monte-Carlo simulations). • Pharmacometrics – concept, components, process; data types and modelling approaches (mathematical, statistical, physiological); model evaluation; application in clinical PK and TDM. • Applied PK/PD modelling for selected drugs (e.g., piperacillin/tazobactam) with practical pharmacometrics examples in special populations. Learning outcomes (General Part): Students will be able to: • Define and describe the principles of clinical PK; benefits in routine practice; kinetic homogeneity; PD in correlation with PK; concept of therapeutic concentration ranges. • Identify technical and clinical aspects significant for TDM – genetic/non-genetic factors driving intra/inter-individual variability in disposition and response, and explain their impact on interpretation. • Discuss fundamentals of (1) analytical and immunochemical methods and their pros/cons underpinning method selection in TDM, and (2) advanced genomic technologies and their practical use, including as tools in

		TDM to explain individual PK/PD differences. • Advance skills in PK/PD modelling towards practical pharmacometric application for dose and regimen optimisation. SPECIAL PART: TDM OF SPECIFIC DRUGS AND CLASSES Chapter 6: Guidelines and Recommendations – Vancomycin, Aminoglycosides and Selected Antibiotics • Vancomycin – PK/PD aspects; TDM approach and recommended guidelines. • Aminoglycosides – PK/PD aspects; TDM approach and recommended guidelines. • TDM-guided selection and optimisation of dose/regimen for: β-lactams; sulphonamides & trimethoprim; chloramphenicol & tetracyclines; quinolones; macrolides; antituberculars. • Clinical decision-making examples. Chapter 7: Guidelines and Recommendations – Cardioactive Drugs (Anticoagulants & Antiarrhythmics) • Digoxin – PK/PD, TDM approach and guidelines; challenges (metabolite interference with immunoassays; spironolactone and related drugs; herbal supplements). • Challenges in monitoring antiarrhythmics by class (IA, IB, IC, II, III, IV). • Pharmacogenetic aspects in warfarin TDM (CYP2C9, VKORC1); non-genetic dose modifiers (vitamin K, diet, age, sex, anthropometrics); therapeutic alternatives to warfarin. • PK/PD and TDM of unfractionated heparin, low-molecular-weight heparins and direct oral anticoagulants. Chapter 8: Guidelines and Recommendations – Antiepileptics and Antidepressants • Indications for unbound drug measurement; TDM specifics for classical vs. newer anticonvulsants; analytical and pharmacogenetic aspects (CYP2C9, CYP2C19, CYP2D6) for antidepressants and antipsychotics; challenges including active metabolites. • TDM-guided dosing for selected antiepileptics (carbamazepine, valproic acid, gabapentin, lamotrigine, levetiracetam, pregabalin, topiramate). • TDM-guided dosing for selected antidepressants – tricyclics (imipramine, nortriptyline) and SSRIs/SNRIs (escitalopram, duloxetine, venlafaxine) and their metabolites. • TDM-guided dosing for selected antipsychotics and metabolites (clozapine, risperidone, olanzapine,

		aripiprazole). Chapter 10: Guidelines and Recommendations – Selected Antineoplastics and Immunosuppressants • Traditional TDM approaches – methotrexate, busulfan. • Pharmacogenetic aspects – constitutional vs. tumour genetics. • Class-based TDM: mercaptopurine, irinotecan, 5-fluorouracil, tamoxifen; anti-EGFR antibodies and tyrosine kinase inhibitors; calcineurin inhibitors (cyclosporine, tacrolimus); mTOR inhibitors (sirolimus, everolimus); mycophenolic acid. Chapter 11: Guidelines and Recommendations – Antiretrovirals for HIV • Therapeutic targets in HIV TDM. • TDM in special populations – pregnancy, paediatrics/adolescents, geriatrics; hepatitis; drug interactions; toxicity management. • Class-based TDM – nucleoside & non-nucleoside reverse transcriptase inhibitors, protease inhibitors, and other classes. • Practical challenges in TDM-guided management of HIV therapy. Chapter 12: Rationale for TDM in Mixed Drug Classes • Antifungals – basic TDM principles; TDM for selected systemic antifungals. • Theophylline – guidelines and recommendations. • Analgesics – focus on opioids and metabolites; testing approaches; TDM in medical use and misuse; sample selection; counterfeit identification. • Role of TDM in identifying clinically significant drug–herbal supplement interactions – mechanisms, clinical effects, analytical interferences. Learning outcomes (Special Part): Students will be able to: • Define principles of population PK/PD, dosing strategies, therapeutic intervals. • Propose timing/frequency of sampling in correlation with sample type and suitable TDM methods. • Discuss additional monitoring approaches, including pharmacodynamic monitoring. • Interpret results considering variability factors and drug–drug / drug–disease interactions. • Apply the TDM process to select and optimise dose/regimen for clinically significant medicines in routine practice.

13.	Course Interrelation	Related to: Instrumental Pharmaceutical Analysis, Basics of Clinical Pharmacy, Clinical Pharmacy and Pharmacotherapy, Biopharmaceutics.
14.	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive sessions including discussions of specific tasks, cases and problems Working methods: 1. Problem-solving (individual/group work to develop research and analytical skills, teamwork and application of theoretical knowledge).
15.	Total Workload	120 hours
16.	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 22.5 hours 16.2. Exercises (laboratory, auditory): 30 hours
17.	Other Forms of Activities	17.1. Project/seminar tasks: 0 hours 17.2. Independent learning: Preparation for theoretical teaching – 22.5 hours; Preparation for practical teaching – 30 hours 17.3. Examination preparation: 30 hours
18.	Requirments for Course Signature	At least 30 points from the prescribed activities.
19.	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: Colloquium 1 – 13–25 points; Colloquium 2 – 13–25 points 19.3. Practical exam: 6–10 points 19.4. Written/oral seminar or project presentation: /
20.	Grading Criteria (points/grade)	Up to 60 pts – 5 (F) 60–66 pts – 6 (E) 67–75 pts – 7 (D) 76–84 pts – 8 (C) 85–93 pts – 9 (B) 94–100 pts – 10 (A)
21.	Method for Quality Assurance of Teaching	Open discussion and anonymous student survey conducted after completion of the course.
22.	Literature	22.1. Mandatory Literature 1. Authorised lecture notes – Faculty of Pharmacy, current year (electronic copy). 2. International TDM guidelines and protocols – international expert groups and associations, current year (electronic copy). 22.2. Additional Literature 1. Amitava Dasgupta – <i>Therapeutic Drug Monitoring: Newer Drugs and Biomarkers</i> (2nd ed.), Academic Press, 2024 (electronic copy). 2. John E. Murphy – <i>Clinical Pharmacokinetics</i> (7th ed.) & <i>Workbook</i>, ASHP, 2021 (electronic copy).

Appendix No.3		Course syllabus from the first cycle of studies
1.	Course Title	QUALITY MANAGEMENT IN ANALYTICAL LABORATORY
2.	Code	FFIP L12
3.	Programme of Study	Master of Pharmacy
4.	Organising Unit (Faculty/Institute/Department/Division)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Applied Chemistry and Pharmaceutical Analysis
5.	Degree (first, second, third cycle)	Integrated First and Second Cycle of Studies
6.	Academic Year / Semester	Year: 3rd Semester: VI / VIII
7.	Course Load expressed in ECTS credits	4 ECTS credits
8.	Lecturer(s)	Prof. Dr. Jelena Acevska (course coordinator) Prof. Dr. Katerina Brezovska Prof. Dr. Aneta Dimitrovska
9.	Language of Instruction	English
10.	Prerequisites for Attending and Passing the Course	Prerequisite for attending: None Prerequisite for passing: None
11.	Course Objectives (Competencies) and Learning Outcomes	Course Objective: To provide students with knowledge of the establishment and maintenance of quality systems in laboratory operations in accordance with national and international standards and regulations. Learning Outcomes: Upon successful completion of the course, students will acquire basic and advanced knowledge of the principles and approaches to quality assurance, control, and improvement in analytical laboratories. The course will help students develop critical skills for applying theoretical knowledge in practice to ensure quality in daily laboratory operations.
12.	Detailed Course Content by Chapters and Learning Outcomes for Each	Chapter 1: Introduction to Quality Management in Analytical Laboratory • Basic principles of quality management: general concepts, definition and importance of quality in analytical laboratories, application of continuous improvement principles. • Regulatory requirements and standards: national and international standards and guidelines for laboratory practice; legal and ethical obligations regarding quality in the pharmaceutical industry. • Challenges in quality management in analytical laboratories: error and variation management, technological advancements, regulatory changes. Learning Outcomes: • Students will understand the basic principles and importance of quality management in analytical laboratories, and the systematic approach to ensuring accuracy, precision, and reliability of results.

	• Students will become familiar with standards such as ISO (International Organization for Standardization), GLP (Good Laboratory Practice), and GMP (Good Manufacturing Practice). • Students will identify key activities for defining quality system objectives, implementing standards, and establishing procedures. Chapter 2: Establishment and Maintenance of Quality Management System • Components of a quality system: resource, process, and system-related requirements. • Quality system management (document control, data and record management, risk management) and continuous improvement. • Risk management: principles of risk management in the context of analytical laboratories, use of tools for risk assessment and mitigation. Learning Outcomes: • Students will understand the main components of a quality management system and their relevance to analytical laboratories. • Students will learn approaches to managing quality through document control, record management, and risk management. • They will apply principles of continuous improvement to ensure development and optimisation of laboratory processes. • Students will gain knowledge on identifying, analysing, and evaluating quality-related risks. Chapter 3: Quality Assurance of Analytical Results • Management of equipment (qualification/calibration), reagents, reference standards, samples for analysis, and staff qualification. • Quality control of analytical results: internal and external quality control using reference materials, statistical tools, repeat testing, and inter-laboratory comparisons. • Data management in laboratories, including electronic systems and databases: data storage, statistical analysis (control charts, trend analysis). Learning Outcomes: • Students will apply key approaches for managing laboratory equipment and reagents. • They will understand the importance of quality assurance of analytical results and implement appropriate quality control measures. • They will understand how to organise and conduct

		inter-laboratory comparisons to ensure accuracy and precision. • They will apply statistical methods for data analysis and use control charts and trend analysis to ensure data accuracy. Chapter 4: Evaluation and Reporting of Analytical Results • Generation of valid results. • Evaluation of measurement uncertainty in analytical testing. • Presentation and reporting of analytical results. Learning Outcomes: • Students will apply verification methods for ensuring result validity. • They will understand the importance of measurement uncertainty and its impact on result interpretation. • Students will gain knowledge on identifying and estimating sources of measurement uncertainty in laboratory analysis.
13.	Correlation with Other Courses	1. Prior knowledge from the following courses is related: <i>Mathematics and Applied Statistics in Pharmacy, Analytical Chemistry Applied in Pharmacy, and Instrumental Pharmaceutical Analyses</i>. 2. Knowledge from this course is required as prior knowledge for: /
14.	Teaching and Working Methods	Teaching Methods: 1. Lectures 2. Interactive sessions including discussions on selected tasks, cases, and problems Working Methods: 1. Problem-solving (students work individually or in groups to solve specific problems, enhancing analytical and teamwork skills). 2. Project work (research on a specific topic to develop independent research and presentation skills).
15.	Total Workload	120 hours
16.	Forms of Teaching Activities	16.1. Lectures – theoretical classes: 30 hours 16.2. Exercises (auditory): 20 hours
17.	Other Forms of Activities	17.1. Project or seminar work: 15 hours 17.2. Independent study: Preparation for theoretical classes – 30 hours; Preparation for practical classes – 10 hours 17.3. Exam preparation: 15 hours
18.	Requirements for Signature	At least 30 points from the planned activities (16.1, 17.1)

19.	Assessment Methods	19.1. Final exam: 30–60 points 19.2. Mid-term exam: / 19.3. Practical exam: / 19.4. Seminar paper/project, written and oral presentation: 6–10 points
20.	Grading Criteria (Points / Grade)	0–59 points → 5 (F) 60–66 → 6 (E) 67–75 → 7 (D) 76–84 → 8 (C) 85–93 → 9 (B) 94–100 → 10 (A)
21.	Method for Monitoring Teaching Quality	Open discussion and anonymous survey conducted after course completion.
22.	Literature	22.1. Mandatory Literature 1. International standards and guidelines – current edition 2. Ludwig Huber – <i>Validation and Qualification in Analytical Laboratories</i> , Informa Healthcare USA, 2007 3. Sandy Weinberg – <i>Good Laboratory Practice Regulations</i> , Informa Healthcare USA, 2007 22.2. Additional Literature To be defined by the course coordinator.

Appendix No.3		Course syllabus from the first cycle of studies
1.	Course Title	PHARMACEUTICAL PROCESS ENGINEERING
2.	Code	FFIP L13
3.	Study Programme	MASTER OF PHARMACY
4.	Organiser of the Study Programme (unit, institute, department, section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Pharmaceutical Technology
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Year: 3rd / 4th Semester: VI / VIII
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturer (in case of several lecturers, indicate the course coordinator)	Prof. Dr. Nikola Geshkovski (course coordinator) Prof. Dr. Marija Glavash Dodov Prof. Dr. Maja Simonoska Crcarevska Prof. Dr. Renata Slavevska Raicki Prof. Dr. Katerina Gorachinova Asst. Prof. Dr. Dushko Shalabalija Asst. Prof. Dr. Ljubica Mihailova Asst. M.Sc. Teodora Tasevska
9.	Language of Instruction	English
10.	Prerequisites for Attending and Taking the Exam	Prerequisite for attending the course: signature from <i>Pharmaceutical Technology I</i> Prerequisite for taking the exam: signature from <i>Pharmaceutical Process Engineering</i>
11.	Course Objectives (Competences) and Learning Outcomes	Course Objectives: The objectives of this course are to familiarise students with the manufacturing processes and unit operations used in the production of active pharmaceutical ingredients and dosage forms, including packaging processes and operations for primary and secondary packaging. In addition, students will acquire basic knowledge for the selection, optimisation, and management of processes across different production stages of a medicinal product, including the ability to identify and monitor critical process parameters and control points in various manufacturing operations covered in the course. The acquired knowledge and competences will provide a solid foundation for employment in development departments, process transfer teams, and production divisions within the pharmaceutical industry. Learning Outcomes: Upon successful completion of the course, students will be able to: - Summarise technological principles and relevant operations for pharmaceutical manufacturing and select appropriate types of equipment for different processes; - Identify common pharmaceutical manufacturing issues and propose strategies to overcome them; - Understand primary and secondary packaging processes

		and recognise suitable packaging equipment; - Demonstrate knowledge of facility and equipment requirements and standards at various stages of pharmaceutical production, including qualification procedures.
12.	Detailed Course Content by Chapters and Learning Outcomes	Chapter: Introduction to Process Engineering Within this chapter, students will acquire the following knowledge and, as a result of learning, will be able to describe, discuss, and apply their understanding of: - What is a process and why process engineering is necessary; - Fundamentals of fluid and powder processing; - Basics of heat and mass transfer in pharmaceutical processes. Chapter: Production of Active Pharmaceutical Ingredients (APIs) and Excipients Students will learn and be able to describe, discuss, and apply knowledge of: - Equipment and processes for synthesis in reactors, purification techniques, crystallisation, and separation (filtration, centrifugation), and drying processes. Optimisation, identification of critical control points, process monitoring, and management. Chapter: Industrial Manufacture of Solid Dosage Forms Students will learn and be able to describe, discuss, and apply knowledge of: - Equipment and processes for dry blending, wet and dry granulation, tableting, coating, and filling of hard and soft gelatin capsules. Optimisation, identification of critical control points, process monitoring, and management. Chapter: Industrial Manufacture of Liquid and Semi-Solid Dosage Forms Students will learn and be able to describe, discuss, and apply knowledge of: - Equipment and processes for mixing, homogenisation, and filtration. Optimisation, identification of critical control points, process monitoring, and management. Chapter: Packaging Processes for Dosage Forms (Primary and Secondary Packaging) Students will learn and be able to describe, discuss, and apply knowledge of: - Equipment and processes for the transfer and packaging of liquid, semi-solid, and solid dosage forms. Optimisation, identification of critical control points, process monitoring, and management.

13.	Course Interconnection	1. Prior knowledge from the course <i>Pharmaceutical Technology 1</i> is required and related to this course. 2. The knowledge acquired in this course serves as prior preparation for following the content of other elective courses.
14.	Detailed Description of Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive sessions including discussions on tasks, cases, and problems. Working methods: 1. Problem-solving (students work independently/in groups to solve specific problems in order to develop research, analytical, and teamwork skills, as well as to apply theoretical knowledge). 2. Project work (developing a project involving research on a given topic aimed at enhancing independent research abilities and presentation skills).
15.	Total Workload	4 ECTS × 30 hours = 120 hours
16.	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 15 weeks × 2 hours = 30 hours 16.2. Exercises (laboratory, auditory): —
17.	Other Forms of Activities	17.1. Project work/seminars: 15 hours 17.2. Independent study: Preparation for theoretical instruction – 60 hours; Preparation for practical instruction – 0 hours. Students independently research, study, and solve tasks to deepen their understanding. 17.3. Exam preparation: 15 hours (review and systematisation of knowledge before the exam).
18.	Requirments for Course Signature	Minimum of 30 points from planned activities (16.1, 16.2, 17.1).
19.	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: Colloquium 1 – 13–25 points; Colloquium 2 – 13–25 points 19.3. Practical exam: — 19.4. Seminar/project work (written and oral presentation): 6–10 points
20.	Grading Criteria (points/grade)	Up to 60 points – 5 (F) 60–66 points – 6 (E) 67–75 points – 7 (D) 76–84 points – 8 (C) 85–93 points – 9 (B) 94–100 points – 10 (A)
21.	Method for Monitoring the Quality of Teaching	Open discussion and anonymous survey conducted after completion of the course.
22.	Literature	22.1. Mandatory Literature 1. Anthony J. Hickey, David Ganderton – <i>Pharmaceutical Process Engineering</i> – Informa Healthcare, 2010 (electronic version).

		22.2. Additional Literature

Appendix No.3		Course syllabus from the first cycle of studies
1.	Title of the Course	MANUFACTURING OF HERBAL PREPARATIONS AND QUALITY STANDARDS
2.	Code	FFIP L14
3.	Study Programme	MASTER OF PHARMACY
4.	Organising Unit (Faculty, Institute, Department, Section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Pharmacognosy
5.	Level (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Year: Third, Fourth, Fifth Semester: VI, VIII
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturers (the course coordinator listed first)	Asst. Prof. Dr. Ivana Cvetkovikj Karanfilova (course coordinator) Prof. Dr. Biljana Bauer Prof. Dr. Marija Karapandzova Asst. Prof. Dr. Ana Trajkovska Asst. Prof. Dr. Veronika Stoilkovska Gjorgievska
9.	Language of Instruction	English
10.	Prerequisites for Attending and Passing the Course	For attending: signatures in Pharmaceutical Botany and Biology (II semester), Phytochemistry (IV semester), Pharmacognosy (V semester) For assessment: /
11.	Course Objectives (Competences) and Learning Outcomes	Objectives To introduce fundamentals of herbal preparations (definition, historical development and significance in the pharmaceutical industry); understanding biological and chemical properties of plant material and its selection for preparing herbal products; overview of traditional and modern use; production techniques; understanding Good Manufacturing Practice (GMP) and its application to herbal production; application of quality and safety standards; regulatory status, standardisation, design and development of herbal medicines; risks and interactions with conventional medicines. Learning Outcomes – Students will acquire knowledge of: • Principles for selection, processing and use of plant raw materials in the pharmaceutical industry. • Cultivation and harvesting techniques for medicinal plants (organic and sustainable production). • Biochemical properties and pharmacological activities of active plant constituents. • Application of modern technologies for extraction, purification and formulation. • Performing analytical tests to evaluate quality, stability and safety. • Regulatory requirements for manufacture and marketing in line with national and international standards. • Preparation of registration documentation. • Simulated inspections and GMP audits.

12.	Detailed Course Content by Chapters and Learning Outcomes	Chapter 1: Introduction to the Manufacture of Herbal Preparations • Fundamentals of the production process from raw material to finished product. • Extraction and processing techniques. • Preparation of different herbal products. Learning outcomes: Students understand the full production process; identify and apply suitable processing and extraction methods (e.g., maceration, percolation, distillation, modern techniques such as supercritical-fluid extraction); and produce various herbal preparations (tinctures, syrups, capsules, creams, teas and other formulations). Chapter 2: Contemporary Trends and Innovations • Integration of advanced technologies in production. • Organically and ecologically certified products. • Growing popularity of personalised herbal medicine. • Sustainable production and ethical aspects. Learning outcomes: Students explain how advanced technologies enhance efficacy, stability and bioavailability; identify principles of organic certification and apply sustainable practices; and discuss ethical sourcing and environmentally responsible production. Chapter 3: Quality Standards, Quality Control and Regulatory Aspects • Understanding and principles of GMP for herbal medicines. • Quality control of raw materials and finished products. • Regulatory aspects and documentation. Learning outcomes: Students explain core GMP principles and their application across all production stages; conduct quality assessment of raw/intermediate/finished products (purity, stability, standardisation); interpret and apply national and international regulations (WHO, FDA, EU directives); and maintain documentation and specifications ensuring full traceability.
13.	Course Interrelation	1) Prior knowledge from Pharmaceutical Botany and Biology, Bioorganic Chemistry, Phytochemistry, Pharmacognosy, and Fundamentals of Pharmaceutical Technology is required/related. 2) Knowledge from this course required for other courses: none.
14.	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive sessions including discussions of specific tasks, cases and problems Working methods: 1. Laboratory exercises (practical skills) 2. Problem-solving (individual/group work) 3. Project work (independent research and presentation skills).
15.	Total Workload	120 hours
16.	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 30 hours 16.2. Exercises (laboratory/auditory): 15 hours

17.	Other Forms of Activities	17.1. Project/seminar tasks: 5 hours 17.2. Independent learning: 45 hours 17.3. Examination preparation: 25 hours
18.	Requirments for Course Signature	At least 30 points from the prescribed activities (16.1, 16.2, 17.1).
19.	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquium (if applicable): / 19.3. Practical exam: 6–10 points 19.4. Written/oral seminar or project presentation: /
20.	Grading Criteria (points/grade)	Up to 60 pts – 5 (F) 60–66 pts – 6 (E) 67–75 pts – 7 (D) 76–84 pts – 8 (C) 85–93 pts – 9 (B) 94–100 pts – 10 (A)
21.	Method for Quality Assurance of Teaching	Open discussion and anonymous student survey conducted after completion of the course.
22.	Literature	22.1. Mandatory Literature 1) World Health Organization – <i>WHO Guidelines on Good Manufacturing Practices (GMP) for Herbal Medicines</i> , WHO, 2007 (hard copy). 2) European Medicines Agency – <i>Guideline on Quality of Herbal Medicinal Products/Traditional Herbal Medicinal Products</i> , EMA, 2022 (hard copy). 22.2. Additional Literature 1) Kulevanova, S.; Stefkov, Ć.; Karapandžova, M. – <i>Phytochemistry</i> , UKIM, 2011 (hard copy). 2) Kulevanova, S.; Stefkov, Ć.; Karapandžova, M.; Cvetkovikj Karanfilova, I. – <i>Pharmacognosy: Natural Medicinal and Aromatic Raw Materials</i> , UKIM (peer-reviewed textbook), 2023 (electronic edition).

Appendix No.3		Course syllabus from the first cycle of studies
1.	Title of the Course	MANUFACTURING OF BIOTECHNOLOGICALS
2.	Code	FFIP Z15
3.	Study Programme	MASTER OF PHARMACY
4.	Organising Unit (Faculty, Institute, Department, Section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Pharmaceutical Technology
5.	Level (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Year: 4 and 5 Semester: VII, IX
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturers (the course coordinator listed first)	Prof. Dr. Renata Slavevska Raichki (course coordinator) Asst. Prof. Dr. Dushko Shalabalija
9.	Language of Instruction	English
10.	Prerequisites for Attending and Passing the Course	For attending: signature in Pharmaceutical Technology II For assessment: signature in Production of Biotechnological Medicines
11.	Course Objectives (Competences) and Learning Outcomes	Objectives To enable students to acquire active and lasting knowledge of the scientific foundations, techniques and process technologies implemented in industrial pharmaceutical biotechnology. The course also introduces characteristic content required for obtaining specific classes of biotechnological medicines and products in line with Good Manufacturing Practice (GMP), resulting in sustainable production of authorised products. Additionally, students will learn about the impact of approved classes of biotechnological medicines in contemporary pharmacy and medicine through case studies. Learning Outcomes – Upon completion, students will be able to: • Interpret scientific principles and understand modern biotechnological process technologies applied to industrial production of specific classes of biotechnological medicines. • Solve problems and challenges in the GMP-compliant manufacture of specific classes of biotechnological medicines, including interpretation and implementation of regulatory requirements. • Participate competently in interdisciplinary teams dedicated to research and development for sustainable industrial production of various classes of biotechnological medicines.
12.	Detailed Course Content by Chapters and Learning Outcomes	Characteristic categories of biotechnological medicines covered: • Industrial production of endogenous proteins. • Production of recombinant (r) insulins – manufacturing of insulin formulations from recombinant microbial systems; engineering of analogues to improve therapy. • Production of commercially available recombinant human haematopoietic growth factors (rhG-CSF, rhGM-CSF, rhEPO, rhSCF,

		rhIL-11). • Production of recombinant coagulation factors and thrombolytic agents; cost-effective production systems to improve access: — rFactor VIII – overview of approved manufacturing technologies. — rFactor IX – overview of approved manufacturing technologies. — rFactor VIIa – overview of approved manufacturing technologies. — rAntithrombin. — rThrombolytic agents. • Production of recombinant hormones (follicle-stimulating hormones and human growth hormone) – production systems, pharmaceutical considerations and case studies of authorised formulations. • Recombinant human deoxyribonuclease – case studies of authorised formulations. • Recombinant interferons and interleukins – case studies of authorised formulations. • Technologies for industrial production of therapeutic classes of monoclonal antibodies – case studies of authorised products. • Technologies for industrial production of modern vaccines using recombinant technology – case studies of authorised vaccines. • Technologies for industrial production of selected antibiotics. Learning outcomes (for the content above): • Acquire key knowledge of typical activities, technologies, processes and methods used to obtain specific categories of biotechnological products of therapeutic interest at industrial scale. • Understand competitive, innovative and superior approaches and processes in pharmaceutical biotechnology for industrial production of specific biotechnological medicines with direct impact on pharmaceutical science, medicine and pharmaceutical care. • Gain knowledge required to address challenges and issues inherent to manufacturing specific categories of biotechnological medicines.
13.	Course Interrelation	1) Prior knowledge from Molecular and Cell Biology & Genetics, Microbiology, Pharmaceutical Technology 1 and 2 is required/related. 2) Knowledge from this course required as prerequisite for others: the course is elective.
14.	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive sessions including discussions of specific tasks and case studies Working methods: 1. Problem-solving (individual and group work to foster research and analytical skills, teamwork and application of theory) 2. Project work (a project involving research on a given topic to develop independent research and presentation skills).
15.	Total Workload	(4 ECTS × 30) = 120 hours
16.	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 15 working weeks × 2 hours per week = 30 hours 16.2. Exercises (laboratory, auditory): /

17.	Other Forms of Activities	17.1. Project/seminar tasks: 7.5 hours (individual or team research of specific problems and proposal of solutions) 17.2. Independent learning: Preparation for theoretical instruction – 60 hours; Preparation for practical instruction – / 17.3. Examination preparation: 22.5 hours (revision and systematisation).
18.	Requirments for Course Signature	At least 30 points from the prescribed activities (16.1, 16.2, 17.1).
19.	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: Colloquium 1 – 13–25 points; Colloquium 2 – 13–25 points 19.3. Practical exam: — 19.4. Written/oral seminar or project presentation: 5–9 points
20.	Grading Criteria (points/grade)	Up to 60 pts – 5 (F) 60–66 pts – 6 (E) 67–75 pts – 7 (D) 76–84 pts – 8 (C) 85–93 pts – 9 (B) 94–100 pts – 10 (A)
21.	Method for Quality Assurance of Teaching	Open discussion and anonymous student survey conducted after completion of the course.
22.	Literature	22.1. Mandatory Literature 1. Dan J. A. Crommelin; Robert D. Sindelar; Bernd Meibohm – <i>Pharmaceutical Biotechnology: Fundamentals and Applications</i> (Macedonian translation of 4th ed.), ISBN 978-608-247-875-3, Ars Lamina, 2017 (hard copy). 2. Ansel, M.; Popovich, N.; Allen, L. – <i>Pharmaceutical Dosage Forms and Drug Delivery Systems</i> (8th ed.), Williams & Wilkins, 2004 (electronic edition). 3. Aulton, M. – <i>Pharmaceutics: The Science of Dosage Form Design</i> (2nd ed.), Churchill Livingstone, 2002 (electronic edition). 4. <i>Remington: The Science and Practice of Pharmacy</i> (21st ed.), Mack Publishing Co., 2005 (electronic edition). 5. European Pharmacopoeia 11 (electronic edition). 22.2. Additional Literature 1. Relevant papers in international scientific journals (electronic editions). 2. EMA and FDA official websites.

Appendix No.3		Course syllabus from the first cycle of studies
1.	Title of the Course	COSMETOLOGY
2.	Code	FFIP Z16
3.	Study Programme	MASTER OF PHARMACY
4.	Organising Unit (Faculty, Institute, Department, Section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Pharmaceutical Technology
5.	Level (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Year: 5 Semester: IX
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturers (the course coordinator listed first)	Prof. Dr. Marija Glavash Dodov (course coordinator) Asst. Prof. Dr. Ljubica Mihailova
9.	Language of Instruction	English
10.	Prerequisites for Attending and Passing the Course	For attending: signature in Pharmaceutical Technology II (VI semester) For assessment: passed Pharmaceutical Technology II (VI semester) and signature in Cosmetology.
11.	Course Objectives (Competences) and Learning Outcomes	Objectives To provide detailed knowledge and understanding of development, industrial manufacture and regulatory requirements for cosmetic products in the Republic of North Macedonia (RNM) and the EU. Students will be able to: (i) analyse and evaluate core regulatory requirements relevant to development, production and placing cosmetic products on the market in RNM/EU; (ii) assess market products regarding formulation components, safety profile and accuracy of cosmetic claims in line with regulations; (iii) understand skin and adnexal conditions and mechanisms, and select appropriate cosmetic actives and products according to consumer/patient needs; (iv) apply formulation-development principles for different cosmetic product types, selecting suitable actives and excipients and assessing their role and safety; (v) design stability-study protocols to predict product shelf-life; (vi) counsel patients/consumers on appropriate product choice (alone or as adjuvant therapy) and on recognising/reporting adverse effects. Learning Outcomes – Upon completion, students will be able to: • Know and appropriately discuss legislation for cosmetic products and their industrial manufacture in RNM/EU, including by-laws, and compare with medical device regulations. • Analyse and solve problems related to cosmetic claims, formulation components and truthful advertising. • Discuss appropriate selection of cosmetic actives and excipients by intended use or by dermatological condition, and address formulation-development issues across product types. • Know key parameters for quality analysis of cosmetic products.

		• Prepare a protocol for stability monitoring and a Final Stability Study Report to recommend shelf-life. • Analyse/resolve issues related to reporting adverse effects from cosmetic use. • Work in teams to solve problems in developing quality cosmetic products across industry, clinic or pharmacy settings.
12.	Detailed Course Content by Chapters and Learning Outcomes	Chapter: Legislation for Cosmetic Products in RNM and the EU – Laws on cosmetics and safety in the EU and RNM; relevant by-laws; preparation of “Product Information File”; role and obligations of the Responsible Person; safety testing of cosmetic substances and products and documentation of the Product Safety Profile. Chapter: Specific Features of Skin and Adnexa, Skin Types and Dermatological Conditions – Skin functions; skin types and characteristics; physiological and photo-induced ageing; seborrhoeic and sebostatic skin; cosmetic products by skin type/condition; dermatological conditions and suitable cosmetic products. Chapter: Formulation Aspects of Different Cosmetic Product Types – Permitted cosmetic actives and other excipients; use of data from the EU Commission’s Cosing database; defining intended use of different cosmetic types; characteristics, formulation development and preparation/production. Chapter: Stability Studies of Cosmetic Products and Shelf-life Prediction – Designing stability-study objectives and protocols; selection of parameters and conditions (temperature and humidity) appropriate to a given formulation; preparation of the Final Stability Study Report. Chapter: The Pharmacist’s Role in Counselling for Appropriate Product Selection – Proper product choice by age, skin type and condition; counselling for various dermatological conditions; educating consumers/patients to recognise and report adverse effects from cosmetic products.
13.	Course Interrelation	1) Prior knowledge from Pharmaceutical Technology 1 and 2. 2) Knowledge from this course required as prerequisite for following content: the course is elective.
14.	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive sessions including discussions of specific tasks, cases and problems Working methods: 1. Problem-solving (individual/group work to foster research and analytical skills, teamwork and application of theory) 2. Homework assignments (research on a given topic to develop independent research, presentation skills and professional critical thinking).
15.	Total Workload	4 ECTS × 30 hours = 120 hours

16.	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 15 working weeks × 2 hours per week = 30 hours 16.2. Exercises (laboratory/auditory): /
17.	Other Forms of Activities	17.1. Project/seminar tasks: / 17.2. Independent learning: Preparation for theoretical instruction – 60 hours (independent research, study and problem-solving to deepen knowledge) 17.3. Examination preparation: 15 hours (revision and systematisation).
18.	Requirments for Course Signature	At least 30 points from the prescribed activities (16.1, 16.2, 17.1).
19.	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquia: Colloquium 1 – 13–25 points; Colloquium 2 – 13–25 points 19.3. Practical exam: / 19.4. Seminar/project (problem-solving, homework) with oral presentation: 5 points
20.	Grading Criteria (points/grade)	Up to 60 pts – 5 (F) 60–66 pts – 6 (E) 67–75 pts – 7 (D) 76–84 pts – 8 (C) 85–93 pts – 9 (B) 94–100 pts – 10 (A)
21.	Method for Quality Assurance of Teaching	Open discussion and anonymous student survey conducted after completion of the course.
22.	Literature	22.1. Mandatory Literature 1. Aleksandar Ančevski et al. – <i>Dermatovenerologija</i> (Dermatovenereology), Kultura, 2005 (hard copy). 2. André O. Barel; Marc Paye; Howard I. Maibach (eds.) – <i>Handbook of Cosmetic Science and Technology</i> (3rd ed.), Informa Healthcare USA, Inc., 2009 (electronic edition). 3. J. W. Fluhr (ed.) – <i>Practical Aspects of Cosmetic Testing</i> , Springer-Verlag Berlin Heidelberg, 2011 (electronic edition). 4. Z. D. Draelos; L. A. Thaman (eds.) – <i>Cosmetic Formulation of Skin Care Products</i> , Taylor & Francis Group, New York, 2006 (electronic edition). 22.2. Additional Literature 1. Relevant papers in international scientific journals (electronic editions).

Appendix No.3		Course syllabus from the first cycle of studies
1.	Title of the Course	QUALITY CONTROL OF HERBAL PRODUCTS
2.	Code	FFIP Z17
3.	Study Programme	MASTER OF PHARMACY
4.	Organising Unit (Faculty, Institute, Department, Section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Pharmacognosy
5.	Level (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Year: Third, Fifth Semester: VI, VIII
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturers (the course coordinator listed first)	Prof. Dr. Marija Karapandzova (course coordinator) Prof. Dr. Gjoshe Stefkov Asst. Prof. Dr. Ivana Cvetkovikj Karanfilova Asst. Prof. Dr. Ana Trajkovska Asst. Prof. Dr. Veronika Stoilkovska Gjorgievska
9.	Language of Instruction	English
10.	Prerequisites for Attending and Passing the Course	For attending: signatures in Pharmaceutical Botany and Biology (II semester), Phytochemistry (IV semester) and Pharmacognosy (V semester). For assessment: —
11.	Course Objectives (Competences) and Learning Outcomes	Objectives To familiarise students with starting herbal raw materials for the manufacture of herbal products and preparations; to acquire knowledge and skills for performing routine analyses in testing and quality control of herbal raw materials and their products in accordance with relevant pharmacopoeial requirements, quality regulations and other standards. Learning Outcomes – Students will gain knowledge of: • Herbal raw materials and their products and preparations. • Their organoleptic and physico-chemical characteristics. • Quality of herbal raw materials and preparations and methods for testing and quality control according to pharmacopoeial and other quality standards. • Performing routine analyses within testing and quality-control procedures.
12.	Detailed Course Content by Chapters and Learning Outcomes	The course comprises three chapters divided into several units: Chapter 1: Definition of “herbal raw material” and “herbal preparation” • Characteristics of herbal raw materials; methods of production; basic technological operations; core concepts and principles of testing herbal raw materials; fundamentals of quality control of herbal raw materials and their products/preparations; the role of pharmacopoeias and other quality standards; WHO recommendations and guidelines and relevant national regulations. Learning outcomes: Students will understand the concepts of herbal

		raw materials and preparations, their production, and quality control in line with quality standards. Chapter 2: Routine methods for testing and quality control of herbal raw materials and their products/preparations according to the European Pharmacopoeia, WHO recommendations and national regulations • Sample preparation based on characteristics of the herbal raw material (organised and unorganised drugs); sieving; determination of foreign matter; principles of macroscopic and microscopic analysis; determination of ash (total ash, acid-insoluble ash, sulphated ash); determination of total extractives; loss on drying/water and other volatile matter; determination of essential oil content; bitterness index; haemolytic index; swelling index; tannins; foaming index; residues of pesticides; heavy metals; mycotoxins (aflatoxins); radioactive contamination; and microbiological purity. Learning outcomes: Students will understand routine methods for testing and quality control of herbal raw materials and their products/preparations in accordance with the European Pharmacopoeia, WHO recommendations and national regulation. Chapter 3: Routine methods for safety assessment, stability and shelf-life of herbal raw materials and preparations • Use of biological models to test efficacy of herbal raw materials and their products/preparations; assessment of toxicity and safety; application of modern approaches to biological evaluation; stability-testing of herbal raw materials and preparations. Learning outcomes: Students will understand safety aspects of the use of herbal raw materials and their products/preparations and their stability.
13.	Course Interrelation	1) Prior knowledge from Pharmaceutical Botany and Biology, Phytochemistry and Pharmacognosy is required/related. 2) Knowledge from this course required for other courses: none.
14.	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive sessions including discussions of specific tasks, cases and problems Working methods: 1. Laboratory exercises (practical skills) 2. Problem-solving (individual/group work to foster research and analytical skills, teamwork and application of theory) 3. Project work (a project involving research on a given topic to develop independent research and presentation skills).
15.	Total Workload	120 hours
16.	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 30 hours 16.2. Exercises (laboratory/auditory): 15 hours
17.	Other Forms of Activities	17.1. Project/seminar tasks: 5 hours 17.2. Independent learning: 50 hours 17.3. Examination preparation: 20 hours

18.	Requirments for Course Signature	At least 30 points from the prescribed activities (16.1, 16.2, 17.1).
19.	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquium (if applicable): — 19.3. Practical exam: 6–10 points 19.4. Seminar/project with written and oral presentation: —
20.	Grading Criteria (points/grade)	Up to 60 pts – 5 (F) 60–66 pts – 6 (E) 67–75 pts – 7 (D) 76–84 pts – 8 (C) 85–93 pts – 9 (B) 94–100 pts – 10 (A)
21.	Method for Quality Assurance of Teaching	Open discussion and anonymous student survey conducted after completion of the course.
22.	Literature	22.1. Mandatory Literature 1. Warude, D.; Patwardhan, B. – <i>Botanicals: Quality and Regulatory Issues</i> , J. Sci. Ind. Res., 64, 83–92, 2005 (electronic edition). 2. WHO Team – <i>Quality Control Methods for Herbal Materials</i> , World Health Organization, Geneva, 2011 (electronic edition). 3. <i>Medicinal Plant Quality Control Publications</i> , Bent Creek Institute (electronic edition). 4. Council of Europe – <i>European Pharmacopoeia</i> , Council of Europe, Strasbourg, 2023 (electronic edition). 22.2. Additional Literature 1. EFSA – <i>Guidance on Safety Assessment of Botanicals and Botanical Preparations Intended for Use as Ingredients in Food Supplements</i> , 2009 (electronic edition). 2. Kulevanova, S.; Stefkov, Gj.; Karapandzova, M.; Cvetkovikj Karanfilova, I. – <i>Pharmacognosy: Natural Medicinal and Aromatic Raw Materials</i> , UKIM, Skopje, 2023 (hard copy).

Appendix No.3		Course syllabus from the first cycle of studies
1.	Title of the Course	FUNDAMENTALS OF PATENTING AND BRANDING IN PHARMACY
2.	Code	FFIP_Z18
3.	Study Programme	MASTER OF PHARMACY
4.	Organising Unit (Faculty, Institute, Department, Section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Pharmaceutical Chemistry
5.	Level (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Year: 3rd or 5th Semester: VII or IX
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturers (the course coordinator listed first)	Prof. Dr. Katerina Anchevska Netkovska (course coordinator) Asst. Prof. Dr. Aleksandar Dimkovski Asst. Prof. Dr. Evgenija Mihajloska
9.	Language of Instruction	English
10.	Prerequisites for Attending and Passing the Course	—
11.	Course Objectives (Competences) and Learning Outcomes	Objective To develop students' understanding of core concepts of patent protection, branding and intellectual property (IP) rights and their role in fostering innovation in the pharmaceutical sector; IP infringement and falsification of medicines; criteria for patentability and the patent-filing process; ability to search national and international patent databases; basic principles of branding, industrial design and copyright in pharmacy; the impact of IP on access to and pricing of medicines; and future trends in IP protection in pharmacy. Students will apply the acquired knowledge through analysis and interpretation of key concepts and legislation related to patent law, branding and other IP rights in pharmacy. Learning outcomes Upon completion, the student will be able to understand and apply the laws regulating IP rights in pharmacy, identify and apply ethical principles related to IP and access to medicines, and recognise and explain challenges posed by new technologies.
12.	Detailed Course Content by Chapters and Learning Outcomes	Chapter: Intellectual Property Rights and Patents – Introduction • Introduction to IP law; definition and significance of patents, trade marks, industrial design and copyright; Law on Industrial Property. Learning outcomes: Students will be able to define patent, trade mark and copyright, and state the conditions for patentability; understand the process of filing a patent application and perform searches in national and international patent databases. Chapter: Patents in the Pharmaceutical Industry

		• Role of patents in the pharmaceutical industry; patent application; national and international patent databases. • Patent life cycle of a medicinal product (from discovery to patent expiry); patent strategies; patent disputes and litigation in originator and generic companies; patenting of biological medicines. Learning outcomes: Students can describe the patent life cycle of a medicinal product and understand patent strategies in pharmaceutical management; relate patents to the marketing authorisation process; become familiar with landmark legal disputes and their outcomes, and with challenges in patenting biologicals. Chapter: Trade Marks – Branding in Pharmacy • Definition and significance of trade marks; branding of pharmaceutical products; examples of pharmaceutical trade marks and their market impact; industrial design; role of copyright in protecting pharmaceutical research publications. Learning outcomes: Students will explain the importance of trade marks and the branding process for pharmaceutical products and their linkage with industrial design and copyright. Chapter: International Agreements Relating to IP Rights • TRIPS, Paris Convention and other international agreements on IP and access to medicines. Learning outcomes: Students will recognise the impact of IP rights on access to and prices of medicines and the international agreements governing IP in pharmacy. Chapter: Contemporary Trends and Protection of IP Rights in Pharmacy • IP rights and biological medicines; role of advanced technologies and the IP legal framework. Learning outcomes: Students will describe and define IP challenges arising from advances in biological medicines and emerging technologies.
13.	Course Interrelation	1) Not required. 2) Knowledge from the course —
14.	Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive classes including discussion of selected cases and problems Working methods: 1. Problem-solving (individual/group work to foster research and analytical skills, teamwork and application of theory) 2. Project work (research on a given topic to develop independent research and presentation skills).
15.	Total Workload	120 hours
16.	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 15 hours 16.2. Exercises (laboratory/auditory): 15 hours

17.	Other Forms of Activities	17.1. Project/seminar tasks: 15 hours 17.2. Independent learning: Preparation for theoretical classes: 22.5 hours; Preparation for practical classes: 22.5 hours 17.3. Examination preparation: 30 hours
18.	Requirments for Course Signature	At least 30 points from the prescribed activities (16.1, 16.2, 17.1).
19.	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquium (if applicable): — 19.3. Practical exam: X 19.4. Seminar paper/project with written and oral presentation: 30–40 points
20.	Grading Criteria (points/grade)	Up to 60 pts – 5 (F) 60–66 pts – 6 (E) 67–75 pts – 7 (D) 76–84 pts – 8 (C) 85–93 pts – 9 (B) 94–100 pts – 10 (A)
21.	Method for Quality Assurance of Teaching	Open discussion and anonymous student survey conducted after completion of the course.
22.	Literature	22.1. Mandatory Literature 1. Ančevska-Netkovska, K.; Grozdanova, A.; Sterjev, Z.; Poceva-Panovska, A.; Tonikj Ribarska, J.; Brezovska, K. – <i>Intellectual Property Rights in Pharmacy</i> , Ss. Cyril and Methodius University – Faculty of Pharmacy – Skopje, 2021. 2. Donner, I. H.; Boundy, D. E. – <i>Patent Prosecution: Law, Practice, and Procedure</i> , Practising Law Institute, 2020. 3. Hitchcock, D. – <i>Patent Searching Made Easy: How to Do Patent Searches Online and in the Library</i> , Nolo, 2020. 22.2. Additional Literature 1. Relevant papers in international scientific journals (from 2018–). 2. National legislation and international regulation (from 2018–).

Appendix No.3		Course syllabus from the first cycle of studies
1.	Title of the Course	PHARMACOVIGILANCE
2.	Code	FFIP Z19
3.	Study Programme	MASTER OF PHARMACY
4.	Organising Unit (Faculty, Institute, Department, Section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Pharmaceutical Chemistry
5.	Level (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Year: 5th Semester: IX
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturers (the course coordinator listed first)	Assoc. Prof. Dr. Zorica Naumovska (course coordinator) Asst. Prof. Dr. Evgenija Mihajloska Asst. Prof. Dr. Aleksandar Dimkovski
9.	Language of Instruction	English
10.	Prerequisites for Attending and Passing the Course	For attending: completed (attended) Pharmaceutical Chemistry 3 (VI semester) and Pharmacoinformatics (VII semester). For taking the exam: passed Pharmaceutical Chemistry 3 (VI semester) and Pharmacoinformatics (VII semester).
11.	Course Objectives (Competences) and Learning Outcomes	Objectives • To provide knowledge and skills in Good Pharmacovigilance Practice (GVP) and reporting of adverse reactions to medicines and other medical products, including application of the pharmacovigilance system to identify risks related to the quality, efficacy and safety of medicines/medical devices and the use of modern health informatics across the process. • To understand national and global regulatory aspects of pharmacovigilance. • To understand pharmacovigilance as a scientific discipline covering reporting of adverse reactions from clinical development through the post-marketing lifecycle, including medication errors, falsified medicines, overdose, misuse/abuse, and drug–drug/food interactions. • To acquire skills for signal detection and risk identification, risk management and risk-minimisation measures, evaluation of therapy and monitoring of effectiveness and safety in special populations, and handling adverse reactions in specific therapeutic classes. • To develop skills to use post-marketing studies and statistical data analysis for early risk detection and timely minimisation in practice. Expected learning outcomes Upon completion students are expected to demonstrate knowledge of: national and international adverse event databases; EU and national legal frameworks and GVP; reporting of events related to medical products; medication errors; off-label use; misuse/abuse; signal detection; risk minimisation and risk management across clinical development and post-marketing; GVP in special populations; and the importance of pharmacovigilance for industry and national competent

		authorities. Students will also understand the role of post-marketing studies and modern health informatics (including electronic health data, AI and digital tools) in implementing good pharmacovigilance practice.
12.	Detailed Course Content by Chapters and Learning Outcomes	Chapter 1: Fundamentals of Pharmacovigilance and Spontaneous ADR Reporting Content: operation of pharmacovigilance systems; safety monitoring of medicines; roles and responsibilities of stakeholders. <i>Learning outcomes:</i> practical skills for reporting adverse events and correct classification; clear understanding of stakeholder roles within PV systems. Chapter 2: Regulatory Framework for Pharmacovigilance Content: current legislation in the EU, USA and Republic of North Macedonia. <i>Learning outcomes:</i> application of current legal requirements associated with PV. Chapter 3: Pharmacovigilance in Clinical Trials Content: PV activities specific to the clinical development phase. <i>Learning outcomes:</i> mastery of PV processes and obligations during clinical studies. Chapter 4: Signal Detection and Risk Management in Pharmacovigilance Content: identification, assessment, validation and management of signals in clinical and post-marketing settings; structure and purpose of Risk Management Plans (RMPs) and risk-management processes. <i>Learning outcomes:</i> competence in managing identified signals across development and post-marketing; understanding the role of RMPs in assuring quality, efficacy and safety on the market. Chapter 5: Pharmacovigilance in the Pharmaceutical Industry Content: PV systems of Marketing Authorisation Holders (MAHs), manufacturers, affiliates and wholesalers. <i>Learning outcomes:</i> understanding responsibilities and the importance of well-established MAH PV systems for product maintenance and regulatory compliance. Chapter 6: Use of Post-Marketing Studies in Pharmacovigilance Content: types, classification and practical application of post-marketing studies for safety signal identification and effectiveness evaluation; use of real-world data/evidence, electronic health records, AI and digital health tools. <i>Learning outcomes:</i> skills to evaluate study types and real-world data for appropriate implementation of GVP. Chapter 7: Pharmacovigilance in Special Populations Content: pathophysiological, PK/PD mechanisms influencing ADRs in special populations; populations at higher risk. <i>Learning outcomes:</i> ability to recognise at-risk groups, identify potential adverse events and report appropriately to MAHs and regulators.

		Chapter 8: Risk-Minimisation Measures in Pharmacovigilance Content: measures implemented to ensure rational use and patient safety. <i>Learning outcomes:</i> knowledge to monitor and apply risk-minimisation measures coordinated by regulators and PV systems with manufacturers and distributors.
13.	Course Interrelation	1) Prerequisite knowledge from: Pharmacology; Pharmaceutical Chemistry 1, 2 and 3; Pharmacoinformatics; Fundamentals of Clinical Pharmacy. 2) The knowledge from this course is required for following related content in subsequent courses.
14.	Teaching and Working Methods	Teaching methods: 1) Lectures; 2) Interactive classes (discussion of tasks, cases and problems). Working methods: 1) Laboratory exercises (practical skills); 2) Problem-solving (individual/group work to foster research and analytical skills, teamwork and application of theory); 3) Project work (research on a given topic to develop independent research and presentation skills).
15.	Total Workload	120 hours
16.	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 30 hours 16.2. Exercises (laboratory/auditory): 22.5 hours
17.	Other Forms of Activities	17.1. Project/seminar tasks: 7.5 hours 17.2. Independent learning: Preparation for theoretical classes: 30 hours; Preparation for practical classes: 15 hours 17.3. Examination preparation: 15 hours
18.	Requirments for Course Signature	40 points
19.	Assessment Method	19.1. Final exam (if no colloquia): 25–50 points 19.2. Colloquium: Colloquium 1: 13–25 points; Colloquium 2: 13–25 points 19.3. Practical exam: 6–10 points 19.4. Seminar paper/project, written and oral presentation: —
20.	Grading Criteria (points/grade)	Up to 60 pts – 5 (F) 60–66 pts – 6 (E) 67–75 pts – 7 (D) 76–84 pts – 8 (C) 85–93 pts – 9 (B) 94–100 pts – 10 (A)
21.	Method for Quality Assurance of Teaching	Open discussion and anonymous student survey conducted after completion of the course.
22.	Literature	22.1. Mandatory Literature 1) Waller, P. – <i>An Introduction to Pharmacovigilance</i>, 2nd ed., Wiley, 2017. 2) Bate, A. – <i>Methods in Pharmacology and Toxicology: Evidence-Based Pharmacovigilance</i>, Humana Press, 2018. 3) Thao Doan; Cheryl Renz – <i>Pharmacovigilance: A Practical Approach</i>, Elsevier, 2019.

		22.2. Additional Literature To be specified.

Appendix No.3		Course syllabus from the first cycle of studies
1.	Title of the Course	REGULATION FOR MARKETING AUTHORISATION OF MEDICINES AND PREVENTION OF FALSIFIED MEDICINES
2.	Code	FFIP Z20
3.	Study Programme	MASTER OF PHARMACY
4.	Organising Unit (Faculty, Institute, Department, Section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Applied Chemistry and Pharmaceutical Analysis
5.	Level (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Year: 5th Semester: IX
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturers (the course coordinator listed first)	Prof. Dr. Katerina Brezovska (course coordinator) Prof. Dr. Jelena Acevska Prof. Dr. Aneta Dimitrovska Asst. M.Sc. Hrisanta Godzo
9.	Language of Instruction	English
10.	Prerequisites for Attending and Passing the Course	For attending: none. For taking the exam: —
11.	Course Objectives (Competences) and Learning Outcomes	Objective To equip students with knowledge of the fundamental principles and legal requirements for obtaining a Marketing Authorisation (MA) for medicines, and the skills to apply this knowledge in pharmaceutical industry, regulatory authorities and research institutions, including competencies relevant to preventing falsified medicines. Learning outcomes Upon completion, students will be able to: • Interpret and apply regulatory requirements for obtaining MA. • Understand the documentation structure in the CTD format for MA applications. • Explain regulatory strategies to combat falsified medicines. • Prepare for roles within regulatory bodies and the pharmaceutical industry.
12.	Detailed Course Content by Chapters and Learning Outcomes	Chapter 1: Pharmaceutical Regulation for Obtaining Marketing Authorisation • Core concepts of MA procedures. • National regulation governing MA. • EU regulation governing MA. • Types of MA procedures. • Role of authorities: MALMED (North Macedonia), other national agencies, and the European Medicines Agency (EMA). • Harmonisation of national with EU legislation. <i>Learning outcomes:</i> Understand principles and significance of MA procedures; know the legal framework (national/EU) and degree of harmonisation; identify key regulatory bodies and their roles;

		distinguish types of procedures. Chapter 2: Dossier and Documentation for Marketing Authorisation • Standards and guidelines (ICH, EMA) for building MA dossiers. • CTD structure and content. • Regulatory assessment of MA dossiers. <i>Learning outcomes:</i> Explain CTD structure and its application in MA; recognise and use ICH/EMA guidance relevant to dossier preparation. Chapter 3: Post-authorisation Obligations of the Marketing Authorisation Holder (MAH) • Post-approval changes (types of variations). • Renewal of MA. <i>Learning outcomes:</i> Describe MAH obligations and legal consequences of non-compliance; identify and classify variation types. Chapter 4: Regulatory Measures to Prevent Falsified Medicines • Introduction, definition and public-health/industry impact of falsified medicines. • Drivers of falsification. • EU legal framework for prevention (e.g., safety features, supply-chain controls). • International agreements and initiatives. • Role of pharmacists and other stakeholders. <i>Learning outcomes:</i> Define falsified medicines and explain their impact; identify national/international regulations and initiatives; articulate the pharmacist's and stakeholders' roles in prevention and response.
13.	Course Interrelation	1) Prior knowledge from Drug Analysis is related to the course. 2) Subsequent courses requiring this knowledge: —
14.	Teaching and Working Methods	Teaching methods: 1) Lectures; 2) Interactive classes (discussion of tasks, cases, problems). Working methods: 1) Problem-solving (individual/group); 2) Project work (research and presentation skills).
15.	Total Workload	120 hours
16.	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 30 hours 16.2. Exercises (laboratory/auditory): 0 hours
17.	Other Forms of Activities	17.1. Project/seminar tasks: 15 hours 17.2. Independent learning: Preparation for theoretical classes: 60 hours 17.3. Examination preparation: 15 hours
18.	Requirments for Course Signature	At least 30 points from the planned activities (16.1, 17.1).
19.	Assessment Method	19.1. Final exam (if colloquia are not taken): 30–60 points 19.2. Colloquium: — 19.3. Practical exam: — 19.4. Seminar paper/project, written and oral presentation: 6–10 points

20.	Grading Criteria (points/grade)	Up to 60 pts – 5 (F) 60–66 pts – 6 (E) 67–75 pts – 7 (D) 76–84 pts – 8 (C) 85–93 pts – 9 (B) 94–100 pts – 10 (A)
21.	Method for Quality Assurance of Teaching	Open discussion and anonymous student survey conducted after completion of the course.
22.	Literature	22.1. Mandatory Literature • National legislation (Medicines Law, bylaws, guidelines); EU Directives; ICH guidelines; EMA QWP guidelines; FDA guidelines – current editions. 22.2. Additional Literature To be specified.

Appendix No.3		Course syllabus from the first cycle of studies
1.	Title of the Course	SUSTAINABILITY IN PHARMACY PRACTICE
2.	Code	FFIP_ZL21
3.	Study Programme	MASTER OF PHARMACY
4.	Organising Unit (Faculty, Institute, Department, Section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Pharmacognosy; Institute of Pharmaceutical Chemistry; Institute of Applied Chemistry and Pharmaceutical Analysis; Institute of Pharmaceutical Technology; Institute of Applied Biochemistry
5.	Level (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Years: 3, 4, 5 Semesters: VI, VII, VIII, IX
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturers (the course coordinator listed first)	Prof. Dr. Gjosh Stefkov (course coordinator) Prof. Dr. Zoran Sterjev Prof. Dr. Ana Poceva Panovska Prof. Dr. Marija Glavash Dodov Prof. Dr. Katerina Anchevska Netkovska Assoc. Prof. Dr. Zoran Zivikj
9.	Language of Instruction	English
10.	Prerequisites for Attending and Passing the Course	For attending: — For taking the exam: —
11.	Course Objectives (Competences) and Learning Outcomes	Objective Integrate UN SDGs and sustainability principles (environmental, social, economic) into pharmacy education and practice; prepare students to address climate change, resource scarcity and health inequities within pharmaceutical sciences and healthcare. Learning outcomes Upon completion, students will be able to: • Explain sustainability principles and their relevance to pharmacy; apply SDGs in education and practice. • Analyse environmental impacts across the medicine lifecycle (manufacture–distribution–disposal) and propose greener practices. • Design and implement sustainable operations in pharmacies and healthcare settings. • Advocate for public health through sustainable pharmacy practices.
12.	Detailed Course Content by Chapters and Learning Outcomes	Chapter 1: Introduction to Sustainability – Definition and principles; overview of UN SDGs; role of healthcare/pharmacy in achieving SDGs. Assessment: short essay on SDGs relevance to pharmacy. Chapter 2: Environmental Impact of Pharmaceuticals – Manufacturing impacts; ecotoxicology & pharmaceutical pollutants; green-by-design and green chemistry. Activities: green-chemistry lab, case analyses, guest lecture. Assessment: group project proposing a green solution in manufacturing.

		Chapter 3: Sustainable Pharmacy Practices – Energy efficiency & waste reduction in pharmacies; sustainable & ethical supply chains. Activities: workshops; role-play on ethical dilemmas. Assessment: group sustainability plan for a pharmacy. Chapter 4: Social & Economic Dimensions – Addressing health inequities; community engagement and education; cost–benefit of sustainable interventions. Assessment: presentation of a community-based sustainability initiative. Chapter 5: Emerging Policies & Technologies – Policies/regulations promoting sustainability; pharmacist’s role in circular economy. Assessment: seminar evaluating an innovative sustainable technology/policy. Cumulative learning outcomes: comprehensive understanding of sustainability in pharmacy; critical appraisal of environmental/social/economic impacts; ability to design and implement sustainable solutions; advocacy within health systems and communities.
13.	Course Interrelation	1) Prior courses: — 2) Subsequent courses requiring this knowledge: —
14.	Teaching and Working Methods	Teaching methods: 1) Lectures; 2) Interactive classes (case/problem discussions). Working methods: 1) Laboratory exercises; 2) Problem-solving (individual/group); 3) Project work (research + presentation).
15.	Total Workload	120 hours
16.	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 30 hours 16.2. Exercises (laboratory/auditory): 15 hours
17.	Other Forms of Activities	17.1. Project/seminar tasks: 5 hours 17.2. Independent learning: 45 hours 17.3. Examination preparation: 25 hours
18.	Requirments for Course Signature	At least 30 points from activities (16.1, 16.2, 17.1).
19.	Assessment Method	19.1. Final exam (if no colloquia): 25–50 pts 19.2. Colloquium: — 19.3. Practical exam: 6–10 pts 19.4. Seminar/project, written & oral presentation: 1–5 pts
20.	Grading Criteria (points/grade)	Up to 60 – 5 (F) 60–66 – 6 (E) 67–75 – 7 (D) 76–84 – 8 (C) 85–93 – 9 (B) 94–100 – 10 (A)
21.	Method for Quality Assurance of Teaching	Open discussion and anonymous survey after course delivery.
22.	Literature	22.1. Mandatory 1) Kümmerer K., Hempel M. Green and Sustainable Pharmacy.

		Springer, 2010. 2) Daughton C.G. Pharmaceuticals and Personal Care Products in the Environment. ACS, 2001 (electronic). 22.2. Additional 1) Nyagah D.M., Njagi A., Nyaga M.N. Pharmaceutical Waste: Overview, Management and Impact of Improper Disposal. KDP Print US, 2020. 2) Frumkin H. Environmental Health: From Global to Local. Wiley, 2010.

Appendix No.3		Course syllabus from the first cycle of studies
1.	Title of the Course	MANAGEMENT OF PHARMACEUTICAL WASTE
2.	Code	FFIP_L22
3.	Study Programme	MASTER OF PHARMACY
4.	Organising Unit (Faculty, Institute, Department, Section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Applied Chemistry and Pharmaceutical Analysis
5.	Level (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Years: 3rd, 4th Semesters: VI, VIII
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturers (the course coordinator listed first)	Prof. Dr. Ana Poceva Panovska (course coordinator) Asst. Prof. Dr. Olga Gigopulu
9.	Language of Instruction	English
10.	Prerequisites for Attending and Passing the Course	For attending: — For taking the exam: —
11.	Course Objectives (Competences) and Learning Outcomes	Objectives • Understand types, sources and impacts of pharmaceutical waste on environment and health. • Adopt principles and practices for sustainable waste management. • Recognise national/international regulations. • Develop skills to apply good practices in community/hospital pharmacy and industry. Learning outcomes Students will: (i) explain waste categories, sources, pathways to the environment, and the medicine life-cycle; (ii) assess environmental/health impacts; (iii) apply compliant, sustainable waste practices per national and international frameworks in healthcare and industry.
12.	Detailed Course Content by Chapters and Learning Outcomes	Chapter 1: Introduction to Pharmaceutical Waste – Definitions and classification; sources and environmental pathways; medicine life-cycle; pharmacist's role. Outcomes: explain key concepts, identify sources/pathways, describe life-cycle stages, and justify proper management.

		Chapter 2: Environmental and Health Impacts – Pollution of water/soil; ecotoxicological consequences; human health risks; rationale for sustainable practice. Outcomes: describe impacts and risks; argue for risk-minimising practices. Chapter 3: Legislation and Regulations – National laws; WHO guidance; EU directives; pharmacist roles; ethical responsibilities; critical appraisal of regulatory effectiveness; aligning local practice to best standards. Outcomes: identify applicable frameworks; assess ethics; propose alignment strategies. Chapter 4: Waste Management Practices – Prevention/minimisation; correct classification, storage, transport, treatment; take-back systems and expired/unused medicines. Outcomes: design practical, compliant workflows and take-back policies. Chapter 5: Sustainable Practices – Applying sustainability across manufacture–use–disposal; green pharmacy technologies; strategies for pharmacies and hospitals. Outcomes: integrate sustainability principles and develop institutional strategies. Chapter 6: Education and Public Awareness – Pharmacist-led public education; household take-back campaigns; cross-sector collaboration. Outcomes: plan outreach campaigns and multi-stakeholder collaboration. Chapter 7: Case Studies and Best Practices – Industrial/health-system exemplars; review of national/international programmes. Outcomes: analyse programmes and adapt best practices locally.
13.	Course Interrelation	1) Prior courses required: — 2) Subsequent courses requiring this knowledge: —
14.	Teaching and Working Methods	Teaching methods: 1) Lectures; 2) Interactive classes (case/problem discussions). Working methods: 1) Problem-solving; 2) Project work.
15.	Total Workload	120 hours
16.	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 30 hours 16.2. Exercises (laboratory/auditory): —
17.	Other Forms of Activities	17.1. Project/seminar tasks: 15 hours 17.2. Independent learning: 60 hours 17.3. Examination preparation: 15 hours
18.	Conditions for Course Signature	12–15 points from activity 16.1.

19.	Assessment Method	19.1. Final exam (if no colloquia): 41–80 pts 19.2. Colloquium: — 19.3. Practical exam: — 19.4. Seminar/project, written & oral presentation: 8–15 pts 19.5. Continuous participation/engagement: up to 5 pts
20.	Grading Criteria (points/grade)	Up to 60 – 5 (F) 60–66 – 6 (E) 67–75 – 7 (D) 76–84 – 8 (C) 85–93 – 9 (B) 94–100 – 10 (A)
21.	Method for Quality Assurance of Teaching	Open discussion and anonymous survey after course delivery.
22.	Literature	22.1. Mandatory 1) Kümmerer K., Hempel M. (eds.) <i>Green and Sustainable Pharmacy</i> . Springer, 2010 (pdf). 2) Kümmerer K. (ed.) <i>Pharmaceuticals in the Environment: Sources, Fate, Effects and Risks</i> . Springer, 2008 (pdf). 22.2. Additional 1) Relevant papers in international journals (latest editions).

Appendix No.3		Course syllabus from the first cycle of studies
1.	Course Title	BIOLOGICAL MEDICINES AND VACCINES
2.	Code	FFIP L23
3.	Study Programme	MASTER OF PHARMACY
4.	Organiser of the Study Programme (unit, institute, department, section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Pharmaceutical Chemistry
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Year: 3rd or 5th Semester: VI / VIII
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturer (in case of several lecturers, the course coordinator should be listed first)	Prof. Dr. Aleksandra Grozdanova (course coordinator) Asst. Prof. Dr. Aleksandar Dimkovski Asst. Prof. Dr. Evgenija Mihajloska
9.	Language of Instruction	English
10.	Prerequisites for attending and taking the exam	/
11.	Course Objectives (Competences) and Learning Outcomes	The aim of the course is for students to acquire and develop an understanding of the basic principles for the development, production, and application of biological medicines. To become familiar with the specificities in pharmacology, pharmaceutical technology and regulation related to biological medicines, as well as with the pharmacoeconomic, safety and ethical aspects of biological therapies. Students will be able to apply the acquired knowledge through analysis and understanding of the basic therapeutic applications and regulations of biological medicines and vaccines and their use in pharmacy. Upon completion of the course, the student will be able to understand and apply the laws regulating intellectual property rights in pharmacy, to identify and apply ethical principles related to intellectual property rights and the availability of medicines, and to recognise and explain challenges associated with new technologies.
12.	Detailed Course Content by Chapters and Learning Outcomes for Each Chapter	Chapter: Introduction to Biological Medicines • Development, definition and classification of biological medicines. • Differences between biological and chemical medicines. • Types of biological medicines: monoclonal antibodies, recombinant proteins, blood and blood products, medicines obtained by recombinant DNA technology, cells, tissues, organs, gene therapy, vaccines, gene and cell therapy. • Innovative biological medicines, methods of obtaining them through genetic engineering and biotechnology. Learning outcomes: Students will be able to define biological

		medicines, identify categories of biological medicines and explain their specificities. Chapter: Biosimilar Medicines • Definition, development and differences from reference biological medicines. • Regulatory requirements in the EU and other countries. • Categories of biosimilar medicines, development of biobetter medicines. Learning outcomes: Students will be able to define biosimilar medicines, identify categories and understand their specific characteristics. Chapter: Regulation of Biological and Biosimilar Medicines • Overview of international and national legislation for obtaining marketing authorisation and post-marketing surveillance of biological medicines and advanced therapy (gene therapy, stem cell therapy, cell and tissue products). • Structure and organisation of documentation for obtaining marketing authorisation (Master file for biological products and vaccines), documents for preparing plans and decisions for assessing quality in pharmaceutical development. • Regulation for maintaining marketing authorisation, variations and renewal. Learning outcomes: Students will be able to define the regulatory requirements for biological and biosimilar medicines. Chapter: Vaccines • Types of vaccines and methods of production. • Vaccines obtained by classical procedures of attenuation and inactivation. • Vector-based vaccines. • Vaccines obtained through recombinant DNA technology. • Vaccines obtained by conjugation and linking with protein carriers. • Vaccines obtained using mRNA technology. • Therapeutic vaccines. Learning outcomes: Students will be able to explain the process of vaccine production, the types of vaccines and their mechanisms of action. Chapter: Application of Biological Medicines • Biological medicines in immunology, oncology, endocrinology and rare diseases. • Specific examples: insulin, immunotherapy, therapy for autoimmune diseases. • Randomised controlled trials and post-marketing monitoring of biological medicines, preparation of plans and quality assessment decisions in pharmaceutical development of biological medicines. • Development of new types of vaccines.
13.	Course Interconnection	Prior knowledge from the course Pharmaceutical Chemistry 2 .

14.	Detailed Description of Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive classes including discussions on specific cases and problems. Working methods: 1. Problem solving (students work individually or in groups to solve specific problems to encourage research and analytical skills, teamwork and application of theoretical knowledge). 2. Project work (preparation of a project involving research on a given topic aimed at developing independent research and presentation skills before an audience).
15.	Total Workload	120 hours
16.	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 20 hours 16.2. Exercises (laboratory, auditory): 20 hours
17.	Other Forms of Activities	17.1. Project assignments/seminars: 20 hours 17.2. Independent study: preparation for theoretical classes: 20 hours; preparation for practical classes: 20 hours 17.3. Exam preparation: 20 hours
18.	Requirments for Course Signature	At least 30 points from the planned activities (16.1, 16.2, 17.1)
19.	Assessment Method	19.1. Final exam (if colloquia are not taken): 25–50 points 19.2. Colloquium: / 19.3. Practical exam: / 19.4. Seminar work/project, written and oral presentation: 30–40 points
20.	Grading Criteria (points/grade)	Up to 60 pts – 5 (F) 60–66 pts – 6 (E) 67–75 pts – 7 (D) 76–84 pts – 8 (C) 85–93 pts – 9 (B) 94–100 pts – 10 (A)
21.	Method for Monitoring Teaching Quality	Open discussion and anonymous survey conducted after course completion.
22.	Literature	22.1. Mandatory literature 1. Rebecca Sheets – <i>Fundamentals of Biologicals Regulation: Vaccines and Biotechnology Medicines</i>. Science Direct, 2021. 2. Wei Wang, Manmohan Singh (eds.) – <i>Biological Drug Products: Development and Strategies</i>. Wiley, 2017. 3. EMA and FDA Guidelines; EU Directives; ICH Guidelines. 4. Stanley A. Plotkin, Walter A. Orenstein – <i>Vaccines</i>. Wiley, 2019. 22.2. Additional literature 1. Relevant papers in international scientific journals. 2. <i>WHO Guidelines on Vaccine Development and Implementation</i> (2024–). 3. National legislation and international regulation. 4. <i>National Immunisation Schedule of the Republic of North Macedonia</i> (2024–).

Appendix No.3		Course syllabus from the first cycle of studies
1.	Course Title	PHARMACEUTICAL MANAGEMENT
2.	Code	FFIP Z24
3.	Study Programme	MASTER OF PHARMACY
4.	Organiser of the Study Programme (unit, institute, department, section)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Pharmaceutical Chemistry
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic Year / Semester	Year: 3rd / 4th Semester: VII / IX
7.	Course Load (ECTS credits)	4 ECTS credits
8.	Lecturer (in case of several lecturers, indicate the course coordinator)	Prof. Dr. Zoran Sterjev (course coordinator) Prof. Dr. Aleksandra Grozdanova
9.	Language of Instruction	English
10.	Prerequisites for Attending and Taking the Exam	Prerequisite for attending the course: (attended Social Pharmacy and Pharmacoinformatics) Prerequisite for taking the exam: (passed Social Pharmacy and Pharmacoinformatics)
11.	Course Objectives (Competences) and Learning Outcomes	Course objectives (competences): The aim is for students to acquire basic knowledge of management, management functions, the fundamentals of pharmaceutical management, modern techniques and functions for integrated management in the healthcare industry, inventory management, order creation, organisational management, internal control and quality management systems. Students will also gain basic knowledge of pharmaceutical marketing and its legal regulation, core models and working methods and techniques for successful communication with patients and other healthcare professionals, and good dispensing practices. Expected outcomes: Upon completion, students are expected to demonstrate knowledge of: the basics of pharmaceutical management; managing processes and people in the pharmaceutical sector; the purpose of strategic planning and concrete steps to develop a strategic plan; concepts of operations and operations management; quality measurement in pharmaceutical practice; procurement and inventory management; as well as techniques and methods for successful communication and overcoming potential barriers and problems in communication with the patient; communication as part of providing quality pharmaceutical care; advancement and development of the pharmacy profession in the health system; applying good dispensing practices; providing the necessary counselling to patients at dispensing related

		to dosage forms; and basic concepts of pharmaceutical management in community-pharmacy operations.
12.	Detailed Course Content by Chapters and Learning Outcomes	Chapter: Introduction to Pharmaceutical Management Management theories, managerial skills, management process, behavioural theory of management, systems theory of management. Learning outcomes: Students will gain knowledge of the five basic managerial responsibilities—planning, organising, directing, coordinating and controlling—and specific skills for effective management of people, systems and processes. Chapter: Strategic Planning in Pharmaceutical Operations Planning in the pharmaceutical sector (business, financial, operational, resource, organisational and strategic planning). Strategic planning process; barriers and limitations in planning. Learning outcomes: Students will acquire basic knowledge of strategic planning, steps in the planning process, and the stages of strategic planning (pre-planning, planning, post-planning). Chapter: Operations Management in the Pharmaceutical Sector Operations strategy, pharmaceutical business operations, pharmaceutical manufacturing operations, business process improvement, technology, planning and control of advanced supply-chain operations, scheduling, process management and quality management. Learning outcomes: Students will gain knowledge on management and optimisation for competitive advantage; business processes, procedures and strategies for improved quality assurance; measurement of product and service quality; strategies for effective operations management; supply-chain management dynamics; and drivers of outsourcing and vertical integration. Chapter: Quality Assurance in Pharmaceutical Operations Quality, quality measurement, quality management, methods for assuring quality in pharmaceutical practice. Learning outcomes: The student is expected to gain knowledge of the importance of quality in pharmaceutical practice, how quality is measured in practice, examples of successful quality practices, differences between quality assurance, quality control and continuous quality improvement, methods for assuring quality in practice, and the necessary steps for a successful continuous quality-improvement plan. Chapter: Business Planning Steps in creating a business plan, elements of a business plan. Learning outcomes: Students will gain knowledge of the purpose of business-plan development, components of a business plan, and how to prepare and implement a business plan. Chapter: Inventory Management Types of inventory, inventory costs, inventory control, methods of inventory control.

		Learning outcomes: Students will gain knowledge of the basics of maintaining inventory, inventory calculations, evaluation and application of related policies and procedures for inventory maintenance, and concepts for managing pharmaceutical inventories. Chapter: Pharmaceutical Marketing Elements of pharmaceutical marketing (product, price, distribution, positioning), promotion of pharmaceutical products, ethical and regulatory aspects in promotion, standards for promotion of pharmaceutical products. Learning outcomes: Students will gain knowledge of the basics and specifics of pharmaceutical marketing; the tasks and scope of activities of pharmaceutical marketing departments within companies; good practices in promotion; and ethical and regulatory aspects related to promotion of pharmaceutical products. Chapter: Dispensing of Medicines Legislation related to dispensing; good dispensing practices; dispensing process; necessary counselling to be provided to patients at dispensing related to dosage forms; most common causes that may lead to dispensing errors. Learning outcomes: Applying good dispensing practices; providing the necessary counselling to patients at dispensing related to dosage forms; and basic concepts of pharmaceutical management in community-pharmacy operations. Chapter: Communication Skills in Pharmaceutical Practice Basic principles of communication: types of communication; elements of successful communication; communication models; barriers and methods for improvement; presentation skills—elements, preparation and techniques; patient counselling and education; empathy; communication between pharmacists and other healthcare professionals. Learning outcomes: Students will gain knowledge of techniques and methods for successful communication and overcoming potential barriers and problems in communication with the patient; communication as part of successfully providing quality pharmaceutical care; and knowledge for advancing and developing the pharmacy profession within the healthcare system.
13.	Course Interconnection	1. Prior knowledge from the courses: Social Pharmacy and Pharmacoinformatics. 2. The knowledge from this course is needed for following the content of: Social Pharmacy and Pharmacoinformatics.
14.	Detailed Description of Teaching and Working Methods	Teaching methods: 1. Lectures 2. Interactive classes including discussions of specific tasks, cases, problems Working methods: 1. Problem-solving (students work independently/in groups to solve specific problems in order to foster research and analytical skills,

		teamwork, and application of theoretical knowledge) 2. Project work (a project involving research on a given topic aimed at developing abilities for independent research and presentation before an audience).
15.	Total Workload	120 hours
16.	Forms of Teaching Activities	16.1. Lectures – theoretical instruction: 30 hours 16.2. Exercises (laboratory, auditory): 0 hours
17.	Other Forms of Activities	17.1. Project tasks/seminars: 30 hours 17.2. Independent study: Preparation for theoretical instruction: 30 hours 17.3. Exam preparation: 30 hours
18.	Requirments for Course Signature	40 points
19.	Assessment Method	19.1. Final exam (if colloquia are not taken): 25–60 points 19.2. Colloquium: — 19.3. Practical exam: — 19.4. Seminar work/project, written and oral presentation: x
20.	Grading Criteria (points/grade)	Up to 60 points – 5 (F) 60–66 points – 6 (E) 67–75 points – 7 (D) 76–84 points – 8 (C) 85–93 points – 9 (B) 94–100 points – 10 (A)
21.	Method for Monitoring the Quality of Teaching	Open discussion and anonymous survey conducted after completion of the course.
22.	Literature	22.1. Mandatory Literature 1. Joan Gratto Liebler, Charles R. McConnell – <i>Management Principles for Health Professionals</i> , 8th Ed. – Jones & Bartlett Learning, 2021 2. John D. Blair, Myron D. Fottler, et al. – <i>Advances in Health Care Management</i> – Emerald Publishing Limited, 2020 3. Sharon B. Buchbinder, Nancy H. Shanks, Dale Buchbinder, Bobbie J. Kite – <i>Cases in Health Care Management</i> , 2nd Ed. – Jones & Bartlett Learning, 2023 22.2. Additional Literature 1. Andrew M. Peterson, William N. Kelly – <i>Leadership and Management in Pharmacy Practice</i> – CRC Press, 2015 2. Ajoy S Joseph – <i>Pharmaceutical Management and Marketing</i> – CBS Publishers, 2021 3. Additional literature —

Appendix No.3		Course syllabus from the first cycle of studies
1.	Course Title	DIPLOMA THESIS
2.	Code	FFDR
3.	Programme of Study	Master of Pharmacy
4.	Organising Unit (Faculty/Institute/Department/Division)	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
5.	Degree (first, second, third cycle)	Integrated First and Second Cycle of Studies
6.	Academic Year / Semester	Year: 5th Semester: X
7.	Course Load (ECTS credits)	10 ECTS credits
8.	Lecturer(s)	All academic staff of the Faculty of Pharmacy
9.	Language of Instruction	English
10.	Prerequisites for Attending and Passing the Course	Prerequisite to enrol: at least 240 ECTS credits earned. Prerequisite to pass (defend): 290 ECTS credits earned.
11.	Course Objectives (Competencies) and Learning Outcomes	Objectives of the Diploma Thesis: 1) Demonstrate acquired knowledge. 2) Develop research skills. 3) Develop analytical and critical-thinking skills. 4) Foster creativity and originality. 5) Contribute to science and professional practice. 6) Improve communication skills. Learning Outcomes: <i>Demonstration of acquired knowledge</i> — apply theoretical and practical knowledge to identify and analyse specific problems; integrate multiple disciplines to fully understand the selected topic. <i>Research skills</i> — conduct independent research using appropriate methodologies and tools; collect, process, and interpret relevant data. <i>Analytical and critical skills</i> — critically analyse scientific sources, link them to own findings, propose solutions, make evidence-based decisions, and solve complex problems systematically. <i>Creativity and originality</i> — generate new ideas/approaches contributing to the field; develop an original, innovative treatment of the topic; stay current with trends; understand ethical and sustainability aspects. <i>Contribution to science and practice</i> — demonstrate applicability of research in real/professional contexts; recommend concrete measures or changes based on findings. <i>Communication skills</i> — produce structured, scientifically sound documentation; present and defend the research effectively.
12.	Detailed Course Content (by chapters/units with learning outcomes)	The diploma thesis is the final component of the student's education, rounding off professional development. Students in the undergraduate

	(integrated) pharmacy programme must prepare and successfully defend a diploma thesis in line with the accredited curriculum. It is a final examination treated equivalently to other courses. The thesis must be written in Macedonian (with standard use of symbols/technical terms). Formatting must follow the official technical guidelines. The diploma thesis is an independent work in which the student develops a specific professional topic from practice or theory within the study field, demonstrating the ability to apply theoretical and practical knowledge and present the acquired professional competencies. The topic may be chosen from the list published at the start of the calendar year on the Faculty website. The thesis is prepared under the mentorship of a teacher (only staff delivering courses within the programme). The mentor supervises the work, provides guidance, and directs to relevant literature. The student may register a thesis after earning at least 240 ECTS. Registration is electronic via the iKnow system once the curriculum conditions are met. A hard-copy registration is also submitted to the Student Services Office. Further details on registration, evaluation, and defence are available on the Faculty website (Diploma Topics – Faculty of Pharmacy). As guidance, the thesis should be 20–35 pages; the length may vary by topic in agreement with the mentor. The final thesis is submitted electronically to the Faculty archive at: diplomska@ff.ukim.edu.mk. Required structure: Title page; Table of contents; Abstract; Introduction; Main body; Conclusion; References; Appendices (if needed). The thesis must comply with the official technical instruction for thesis writing available on the Faculty website.
13.	Correlation with Other Courses /

14.	Teaching and Working Methods	Interactive sessions including discussions on selected topics, cases, and problems; Experimental work.
15.	Total Workload	—
16.	Forms of Teaching Activities	16.1. Lectures – theoretical classes: / 16.2. Exercises (laboratory, auditory): /
17.	Other Forms of Activities	17.1. Project/seminar tasks: / 17.2. Independent study: / 17.3. Exam preparation: /
18.	Requirements for Signature	/
19.	Assessment Methods	19.1. Final exam (defence): 50–100 points 19.2. Mid-term exam: / 19.3. Practical exam: / 19.4. Seminar/project, written & oral presentation: /
20.	Grading Criteria (Points / Grade)	0–59 → 5 (F) 60–66 → 6 (E) 67–75 → 7 (D) 76–84 → 8 (C) 85–93 → 9 (B) 94–100 → 10 (A)
21.	Method for Monitoring Teaching Quality	Open discussion and anonymous survey conducted after course completion.
22.	Literature	22.1. Mandatory Literature: To be specified by mentor/supervisor. 22.2. Additional Literature: To be specified by mentor/supervisor.

ANNEX NO. 4

No.1	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Zoran Sterjev		
2.	Date of Birth	02.04.1974		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate Studies	1998	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master's Studies	2008	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral Studies	2012	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Clinical Pharmacy
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines.	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Clinical Pharmacy
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Full Professor	Pharmaceutical Chemistry, Pharmacoinformatics, Social pharmacy
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.1.	List of courses taught by the instructor in the first cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Pharmaceutical Chemistry III	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	2.	Pharmaceutical Chemistry II	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	3.	Fundamentals of Clinical Pharmacy	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	4.	Pharmacoeconomics and Pharmacoepidemiology	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	5.	Clinical Pharmacy and Therapeutics	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	6.	Pharmacoinformatics	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	7.	Health promotion	Dietetics and Diet Therapy/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	8.	Information Retrieval and Database Utilization	Dietetics and Diet Therapy/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
9.2.	List of courses taught by the instructor in the second cycle of studies			

		No.	Course Title	Study Program / Institution
		1.	Pharmacoinformatics	Pharmaceutical Regulation/Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		2.	Application of pharmacoinformatics I pharmacoeconomics in Pharmacovigilance	Pharmacovigilance /Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		3.	Pharmaceutical marketing	Pharmaceutical industry/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		4.	Pharmaceutical marketing	Cosmetology/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
	9.3.	List of courses taught by the instructor in the third cycle of studies		
		No.	Course Title	Study Program / Institution
		1.	Pharmaceutical management and pharmacoeconomics	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		2.	Clinical Pharmacy	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		3.	Molecular Basis of Therapeutics	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
10.	Selected Results in the Last Five Years			
10.1.	Relevant Published Scientific Papers (up to five)			
	No.	Authors	Title	Publisher / Year
	1.	Kapedanovska Nestorovska A, Sterjev Z.	Cost-Effectiveness of Oral Nutritional Supplements in Malnourished or at Risk of Disease-Related Malnutrition Cancer Patients in North Macedonia.	Clinicoecon Outcomes Res. 2025 Mar 26;17:265-276. doi: 10.2147/CEOR.S504094.
	2.	Grozdanova A, Mihajloska E, Naumovska Z, Staninova Stojovska M, Sterjev Z , Dimkovski A, Anchevska Netkovska K.	Toward value in healthcare: opportunities and challenges for implementing Value-Based Healthcare in North Macedonia.	Front Public Health. 2025 Oct 15;13:1646870. doi: 10.3389/fpubh.2025.1646870. PMID: 41170483; PMCID: PMC12568455.

		3.	Dimkovski A, Dobričić V, Simić MR, Jurhar Pavlova M, Mihajloska E, Sterjev Z , Poceva Panovska A.	Synthesis, Biological Evaluation, and Molecular Docking Studies of Novel Coumarin-Triazole-Isatin Hybrids as Selective Butyrylcholinesterase Inhibitors.	Molecules. 2025 May 11;30(10):2121. doi: 10.3390/molecules30102121. PMID: 40430294; PMCID: PMC12114297.
		4.	Nestorovska KA, Naumovska Z, Stojovska MS, Sterjev Z , Dimovski A, Suturkova Lj.	Co-Existence of* 1/* 2 and. 3435 CT Genotype has a Potential Impact on Clinical Outcome in CAD Patients Treated with Clopidogrel	Balkan Journal of Medical Genetics. 2023; 26(2):35-40. https://doi.org/10.2478/bjmg-2023-0023
		5.	Ivanov E, Sterjev Z , Budic I, Nojkov J, Karadzova D, Sivevski A.	Influence of Potential Gene Polymorphisms on Propofol Dosage Regimen in Patients Undergoing Abdominal Hysterectomy.	Balkan J Med Genet. 2021; 23(2):41-48. doi: 10.2478/bjmg-2020-0030 PMID: 33816071; PMCID: PMC8009561.
	10.2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Principal Investigator	Implementation of an Electrochemical Method Using a Potentiostat for Simulation and Analysis of Drug Metabolism in the Central Nervous System (CNS)	Ministry of Education and Science (2025–2027)
		2.	Participant	Implementation of the Pharmaceutical Service “New Medicine Service”	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy (2025–2026)

		3.	Participant	Implementation of innovation models to the process of new product development for wound healing in the health	Type of project: Bilateral Austria-North Macedonia project Financed by: ME Project length: 2022-2023
		4.	Participant	Detection of minimal residual disease by analysis of individual specific rearrangements of immunoglobulin and/or T-cell receptor genes	Type of project: National Financed by: ME North Macedonia Project length: 2020-2022
		5.	Participant	EU Health Policies – Harmonization and Advancement of National Needs for Implementing Value-Based Healthcare	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy (2024–2025)
	10.3.	Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Naumovska, Z., Kapedanovska-Nestorovska, A., Sterjev, Z. , Mladenovska, K., Grozdanova, A., Dimkovski, A., & Mihajloska, E.	Manual for Practical Classes in Pharmaceutical Chemistry I. Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy.	National and University Library "Ss. Kliment Ohridski", Skopje/2025. 615.011(076). ISBN 978-608-5037-10-0. COBISS.MK-ID 65051653. Available at: http://www.ff.ukim.edu.mk/wp-content/uploads/2025/01/
		2.	Anchevska Netkovska K, Grozdanova A, Sterjev Z , Poceva Panovska A, Tonic Ribarska J, Brezovska K.	Intellectual property rights in pharmacy	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy-2021
	10.4.	Published Professional Papers in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year

		1.	Nestorovska KA, Naumovska Z, Stojovska MS, Sterjev Z , Dimovski A, Suturkova Lj.	Co-Existence of* 1/* 2 and. 3435 CT Genotype has a Potential Impact on Clinical Outcome in CAD Patients Treated with Clopidogrel	Balkan Journal of Medical Genetics. 2023; 26(2):35-40. https://doi.org/10.2478/bjmg-2023-0023
		2.	Micik J, Dimovski A, Sterjev Z , Shuturkova L, Grozdanova A.	Implementing an Antimicrobial Stewardship Program and Complete Screening in an Intensive Care Unit in Relation to the Overall Clinical Outcome of Patients.	Pril (Makedon Akad Nauk Umet Odd Med Nauki). 2024 Dec 12;45(3):13-24. doi: 10.2478/prilozi-2024-0019. PMID: 39667009.
		3.	Lazarova B, Eftimova B, Mihailova L, Filkova S, Naumovska Z, Sterjev Z .	Evaluation of antibiotic consumption in Clinical hospital in Stip for the period 2017-2019.	Macedonian pharmaceutical bulletin. 2020; 66 (1): 77-78. DOI: 10.33320/maced.pharm.bull.2020.66.03.038
		4.	Ivanov E, Sterjev Z , Budic I, Nojkov J, Karadzova D, Sivevski A.	Influence of Potential Gene Polymorphisms on Propofol Dosage Regimen in Patients Undergoing Abdominal Hysterectomy.	Balkan J Med Genet. 2021; 23(2):41-48. doi: 10.2478/bjmg-2020-0030 PMID: 33816071; PMCID: PMC8009561.
		5.	Qehaja SS, Sterjev Z , Shuturkova Lj, Nestorovska KA, Naumovska Z, Krasniqi V, Elezi E.	Knowledge, attitude and practice of pharmacists to pharmacovigilance and adverse drug reactions reporting process: a cross-sectional study in Kosovo	Macedonian pharmaceutical bulletin. 2021; 67 (1): 67-77. DOI: 10.33320/maced.pharm.bull.2021.67.01.007
11.	Mentorships				
	11.1.	Diploma Theses		50	
	11.2.	Master's Theses		25	

	11.3.	Doctoral Dissertations	2		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	Kapedanovska Nestorovska A, Sterjev Z.	Cost-Effectiveness of Oral Nutritional Supplements in Malnourished or at Risk of Disease- Related Malnutrition Cancer Patients in North Macedonia.	Clinicoecon Outcomes Res. 2025 Mar 26;17:265-276. doi: 10.2147/ CEOR.S504094.
		2.	Grozdanova A, Mihajloska E, Naumovska Z, Staninova Stojovska M, Sterjev Z, Dimkovski A, Anchevska Netkovska K.	Toward value in healthcare: opportunities and challenges for implementing Value-Based Healthcare in North Macedonia.	Front Public Health. 2025 Oct 15;13:1646870. doi: 10.3389/fpubh.2025.1646870. PMID: 41170483; PMCID: PMC12568455.
		3.	Dimkovski A, Dobričić V, Simić MR, Jurhar Pavlova M, Mihajloska E, Sterjev Z, Poceva Panovska A.	Synthesis, Biological Evaluation, and Molecular Docking Studies of Novel Coumarin- Triazole-Isatin Hybrids as Selective Butyrylcholinesterase Inhibitors.	Molecules. 2025 May 11;30(10):2121. doi: 10.3390/molecules30102121. PMID: 40430294; PMCID: PMC12114297.
4.	Nestorovska KA, Naumovska Z, Stojovska MS, Sterjev Z, Dimovski A, Suturkova Lj.	Co-Existence of* 1/* 2 and. 3435 CT Genotype has a Potential Impact on Clinical Outcome in CAD Patients Treated with Clopidogrel	Balkan Journal of Medical Genetics. 2023; 26(2):35-40. https://doi.org/10.2478/bjmg-2023-0023		

		5.	Ivanov E, Sterjev Z , Budic I, Nojkov J, Karadzova D, Sivevski A.	Influence of Potential Gene Polymorphisms on Propofol Dosage Regimen in Patients Undergoing Abdominal Hysterectomy.	Balkan J Med Genet. 2021; 23(2):41-48. doi: 10.2478/bjmg-2020-0030 PMID: 33816071; PMCID: PMC8009561.
		6.	Nestorovska KA, Naumovska Z, Stojovska MS, Sterjev Z , Dimovski A, Suturkova Lj.	Co-Existence of* 1/* 2 and. 3435 CT Genotype has a Potential Impact on Clinical Outcome in CAD Patients Treated with Clopidogrel	Balkan Journal of Medical Genetics. 2023; 26(2):35-40. https://doi.org/10.2478/bjmg-2023-0023
	12.2.	Evidence of at least two published research papers in international scientific journals with an impact factor in the given field over the past five years			
		No	Authors	Title	Publisher / Year
		1.	Kapedanovska Nestorovska A, Sterjev Z .	Cost-Effectiveness of Oral Nutritional Supplements in Malnourished or at Risk of Disease-Related Malnutrition Cancer Patients in North Macedonia.	Clinicoecon Outcomes Res. 2025 Mar 26;17:265-276. doi: 10.2147/CEOR.S504094 (IF=2.2)
		2.	Dimkovski A, Dobričić V, Simić MR, Jurhar Pavlova M, Mihajloska E, Sterjev Z , Poceva Panovska A.	Synthesis, Biological Evaluation, and Molecular Docking Studies of Novel Coumarin-Triazole-Isatin Hybrids as Selective Butyrylcholinesterase Inhibitors.	Molecules. 2025 May 11;30(10):2121. doi: 10.3390/molecules30102121. PMID: 40430294; PMCID: PMC12114297. (I.F – 4.6)

		3.	Mihajloska E, Dimkovski A, Grozdanova A, Vasilevska A, Antova D, Naumovska Z, Nestorovska AK, Sterjev Z , Osmani B, Shuturkova L.	Early predictive factors in routine clinical practice for rituximab therapy response in patients with rheumatoid arthritis.	Reumatologia. 2024 Jun 18;62(3):15 (IF=1.7)	
	12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
		No	Authors	Title	International Meeting / Conference	Publisher / Year
		1.	Sterjev Zoran	Pharmacogenetic Approach in the Treatment of CNS Disease	International conference New horizons in technology transfer in pharmacy, Varna - Bulgaria	2025
		2.	Lirim Shabani, Zoran Sterjev	Importance of medication therapy management for neurological patients with polytherapy	8 th Congress of the Macedonian Neurological Society	2025
		3.	Aleksandra K.Nestorovska, Zoran Sterjev	Nutrition care matters: Cost-Effectiveness of oral nutritional supplements in cancer patients within a national cancer care program in North Macedonia	4th Croatian Congress of Clinical Pharmacy, Zagreb - Croatia	2025

No.2	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Aleksandar Dimovski		
2.	Date of Birth	October 18, 1962		
3.	Educational Qualification	VIII (MD, PhD)		
4.	Academic and Professional Titles	Full Professor, MD PhD		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		MD	1987	Faculty of Medicine, University Ss. Cyril and Methodius, Skopje
		PhD	2003	University of Limburg, Maastricht, The Netherlands
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		/	/	/
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical sciences and health	Medicine	Molecular medicine
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	UKIM – Faculty of Pharmacy	Full Professor	Pharmacogenetics, Imunochemistry
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.1.	List of courses taught by the instructor in the first cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Molecular and cell biology and genetics	Master of pharmacy, UKIM – Faculty of Pharmacy, Skopje	
	2.	Basic immunology	Master of pharmacy, UKIM – Faculty of Pharmacy, Skopje	
	3.	Pharmacogenetics, pharmacogenomics and individualized therapy	Master of pharmacy, UKIM – Faculty of Pharmacy, Skopje	
9.2.	List of courses taught by the instructor in the second cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.			
	2.			
	3			
9.3.	List of courses taught by the instructor in the third cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Methods of scientific research	Pharmacy / UKIM – Faculty of Pharmacy, Skopje	

		2.	Molecular diagnostics of inherited, infectious and malignant diseases	Pharmacy / UKIM – Faculty of Pharmacy, Skopje
		3.	Cell signaling	Pharmacy / UKIM – Faculty of Pharmacy, Skopje
10.	Selected Results in the Last Five Years			
	10.1.	Relevant Published Scientific Papers (up to five)		
		No.	Authors	Title
		1	Krstevska Bozhinovikj E, Matevska-Geshkovska N, Marija Staninova Stojovska M, Gjorgievska E, Ridova N, Panovska Stavridis I, Kocheva S, Dimovski AJ.	<i>Presence of minimal residual disease determined by next-generation sequencing is not a reliable prognostic biomarker in children with acute lymphoblastic leukemia</i>
		2	Bonato A, Chakraborty S, Bomben R, Canarutto G, Felician G, Martines C, Zucchetto A, Pozzo F, Vujovikj M, Chiarenza A, Del Poeta G, Marasca R, Tafuri A, Laurenti L, Piazza S, Dimovski AJ, Gattei V, Efremov DG	<i>NFKBIE mutations are selected by the tumor microenvironment and contribute to immune escape in chronic lymphocytic leukemia</i>
				Publisher / Year
				Leukemia and Lymphoma. 2025 Jan 22:1-8. doi: 10.1080/10428194.2025.2456100.
				Leukemia 38:1511–1521, 2024 doi.org/10.1038/s41375-024-02224-8.

		3	Claudio Martines, Supriya Chakraborty, Vincenzo Guastafierro, Marija Vujovikj, Tiziana Vaisitti, Silvia Deaglio, Luca Laurenti, Aleksandar Dimovski , Dimitar Efremov	<i>Macrophage- and BCR- but not TLR-derived signals support the growth of CLL and Richter Syndrome murine models in vivo.</i>	Blood 2022 Dec 1;140(22):2335-2347. doi: 10.1182/blood.2022016272.
		4	Claire Palles, ... Aleksandar J Dimovski and Richarda M de Voer,	<i>Germline MBD4-deficiency causes a multi-tumor predisposition syndrome</i>	Am J Hum Genet. 2022 May 5;109(5):953-960. doi: 10.1016/j.ajhg.2022.03.018. Epub 2022 Apr 22. PMID: 35460607
		5	Supriya Chakraborty, ..., Aleksandar J Dimovski ,..... ... and Dimitar G Efremov.	<i>B Cell Receptor signaling and genetic lesions in TP53 and CDKN2A/CDKN2B cooperate in Richter Transformation.</i>	Blood. 2021 Sep 23;138(12):1053-1066. doi: 10.1182/blood.2020008276
	10.2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	<i>ELEGANT - Exploring Leukemia: Education, Genetics, And Novel Technologies</i>	2023 – 2026, financed by Copenhagen University, Denmark and Interreg Öresund-Kattegat-Skagerrak, Lund University, Sweden
		2.	Participant	<i>Natural antibody and cytotoxic T cell responses in asymptomatic/mildly symptomatic, severely symptomatic and critically ill patients with COVID-19</i>	2020-2022, financed by ICGEB, Trieste, Italy

		3.	Principal investigator	<i>Upgrade of the capacities of the national center for genomics and proteomics at the ICGEB – MASA for personalized medicine applications</i>	2021-2022, financed by the ICGEB-MASA and the Ministry for education and science of the RN Macedonia
		4.	Principal investigator	<i>Precise medicine in the diagnosis, prognosis and therapy of malignant diseases</i>	2022-2028, Funds for scientific and artistic projects of the MASA
		5.	Participant	<i>Diagnostic, prognostic and predictive biomarkers for bladder cancer management</i>	2020-2022, financed by ICGEB, Trieste, Italy
	10.3.	Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Vlado Kambovski, Taki Fiti, Aleksandar Dimovski et al	Social approach for the acceptance of risk reduction strategies through science and investigations	MASA, 2001, 151 pages, ISBN 978-608-203-345-7
	10.4.	Published Professional Papers in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	/	/	/
	11.	Mentorships			
11.1.		Diploma Theses		>50	
11.2.		Master’s Theses		5	
11.3.		Doctoral Dissertations		12 (7 co-mentorship)	
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year

		1.	Staninova-Stojovska M, Matevska-Geshkovska N, Krstevska-Bozhinovikj E, Jovanovic R, Kubelka Sabit K, Angelovska B, Mitrevski N, Dimovski A	<i>Qualitative and quantitative aspects of discrepancies between various methods for microsatellite instability detection.</i>	Balkan Journal of Medical Genetics, 28(1):1-10,2025
		2.	Bonato A, Chakraborty S, Bomben R, Canarutto G, Felician G, Martines C, Zucchetto A, Pozzo F, Vujovikj M, Chiarenza A, Del Poeta G, Marasca R, Tafuri A, Laurenti L, Piazza S, Dimovski AJ , Gattei V, Efremov DG	<i>NFKBIE mutations are selected by the tumor microenvironment and contribute to immune escape in chronic lymphocytic leukemia</i>	Leukemia 38:1511–1521, 2024 doi.org/10.1038/s41375-024-02224-8.
		3.	Katarina Davalieva, Sanja Kiprijanovska, Ognen Ivanovski, Aleksandar Trifunovski, Skender Saidi, Aleksandar Dimovski , Zivko Popov.	<i>Proteomics profiling of bladder cancer tissues from early to advanced stages reveals NNMT and GALK1 as biomarkers for early detection and prognosis of BCa</i>	International Journal of Molecular Sciences 24 (19), 14938, 2023
		4	Claire Palles Aleksandar J Dimovski.....a and Richarda M de Voer,	<i>Germline MBD4-deficiency causes a multi-tumor predisposition syndrome</i>	Am J Hum Genet. 2022 May 5;109(5):953-960. doi: 10.1016/j.ajhg.2022.03.018. Epub 2022 Apr 22. PMID: 35460607

		5	Supriya Chakraborty, ..., Aleksandar J Dimovski ,..... and Dimitar G Efremov.	<i>B Cell Receptor signaling and genetic lesions in TP53 and CDKN2A/CDKN2B cooperate in Richter Transformation.</i>	Blood. 2021 Sep 23;138(12):1053-1066. doi: 10.1182/blood.2020008276
		6	Andreas Agathangelidis, ... Aleksandar Dimovski , ...Kostas Stamatopoulos	<i>Higher-order connections between stereotyped subsets: implications for improved patient classification in CLL</i>	Blood 2021 Mar 11;137(10):1365-1376. doi: 10.1182/blood.2020007039
	12.2.				
		No	Authors	Title	Publisher / Year
		1	Bonato A, Chakraborty S, Bomben R, Canarutto G, Felician G, Martines C, Zucchetto A, Pozzo F, Vujovikj M, Chiarenza A, Del Poeta G, Marasca R, Tafuri A, Laurenti L, Piazza S, Dimovski AJ , Gattei V, Efremov DG	<i>NFKBIE mutations are selected by the tumor microenvironment and contribute to immune escape in chronic lymphocytic leukemia</i>	Leukemia 38:1511–1521, 2024 doi.org/10.1038/s41375-024-02224-8.
		2	Supriya Chakraborty, ..., Aleksandar J Dimovski,..... and Dimitar G Efremov.	<i>B Cell Receptor signaling and genetic lesions in TP53 and CDKN2A/CDKN2B cooperate in Richter Transformation.</i>	Blood. 2021 Sep 23;138(12):1053-1066. doi: 10.1182/blood.2020008276
	12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
		No	Authors	Title	Publisher / Year
					Authors

		1.	Elizabetha Krstevska Bozhinovikj, Marija Staninova Stojovska, Nadica Matevska Geshkovska, Svetlana Kocheva, Aleksandar Dimovski	<i>The role of CREBBP in refining stratification of pediatric patients with B-cell acute lymphoblastic leukemia.</i>	ESHG, European Human Genetics Conference, Milan, Italy	May 24–27, 2025
		2.	Marija Staninova Stojovska, Nadica Matevska Geshkovska, Elizabetha Krstevska Bozhinovikj, Rubens Jovanovic, Darko Dzambaz, Florian Battke, Benjamin Kästle, Aleksandar Dimovski	<i>Co- inheritance of KMT2C germline mutations may influence the phenotype of MSI-L/MSS Lynch syndrome patients</i>	ASCO Annual Meeting 2025, Chicago, Il, USA	May 30 - June 3, 2025

		3.	Claudio Martines, Supriya Chakraborty, Giulia Felician, Karin Hofmann, Sasha Blasutig, Ivan Negara, Alice Bonato, Marija Vujovikj, Giulia Canarutto, Silvano Piazza, Alberto Zamo, Andreas Rosenwald, Aleksandar J Dimovski, and Dimitar G Efremov	<i>Richter Syndrome-associated genetic lesions in TP53 and the cell cycle inhibitors CDKN2A and CDKN2B induce transformation of a CD5+ B cell subset characterized by a restricted IGHV repertoire, autoreactivity and BCR dependence</i>	ASH Annual Meeting and Exposition, San Diego, CA, USA	4-10.12.2024

No.3	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Ljubica Suturkova		
2.	Date of Birth	4.12.1959		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate Studies	1983	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master's Studies	1987	Faculty of Pharmacy, Univeristy of Belgrade
		Doctoral Studies	1994	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical chemistry
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Clinical Pharmacy
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Full Professor	Pharmaceutical Chemistry, Pharmacoinformatics, Social pharmacy
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
	9.1.	List of courses taught by the instructor in the first cycle of studies		
		No.	Course Title	Study Program / Institution
		1.	Pharmaceutical Chemistry III	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		3.	Fundamentals of Clinical Pharmacy	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		4.	Clinical pharmacy and therapeutics	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		5.	Fundamentals of Pharmacotherapy and Therapeutic Nutrition	Dietetics and Diet Therapy/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
	9.2.	List of courses taught by the instructor in the second cycle of studies		
		No.	Course Title	Study Program / Institution
		1.	Pharmacovigilance	Pharmacovigilance/Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		2.	Biological drugs	Pharmaceutical Regulation/Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
	9.3.	List of courses taught by the instructor in the third cycle of studies		
		No.	Course Title	Study Program / Institution

		1.	Development and Appli cation of Pharmaceutical Practice	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		2.	Clinical Pharmacy	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		3.	Molecular Basis of Therapeutics	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
10.	Selected Results in the Last Five Years				
	10.1.	Relevant Published Scientific Papers (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Mihajloska E., Velichkovska B., Dimkovski A., Staninova Stojovska M., Vasilevska A., Antova D., Shuminoski T., Grozdanova A., Shuturkova L.	Machine Learning approaches for DAS28 score prediction after rituximab treatment in rheumatoid arthritis patients.	Journal of Medical Artificial Intelligence (J Med Artif Intell), 2025; doi:10.21037/jmai-24
		2.	Mihajloska E., Dimkovski A., Grozdanova A., Vasilevska A., Antova D., Naumovska Z., Nestorovska A.K., Sterjev Z., Osmani B., Shuturkova L.	Early predictive factors in routine clinical practice for rituximab therapy response in patients with rheumatoid arthritis.	Reumatologia, 2024; 62(3):150– 156. doi:10.5114/reum/189780.
		3.	Rafailovska, E., Xhemaili, E., Naumovska, Z., Gigopulu, O., Miova, B., Suturkova, L. and Stefkov, G	Unlocking the antidiabetic potential of CBD: in vivo preclinical studies.	2025 Pharmaceuticals, 18(4), p.446.
	10.2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project

		1.	Principal	EU Health Policies – Harmonization and Advancement of National Needs for the Introduction of Value-Based Healthcare	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, 2024-2025
		2.	Participant	Development of a New Software Package: Electronic Database for Drug Information – INFOLek	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, 2023-2025
	10.3.	Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Naumovska, Z., Nestorovska, A., Grozdanova, A., Hristova, K., Dimovski, A., Suturkova, L. and Sterjev, Z.,	Assessment of Statin Utilization in the Republic of North Macedonia during 2013–2022. Pharmaceutical Science: New Insights and Developments Vol. 3, pp.44-64.	BP International,2025
		2.		/	
	10.4.	Published Professional Papers in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Micik J, Dimovski A, Sterjev Z, Shuturkova Lj , Grozdanova A.	Implementing an Antimicrobial Stewardship Program and Complete Screening in an Intensive Care Unit in Relation to the Overall Clinical Outcome of Patients.	Pril (Makedon Akad Nauk Umet Odd Med Nauki). 2024 Dec 12;45(3):13-24. doi: 10.2478/prilozi-2024-0019. PMID: 39667009.

		2.	Qehaja SS, Sterjev Z, Shuturkova Lj , Nestorovska KA, Naumovska Z, Krasniqi V, Elezi E.	Knowledge, attitude and practice of pharmacists to pharmacovigilance and adverse drug reactions reporting process: a cross-sectional study in Kosovo	Macedonian pharmaceutical bulletin. 2021; 67 (1): 67-77. DOI: 10.33320/maced.pharm.bull.2021.67.01.007
		3.	Micik J., Mihajloska E., Dimkovski A., Atanasova G.G., Dimovski A., Shuturkova Lj. , Sterjev Z., Grozdanova A.	Evaluation of inflammatory markers in patients with confirmed bacterial infection according to the type of isolated pathogen.	Macedonian Pharmaceutical Bulletin, 2025; 71(2).
11.	Mentorships				
	11.1.	Diploma Theses		25	
	11.2.	Master’s Theses		19	
	11.3.	Doctoral Dissertations		5	
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	Djemaili E., Rafailovska E., Dimkovski A., Mihajloska E., Naumovska Z., Stefkov Gj., Miova B., Suturkova Lj.	Analysis of hypoglycemic effects of cannabidiol following oral and intraperitoneal administration in healthy rats.	Macedonian Pharmaceutical Bulletin, 2022; 68(2)
	12.2.	Evidence of at least two published research papers in international scientific journals with an impact factor in the given field over the past five years			
		No	Authors	Title	Publisher / Year

		1.	Mihajloska E., Velichkovska B., Dimkovski A., Staninova Stojovska M., Vasilevska A., Antova D., Shuminoski T., Grozdanova A., Shuturkova L.	Machine Learning approaches for DAS28 score prediction after rituximab treatment in rheumatoid arthritis patients.	Journal of Medical Artificial Intelligence (J Med Artif Intell), 2025; doi:10.21037/jmai-24
		2.	Rafailovska, E., Xhemaili, E., Naumovska, Z., Gigopulu, O., Miova, B., Suturkova, L. and Stefkov, G	Unlocking the antidiabetic potential of CBD: in vivo preclinical studies.	2025 Pharmaceuticals, 18(4), p.446.
		3.	Mihajloska E., Dimkovski A., Grozdanova A., Vasilevska A., Antova D., Naumovska Z., Nestorovska A.K., Sterjev Z., Osmani B., Shuturkova L.	Early predictive factors in routine clinical practice for rituximab therapy response in patients with rheumatoid arthritis.	Reumatologia, 2024; 62(3):150– 156. doi:10.5114/reum/189780.
	12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	Mihajloska E., Vasilevska A., Dimkovski A., Antova D., Grozdanova A., Nestorovska K.A, Naumovska Z., Osmani B., Shuturkova Lj.	Clinical outcomes of COVID-19 in rituximab-treated patients with inflammatory rheumatic disorders	Rheumatology Update Europe- Vienna May 2023

No.4	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Aleksandra Grozdanova		
2.	Date of Birth	04.02.1974		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate studies	1998	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master studies	2003	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral studies	2012	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical Chemistry
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Immunology with immunochemistry
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Full professor	Pharmaceutical Chemistry, Immunochemistry, Social Pharmacy
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.1.	List of courses taught by the instructor in the first cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Pharmaceutical chemistry 2	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	2.	Pharmaceutical chemistry 3	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	3.	Social pharmacy and methodology	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	4.	Clinical Pharmacy and Therapeutics	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	5.	Microbiology with immunology	Laboratory Bioengineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	6.	Nutrition and Epidemiology	Dietetics and Diet Therapy/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	7.	Immunology for dieticians	Dietetics and Diet Therapy/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
9.2.	List of courses taught by the instructor in the second cycle of studies			
	No.	Course Title	Study Program / Institution	

		1.	Biological drugs	Pharmaceutical Regulation/Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		2.	Biosimilar drugs	Pharmaceutical Regulation/Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		3			
	9.3.	List of courses taught by the instructor in the third cycle of studies			
	No.	Course Title	Study Program / Institution		
	1.	Research Methods and Policies in Social Pharmacy	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy		
	2.	Development and Application of Pharmaceutical Practice – Modern Models and Advanced Technologies	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy		
	3.	Clinical pharmacy	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy		
10.	Selected Results in the Last Five Years				
	10.1.	Relevant Published Scientific Papers (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Grozdanova A., Mihajloska E., Naumovska Z., Staninova Stojovska M., Sterjev Z., Dimkovski A., Anchevska Netkovska K.	Toward value in healthcare: opportunities and challenges for implementing Value-Based Healthcare in North Macedonia.	Frontiers in Public Health, 2025, Volume 13. doi:10.3389/fpubh.2025.1646870
		2.	Mihajloska E., Velichkovska B., Dimkovski A., Staninova Stojovska M., Vasilevska A., Antova D., Shuminoski T., Grozdanova A., Shuturkova L.	Machine Learning approaches for DAS28 score prediction after rituximab treatment in rheumatoid arthritis patients.	Journal of Medical Artificial Intelligence (J Med Artif Intell), 2025; doi:10.21037/jmai-24

		3.	Mihajloska E., Dimkovski A., Grozdanova A., Vasilevska A., Antova D., Naumovska Z., Nestorovska A.K., Sterjev Z., Osmani B., Shuturkova L.	Early predictive factors in routine clinical practice for rituximab therapy response in patients with rheumatoid arthritis.	Reumatologia, 2024; 62(3):150– 156. doi:10.5114/reum/189780.
		4.	Mustafa Z, Memeti S, Karadzovski Z, Arsova Sarafinovska Z, Mihajloska E, Anchevska Netkovska K, Grozdanova. A.	The influence of COVID-19 pandemic on the vaccination of the population with the influenza vaccine in the Republic of North Macedonia	MEDIS – International Journal of Medical Sciences and Research. 2022;1(2):49-53. DOI:10.35120/medisij010249m.
		5.	Panovska- Stavridis I., Ridova N., Stojanoska T., Demiri I., Stevanovic M., Stojanovska S., Ristevska T., Dimkovski A., Filipce V., Dimovski A., Grozdanova A.	Insight in the Current Progress in the Largest Clinical Trials for COVID-19 Drug Management (As of January 2021).	Prilozi (Contributions), 2021; 42(1).
	10.2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Principal Investigator	EU Health Policies – Harmonization and Advancement of National Needs for the Introduction of Value- Based Healthcare	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, 2024-2025
		2.	Principal Investigator	Promotion of vaccination in the pharmacy	Center for Continuing Education at the Faculty of Pharmacy UKIM from Skopje in cooperation with the Macedonian Pharmaceutical Society

		3.	Investigator	Research on knowledge, attitudes and practices of healthcare workers regarding seasonal influenza vaccination	International project of the Institute of Public Health, the National Committee for Immunization of the Republic of Macedonia and the Center for Infectious Diseases, Atlanta, USA (CDC, USA), supported by the Ministry of Health of the Republic of Macedonia, May - December 2019
	10.3.	Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Anchevska Netkovska K, Grozdanova A, Sterjev Z, Poceva Panovska A, Tonic Ribarska J, Brezovska K.	Intellectual property rights in pharmacy	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy-2021
	10.4.	Published Professional Papers in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Grozdanova A., Mihajloska E., Naumovska Z., Staninova Stojovska M., Sterjev Z., Dimkovski A., Anchevska Netkovska K.	Toward value in healthcare: opportunities and challenges for implementing Value-Based Healthcare in North Macedonia.	Frontiers in Public Health, 2025, Volume 13. doi:10.3389/fpubh.2025.1646870
		2.	Mustafa, Zana and Memeti Shaban and Pollo zhani, Azis and Arsova-Sarafinovska, Zorica and Stravrik, Katarina and Grozdanova Aleksandra	Impact of the SARS-CoV-2 pandemic on routine immunization of the population in the Republic of North Macedonia	Macedonian pharmaceutical bulletin, 68 (1). pp. 515-516. ISSN 1857 – 8969, 2022
		3.	Nestorovska – Gjoshevska B., Glavash-Dodov M., Grozdanova A., Sterjev Z., Anchevska-Netkovska K.	Intellectual property rights and misleading advertising of drugs and cosmetic products in the republic of North Macedonia	KNOWLEDGE-International Journal 55 (4) 813-816, 2022

11.	Mentorships					
11.1.	Diploma Theses	/				
11.2.	Master’s Theses	/				
11.3.	Doctoral Dissertations	/				
12.	For PhD Mentors: Selected Results in the Last Four/Five Years					
12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years					
	No	Authors	Title	Publisher / Year		
	1.	Micik J., Mihajloska E., Dimkovski A., Atanasova G.G., Dimovski A., Shuturkova Lj., Sterjev Z., Grozdanova A.	Evaluation of inflammatory markers in patients with confirmed bacterial infection according to the type of isolated pathogen.	Macedonian Pharmaceutical Bulletin, 2025; 71(2).		
	2.	Micik J., Mihajloska E, Dimkovski A., Shuturkova Lj., Grozdanova A.	Development and implementation of an antimicrobial stewardship program through the control of antimicrobial resistance and the rational use of antibiotics	Knowledge –International Journal, Vol.59.4, 2023		
	3.	Vesa Halimi, Armond Daci, Simona Stojanovska, Irina Panovska-Stavridis, Milena Stevanovic, Venko Filipce and Aleksandra Grozdanova	Current regulatory approaches for accessing potential COVID-19 therapies	Journal of Pharmaceutical Policy and Practice (2020) 13:16 https://doi.org/10.1186/s40545-020-00222-6		
	12.2.	4.				
		5.	/	/	/	
		/	/	/		

			/	/	/
	12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	Aleksandra Grozdanova		Transforming cancer care: a cross-country roundtable on investment & regional collaboration. April 2025, Tirana Albania
		2.	Aleksandra Grozdanova		Balkan Forum for breast cancer, 3-4 Sept.2025 Tirana, Albania
		3.	Aleksandra Grozdanova		XXI Congress of the doctors of Republic of North Macedonia
			Aleksandra Grozdanova		Intensive Value-Based Healthcare (VBHC) Course Harvard Business Scholl

No.5	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Katerina Anchevska Netkovska		
2.	Date of Birth	26.03.1969		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Full Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate Studies	1996	Ss. Cyril and Methodius University in Skopje, Faculty of Law
		Master's Studies	2006	Ss. Cyril and Methodius University in Skopje, Faculty of Law
		Doctoral studies	2011	Ss. Cyril and Methodius University in Skopje, Faculty of Law
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Social sciences	Law	
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Legal sciences	Law	
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Full professor	Social pharmacy
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Legislation and laboratory management	Laboratory Bioengineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	2.	Pharmaceutical Law and Ethics	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	3.	Intellectual property rights in pharmacy	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		Social Pharmacy and Methodology	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	Intellectual property rights	Phytotherapy, herbal medicines and dietary supplements/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	2.	Pharmaceutical law and pharmacovigilance guides	Pharmacovigilance/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	3	Copyright and industrial property	Pharmaceutical Regulation/Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	

	9.	List of courses taught by the instructor in the third cycle of studies			
	3.	No.	Course Title	Study Program / Institution	
		1.	Research methods and policies in social pharmacy	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		2.	Pharmaceutical Management and Pharmacoeconomics	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		3.	Development and application of pharmaceutical practice - modern models and advanced technologies	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
10.	Selected Results in the Last Five Years				
	10	Relevant Published Scientific Papers (up to five)			
	.1.	No.	Authors	Title	Publisher / Year
		1.	Grozdanova A., Mihajloska E., Naumovska Z., Staninova Stojovska M., Sterjev Z., Dimkovski A., Anchevska Netkovska K.	Toward value in healthcare: opportunities and challenges for implementing Value-Based Healthcare in North Macedonia.	Frontiers in Public Health, 2025, Volume 13. doi:10.3389/fpubh.2025.1646870
		2.	Atanasovikj S, Kuzmanovska AM, Petreska Ivanovska T, Sterjev Z, Anchevska Netkovska K	Nutritional information and labels in relation to food advertising: a survey of Macedonian consumers.	Maced Pharm Bull. 2024;70(1):25-30. doi:10.33320/maced.pharm.bull.2024.70.01.003
		3.	Kuzmanova K, Dimkovski A, Mihajloska E, Grozdanova A, Anchevska Netkovska K	Challenges to patients' rights during the COVID19 pandemic: survey of public perceptions in North Macedonia	Maced Pharm Bull. 2024;70(1):31-36. doi:10.33320/maced.pharm.bull.2024.70.01.004
		4.	Zerde S.G., Mihajloska E., Dimkovski A., Naumovska Z., Sterjev Z., Netkovska K.A	Regulatory framework for advertising of medical products in the Republic of North Macedonia and the European Union.	Knowledge–International Journal, 2024; 62(4):541–546

		5.	Mustafa Z, Memeti S, Karadzovski Ž, Arsova-Sarafinovska Z, Mihajloska E, Anchevska Netkovska K, Grozdanova A	The influence of covid-19 pandemic on the vaccination of the population with the influenza vaccine in the republic of North Macedonia	MEDIS - Medical Science and Research, 1 (2). pp. 49-54. ISSN 2671-3497, 2022
10	.2.	Participation in National and International Research Projects (up to five)			
No.		Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project	
1.		Participant	EU Health Policies – Harmonization and Advancement of National Needs for Implementing Value-Based Healthcare	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy (2024–2025)	
		2.	Participant	Design, development and characterization of combined solid dosage forms using 3D printing and electrospinning with application of machine learning models	Ministry of Education and Science, North Macedonia (2025–2027)
10	.3.	Printed Books in the Last Five Years (up to five)			
No.		Authors	Title	Publisher / Year	
		1.	Anchevska Netkovska K, Grozdanova A, Sterjev Z, Poceva Panovska A, Tonikj Ribarska J, Brezovska K.	Intellectual property rights in pharmacy	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy-2021
10	.4.	Published Professional Papers in the Last Five Years (up to five)			
No.		Authors	Title	Publisher / Year	
1.		Nestorovska-Gjoshevska B, Ancevska-Netkovska	The role of artificial intelligence in drug safety	Arh Farm/ 2025;75:S76. doi:10.5937/arhfarm-61424	
		2.	Anchevska Netkovska K.,Mihajloska E	Advertising of medicines in the Republic of North Macedonia and the European Union - regulatory framework	Lawyer, Association of Lawyers of the Republic of North Macedonia/2025

		3.	Anchevska-Netkovska K, Dimkovski A, Mihajloska E, Sterjev Z.	Protection of consumer rights in the pharmaceutical industry	Book of abstracts (Pharmaceutical care: current events, opportunities, challenges) ISBN: 978-608-244-993-7/2023
		4.	Koneska E., Mitkovska M., Ancevska Netkovska K.,	Medical use patents of antineoplastics: new trend of ‘evergreening’ and prevention generics on the market	Macedonian Pharmaceutical Bulletin 68(03):529-530/2022
		5.	Mitkovska M., Ancevska Netkovska K., Poceva Panovska A	Changes in intellectual property systems in Commonwealth of Independent States and their harmonization within Eurasian Economic Union,	Macedonian Pharmaceutical Bulletin, Vol. 66 Supp 1, 2020 Ebsco
11.	Mentorships				
	11 .1.	Diploma Theses		10	
	11 .2.	Master’s Theses		15	
	11 .3.	Doctoral Dissertations		2	
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	Nestorovska-Gjoshevska B, Anchevska-Netkovska K, Glavash Dodov M	Intellectual property rights and advertising of cosmetic products in Republic of North Macedonia	Macedonian Pharmaceutical Bulletin 68(03):521-522/2022

		2.	Mitkovska M., Ancevska Netkovska K., Poceva Panovska A	Changes in intellectual property systems in Commonwealth of Independent States and their harmonization within Eurasian Economic Union	Macedonian Pharmaceutical Bulletin, Vol. 66 Supp 1, 2020 Ebsco
		3.	Nestorovska-Gjoshevska B, Glavash Dodov M, Grozdanova A, Sterjev Z, Anchevska-Netkovska K	Intellectual property rights and misleading advertising of drugs and cosmetic products in the republic of north macedonia	Knowledge Vol. 55 No. 4 (2022):
		Evidence of at Least Three Participations in International Conferences in the Last Five Years			
12 .3.	No	Authors	Title	Publisher / Year	Authors
	1.	Dimkovski A, Mihajloska E, Grozdanova A, Poceva Panovska A, Anchevska Netkovska K.	From innovation to patients: AI-driven drug discovery and the role of intellectual property rights	Fourth Scientific Symposium of the Union of Pharmaceutical Associations of Serbia 2025, Invited Lectures, pp. 14-14	2025
	2.	Grozdanova A, Mihajloska E, Dimkovski A, Netkovska K, Sterjev Z.	Health data platform as a strategic step toward value-based healthcare readiness	IX congress of pharmacy with international participation- Borovec Bulgaria 30 october – 2 november 2025	2025

		3.	Zerde S.G., Mihajloska E., Dimkovski A., Naumovska Z., Sterjev Z., Netkovska K.A	Regulatory framework for advertising of medical products in the Republic of North Macedonia and the European Union	Knowledge IJ, IKM Conferences-Bansko, Bulgaria	2024

No.6	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Aleksandra Kapedanovska Nestorovska		
2.	Date of Birth	01.10.1980		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate Studies	2004	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master's Studies	2009	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral Studies	2015	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical Chemistry
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical Chemistry
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Full Professor	Pharmaceutical Chemistry, Pharmacoinformatics
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.1.	List of courses taught by the instructor in the first cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Pharmaceutical Chemistry I	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	2.	Pharmaceutical Chemistry III	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	3.	Fundamentals of Clinical Pharmacy	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	4.	Pharmaceutical Care	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	5.	Pharmacoeconomics and Pharmacoepidemiology	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	6.	Clinical Pharmacy and Therapeutics	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	7.	Medicinal Chemistry	Laboratory Bioengineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	8.	Fundamentals of Pharmacotherapy and Therapeutic Nutrition	Dietetics and Diet Therapy/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
9.2.	List of courses taught by the instructor in the second cycle of studies			

		No.	Course Title	Study Program / Institution
		1.	Pharmacoeconomics 1, 2, 3	Health Management and Pharmacoeconomics / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		2.	Health Technology Assessment	Health Management and Pharmacoeconomics / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		3.	Measurement of Patient-Reported Outcomes	Health Management and Pharmacoeconomics / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		4.	Practical Application of Pharmacoeconomics in Health Technology Assessment	Health Management and Pharmacoeconomics / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		5.	Signal Detection, Risk Management and Inspection in Pharmacovigilance	Pharmacovigilance /Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		6.	Pharmacovigilance	Pharmaceutical Regulation/Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		7.	Preclinical and Clinical Drug Development	Pharmaceutical Regulation/Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		8.	Fundamentals of Clinical Pharmacy	Clinical Pharmacy/Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		9.	Pharmacotherapy	Clinical Pharmacy/Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		10.	Research Methodology in Community Pharmacy Practice	Community Pharmacy Practice/Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		11.	Pharmaceutical Care I, II	Community Pharmacy Practice/Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
	9.3.	List of courses taught by the instructor in the third cycle of studies		
		No.	Course Title	Study Program / Institution
		1.	Clinical Pharmacy	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		2.	Development and Application of Pharmaceutical Practice	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy

		3.	Pharmacogenetics, Pharmacogenomics and Individualization of Therapy	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		4.	Molecular Basis of Therapeutics	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
10.	Selected Results in the Last Five Years				
	10.1.	Relevant Published Scientific Papers (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Shutevska K, Kadifkova PT, Zhivikj Z, Kapedanovska NA	<i>In Vitro Analysis of AKR1D1 Interactions with Clopidogrel: Effects on Enzyme Activity and Gene Expression.</i>	Balkan J Med Genet. 2025 Mar 6;27(2):69-75. doi: 10.2478/bjmg-2024-0012
		2.	Kapedanovska Nestorovska A , Sterjev Z.	<i>Cost-Effectiveness of Oral Nutritional Supplements in Malnourished or at Risk of Disease-Related Malnutrition Cancer Patients in North Macedonia.</i>	Clinicoecon Outcomes Res. 2025 Mar 26;17:265-276. doi: 10.2147/CEOR.S504094
		3.	Shutevska K, Nestorovska AK.	<i>Cloning, expression, and purification of recombinant AKR1D1 for therapeutic applications.</i>	Acta Pharm. 2025 Apr 10;75(1):147-157. doi: 10.2478/acph-2025-0003
		4.	Elshani N, Ukella K, Staninova SM, Naumovska Z, Kurshumliu M, Gorani D, Kapedanovska NA.	<i>Association of CYP2C19*2 c.681G>A (rs4244285) Loss-of-function Allele with Cardiovascular Disease Risk in the Kosovo Population.</i>	Balkan J Med Genet. 2025 Mar 6;27(2):77-85. doi: 10.2478/bjmg-2024-0015.

		5.	Mihajloska E, Dimkovski A, Grozdanova A, Vasilevska A, Antova D, Naumovska Z, Nestorovska AK , Sterjev Z, Osmani B, Shuturkova L.	<i>Early predictive factors in routine clinical practice for rituximab therapy response in patients with rheumatoid arthritis.</i>	Reumatologia. 2024 Jun 18;62(3):15
	10.2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	Implementation of an Electrochemical Method Using a Potentiostat for Simulation and Analysis of Drug Metabolism in the Central Nervous System (CNS)	Ministry of Education and Science (2025–2027)
		2.	Principal Investigator	Implementation of the Pharmaceutical Service “New Medicine Service”	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy (2025–2026)
		3.	Participant	Application of Genetic Polymorphisms Related to Nutrient Metabolism in Designing Individualized Nutrition	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy (2025–2026)
		4	Principal Investigator	Role and Activities of Pharmacists in Community Pharmacy During the COVID-19 Pandemic	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy (2020–2025)

	5	Participant	EU Health Policies – Harmonization and Advancement of National Needs for Implementing Value-Based Healthcare	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy (2024–2025)
10.3.	Printed Books in the Last Five Years (up to five)			
	No.	Authors	Title	Publisher / Year
	1.	Mladenovska, K., Zafirov, D., Sterjev, Z., Matevska Geshkovska, N., Kapedanovska Nestorovska, A. , Naumovska, Z., Jaćoski, K., Trojačanec, J., & Staninova, M.	Manual on Fundamentals of Pharmacology. Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	National and University Library "Ss. Kliment Ohridski", Skopje/ 2024. 615(075.8). ISBN 978-608- 5037-04-9. Available at: http://www.ff.ukim.edu.mk/wp-content/uploads/2024/03/практикум-ОФ-лекториран-2024.pdf
	2.	Naumovska, Z., Kapedanovska- Nestorovska, A. , Sterjev, Z., Mladenovska, K., Grozdanova, A., Dimkovski, A., & Mihajloska, E.	Manual for Practical Classes in Pharmaceutical Chemistry I. Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy.	National and University Library "Ss. Kliment Ohridski", Skopje/2025. 615.011(076). ISBN 978-608-5037-10-0. COBISS.MK- ID 65051653. Available at: http://www.ff.ukim.edu.mk/wp-content/uploads/2025/01/
	3.	Simonovska Crcarevska, M., Kapedanovska Nestorovska, A. , Dincheska Gegovska, A., Dineva, V., & Ismaili, E.	Pharmacy Practice, textbook for the second year of secondary vocational education in health professions.	National and University Library "Ss. Kliment Ohridski", Skopje/ 2022. 614.27(075.3). ISBN 978- 608-273-114-8, COBISS.MK-ID 58578437. Available at: https://e-ucebnici.mon.gov.mk/pdf/Aptekars_ko_rabotenje_2_mak.pdf
10.4.	Published Professional Papers in the Last Five Years (up to five)			
	No.	Authors	Title	Publisher / Year

	1.	Elshani N, Ukella K, Staninova Stojovska M, Kurshumliu M, Ukmata A, Gorani D, Kapedanovska Nestorovska A.	<i>Analysis of the AKR1D1*36 (rs1872930) Genetic Variant in the Kosovo Population: Allele Frequency and Genotype Distribution.</i>	Macedonian pharmaceutical bulletin. 2025, 71 (1) 11 - 17 . DOI: 10.33320/maced.pharm.bull.2025.71.01.002
	2.	Bozhinoska A, Dimkovic D, Veseli F, Kapedanovska Nestorovska A, Mladenovska K.	<i>Clinical pharmacist interventions in patients with mental health disorders.</i>	Macedonian Pharmaceutical Bulletin Vol. 69(2) 2023 (early on-line, 21 May 2024; http://bulletin.mfd.org.mk/volumes/Volume%2069_2/69_2_006.pdf)
	3.	Pop-Nikolov G, Nestorovska AK, Naumovska Z, Suturkova L, Sterjev Z.	<i>Social media marketing of pharmacies across the Republic of North Macedonia..</i>	Macedonian Pharmaceutical Bulletin. 2021 Jan 1;66(2). DOI: 10.33320/maced.pharm.bull.2020.66.02.009
	4.	Rambabova-Bushljetik I, Dzekova-Vidimliski P, Karanfilovski V, Sterjova-Markovska Z, Cana F, Bushljetikj O, Balkanov S, Kapedanovska-Nestorovska A, Dimovski A.	<i>Rhabdomyolysis Associated with Recent SARS-COV-2 Infection in a Patient with Carnitine Palmitoyltransferase II Deficiency</i>	Pril (Makedon Akad Nauk Umet Odd Med Nauki). 2022 Dec 4;43(3):61-66. DOI: 10.2478/prilozi-2022-0037
	5.	Shalabalija D, Mihailova L, Crcarevska MS, Karanfilova IC, Ivanovski V, Nestorovska AK, Novotni G, Dodov MG.	<i>Formulation and optimization of bioinspired rosemary extract loaded PEGylated nanoliposomes for potential treatment of Alzheimer's disease using design of experiments.</i>	Journal of Drug Delivery Science and Technology. 2021 Jun 1;63:102434.
11.	Mentorships			
	11.1.	Diploma Theses	27	

	11.2.	Master's Theses	/		
	11.3.	Doctoral Dissertations	2		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	Shutevska K, Kadifkova PT, Zhivikj Z, Kapedanovska NA	<i>In Vitro Analysis of AKR1D1 Interactions with Clopidogrel: Effects on Enzyme Activity and Gene Expression.</i>	Balkan J Med Genet. 2025 Mar 6;27(2):69-75. doi: 10.2478/bjmg-2024-0012
		2.	Kapedanovska Nestorovska A, Sterjev Z.	<i>Cost-Effectiveness of Oral Nutritional Supplements in Malnourished or at Risk of Disease-Related Malnutrition Cancer Patients in North Macedonia.</i>	Clinicoecon Outcomes Res. 2025 Mar 26;17:265-276. doi: 10.2147/CEOR.S504094
		3.	Shutevska K, Nestorovska AK.	<i>Cloning, expression, and purification of recombinant AKR1D1 for therapeutic applications.</i>	Acta Pharm. 2025 Apr 10;75(1):147-157. doi: 10.2478/acph-2025-0003
		4.	Elshani N, Ukella K, Staninova SM, Naumovska Z, Kurshumliu M, Gorani D, Kapedanovska NA.	<i>Association of CYP2C19*2 c.681G>A (rs4244285) Loss-of-function Allele with Cardiovascular Disease Risk in the Kosovo Population.</i>	Balkan J Med Genet. 2025 Mar 6;27(2):77-85. doi: 10.2478/bjmg-2024-0015.
		5.	Mihajloska E, Dimkovski A, Grozdanova A, Vasilevska A, Antova D, Naumovska Z, Nestorovska AK, Sterjev Z, Osmani B, Shuturkova L.	<i>Early predictive factors in routine clinical practice for rituximab therapy response in patients with rheumatoid arthritis.</i>	Reumatologia. 2024 Jun 18;62(3):15

	12.2.	Evidence of at least two published research papers in international scientific journals with an impact factor in the given field over the past five years			
		No	Authors	Title	Publisher / Year
	1.		Kapedanovska Nestorovska A, Sterjev Z.	<i>Cost-Effectiveness of Oral Nutritional Supplements in Malnourished or at Risk of Disease-Related Malnutrition Cancer Patients in North Macedonia.</i>	Clinicoecon Outcomes Res. 2025 Mar 26;17:265-276. doi: 10.2147/CEOR.S504094
	2.		Shutevska K, Nestorovska AK.	<i>Cloning, expression, and purification of recombinant AKR1D1 for therapeutic applications.</i>	Acta Pharm. 2025 Apr 10;75(1):147-157. doi: 10.2478/acph-2025-0003
	3.		Elshani N, Ukella K, Staninova SM, Naumovska Z, Kurshumliu M, Gorani D, Kapedanovska NA.	<i>Association of CYP2C19*2 c.681G>A (rs4244285) Loss-of-function Allele with Cardiovascular Disease Risk in the Kosovo Population.</i>	Balkan J Med Genet. 2025 Mar 6;27(2):77-85. doi: 10.2478/bjmg-2024-0015.
	4.		Shutevska K, Kadifkova PT, Zhivikj Z, Kapedanovska NA	<i>In Vitro Analysis of AKR1D1 Interactions with Clopidogrel: Effects on Enzyme Activity and Gene Expression.</i>	Balkan J Med Genet. 2025 Mar 6;27(2):69-75. doi: 10.2478/bjmg-2024-0012
	12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
		No	Authors	Title	International Meeting / Conference
					Publisher / Year

		1.	Kapedanovska Nestorovska A, Sterjev Z.	<i>Nutrition care matters: cost-effectiveness of oral nutritional supplements in cancer patients within a national cancer care program in North Macedonia</i>	“Excellence and new trends in clinical pharmacy”. 4 th Croatian congress of Clinical Pharmacy with international participation; 16-18.10 Zagreb, Croatia,	2025
		2.	Lazarova B, Kovaceva M, Crcarevska MS, Nestorovska AK, Naumovska Z. 2024.	<i>Hospital pharmacists’ engagement in pharmacovigilance practices during COVID-19 in the North Macedonia.</i> EAHP Congress-Bordeaux, France, 20-22nd March 2024.	European Journal of Hospital Pharmacy 31, A207-A208. https://doi.org/10.1136/ejhpharm-2024-eahp.429	2024
		3.	Naumovska Z, Crcarevska MS, Kapedanovska Nestorovska A, Tasevska T, Bozinovska B, Andonovska J, Atanasovic S, Boshkoska D, Krmova S, Shajnovska A, Tundgeva M, Janevska S, Stavrikj K. CSP Vol. 24 No. 7 (2024):	<i>Education and training strategy supported by The International Primary Care Respiratory Group (IPCRG) for the community pharmacist in asthma care in the Republic of North Macedonia.</i>	FIP World Congress Cape Town 2024. Abstracts Pharmacy Education (2024) 24(7) 144-145 https://doi.org/10.46542/pe.2024.247.75157	2024

No.7		Information on Teaching Staff and PhD Mentors		
1.	Name and surname	Zorica Naumovska		
2.	Date of birth	30.12.1980		
3.	Level of education	VIII (Doctor of Science)		
4.	Title of teaching-scientific, teaching-professional, teaching, scientific and associate positions	Full Professor		
5.	. Information about completed education and acquired academic and scientific degrees	Education level	Year	Institution
		Higher education	2004	Faculty of Pharmacy, UKIM, Skopje
		Master's studies	2009	Faculty of Pharmacy, UKIM, Skopje
		Doctoral studies	2015	Faculty of Pharmacy, UKIM, Skopje
6.	Field, area, and discipline of the scientific degree – Master's studies	Field	Area	Discipline
		Medical sciences and health	Pharmacy	Pharmaceutical chemistry and pharmacoinformatics
7.	Field, area and discipline of the scientific degree doctor of science with the corresponding code number of the scientific field of doctoral study according to the international frascati classification (2015) and relevant national acts that determine third-level research fields (areas)	Field	Area	Discipline
		Medical sciences and health	Pharmacy	Pharmaceutical chemistry and pharmacoinformatics
8.	If employed, indicate the institution where the person works and the academic title held, including the scientific field with the corresponding code number according to the international frascati classification (2015) and relevant national acts that determine third-level research fields (areas)	Institution	Position	Scientific field
		UKIM, Faculty of Pharmacy, Skopje	Full Professor	Pharmaceutical chemistry and pharmacoinformatics
9.	List of courses taught, Undergraduate (first cycle), Postgraduate (second cycle), Doctoral (third cycle)			
9.1.	List of courses taught Undergraduate (first cycle):			
	No.	Subject	Study program/ Institution	
	1.	Medical Chemistry	Laboratory bioengineering	

			Faculty of Pharmacy, UKIM, Skopje
	2.	Pharmaceutical chemistry 1	Master of pharmacy Faculty of Pharmacy, UKIM, Skopje
	3.	Pharmaceutical chemistry 3	Master of pharmacy Faculty of Pharmacy, UKIM, Skopje
	4	Pharmacoinformatics	Master of pharmacy Faculty of Pharmacy, UKIM, Skopje
	5.	Clinical pharmacy and therapeutics	Master of pharmacy Faculty of Pharmacy, UKIM, Skopje
9.2.	P List of courses taught ostgraduate (second cycle)		
	No.	Subject	Study program/ Institution
	1.	Pharmacovigilance	Pharmaceutical Regulation / Faculty of Pharmacy, UKIM, Skopje
	2.	Pharmacovigilance	Pharmacovigilance / Faculty of Pharmacy, UKIM, Skopje
9.3.	List of courses taught Doctoral (third cycle)		
	No.	Subject	Study program/ Institution
	1.	Preclinical and Clinical Drug Trials	Doctoral studies in the scientific research field of pharmacy
	2.	Pharmaceutical Management	Doctoral studies in the scientific research field of pharmacy
10.	Selected results in the last five years		
10.1.	Relevant published scientific papers (up to five)		
	Authors	Titile	Publisher / year
	Lazarova B, Eftimova B, Crcarevska MS, Tashkov T, Miceva D, Naumovska Z.	Evaluation of Hospital Antibiotic Consumption during the COVID-19 Pandemic.	Curr Drug Saf. 2025 Sep 26. doi: 10.2174/0115748863385928250 911004158. Epub ahead of print. PMID: 41029017.
	Grozdanova, A., Mihajloska, E., Naumovska, Z., Staninova Stojovska, M., Sterjev, Z., Dimkovski, A. and Ancevska- Netkovska, K	Toward value in healthcare: Opportunities and challenges for implementing Value-Based Healthcare inNorth Macedonia	<i>Frontiers in Public Health</i> , 2025, 13, p.1646870.

		Stavrova, V., Simonoska Crcarevska, M., Naumovska, Z., Bozhinovska, B., Andonoska, J., Stavric, K., Maksimova, V., Meštrović, A. and Rouse, M.J.	What a SMART Pharmacist Can Discover in Only One Day: A Public Health Initiative Focused on Diabetes in North Macedonia.	2025, August. <i>Healthcare</i> (Vol. 13, No. 17, p. 2107). MDPI.
		Miceva, D., Crcarevska, M.S., Naumovska, Z., Smilkov, K., Ackova, D.G., Lazarova, B., Angelovska, B. and Sersemova, E.D	The role of pharmacists in asthma management: patient opinions and expectations in North Macedonia.	2025 <i>Pharmacia</i> , 72, pp.1-9.
		Miceva, D., Smilkov, K., Ackova, D.G., Naumovska, Z., Lazarova, B., Angelovska, B. and Sersemova, E.D	An overview of medication adherence: measurement methods and interventions.	2025 <i>Archives of Pharmacy</i> , 75(3), pp.181-201.
		Elena Mladenovska, Ivana Cvetkovikj Karanfilova, Gjoshe Stefkov, Zoran Sterjev and Zorica Naumovska	Role od pharmacovigilance of herbal and traditional herbal medicines	2024. <i>World Journal of Pharmaceutical Science and Research</i> , 3(6), 19-40.
10.2.	Participation in national and international research projects (up to five)			
	Role (Lead or Participant)	Title	Duration Organizing / Funding / Implementing Institution	
	Participant	Design, development and characterization of combined solid dosage forms using 3D printing and electrospinning with the application of machine learning models (3DOSE-IT), funded by Ministry of education and science, North Macedonia	Ministry of education and science, North Macedonia 2025-2026	
	Participant	Implementation of an electrochemical method using a potentiostat for simulating the analysis of drug metabolism affecting the CNS	Ministry of education and science, North Macedonia 2025-2026	
	Participant	Application of genetic polymorphisms related to nutrient metabolism in	Faculty of Pharmacy, Ss. Cyril and Methodius University, Skopje, 2025	

		designing personalized nutrition	
Participant	EU Health Policies – Harmonization and Advancement of National Needs for Implementing Value-Based Healthcare	Faculty of Pharmacy, Ss. Cyril and Methodius University, Skopje 2024-2025	
Lead	Electronic Drug Information Database – INFOLEK	Faculty of Pharmacy, Ss. Cyril and Methodius University, Skopje-(2022-2024)	
Lead	Post-Marketing Monitoring of Cannabis-Based Preparations	Фармацевтски факултет-Скопје(2020-2022)	
Participant	Platform for Integration, Aggregation, and Storage of Knowledge Related to Pharmaceutical Sciences – PharmDataBorg	Faculty of Pharmacy, Ss. Cyril and Methodius University, Skopje, 2022 – 2024	
Participant	Population Screening Study of Histological Changes Suggestive of Celiac Disease Using Small Intestine Biopsy in the Adult Population of the Republic of North Macedonia	MANU(2023-2025)	
Participant	Impact of the Gut Microbiome on Non-Alcoholic Fatty Liver Disease	MANU (2023-2025)	
Participant	Roles and activities of community pharmacists during COVID 19	Faculty of Pharmacy, Ss. Cyril and Methodius University, Skopje, 2020-2022	
Participant	Detection of Minimal Residual Disease through Analysis of Individually Specific Rearrangements of Immunoglobulin and/or T-Cell Receptor Genes	Faculty of Pharmacy, Ss. Cyril and Methodius University, Skopje-2020	
Participant	Model of pharmacy care in community practice-patients with dementia,	Faculty of Pharmacy, Ss. Cyril and Methodius University, Skopje (2019-2021)	
Participant	Introduction of a Novel Method for Detecting Low-Concentration Somatic Mutations Using Liquid Biopsy and dPCR	Ministry of education and science, North Macedonia and CBFA- Faculty of Pharmacy, Ss. Cyril and Methodius University, Skopje (2021-2023)	

	10.3.	Printed Books in the Last Five Years (up to five)		
		Authors	Titile	Publisher / year
		Naumovska, Z., Lazarova, B., Kovaceva, M., Nestorovska, A.K., Crcarevska, M.S., Mihajlova, E. and Dimkovski, A	Frontline Care: The Role of Hospital Pharmacists During the COVID-19 Pandemic in North Macedonia. <i>Pharmaceutical Science: New Insights and Developments Vol. 6, 6, pp.1-10.</i>	BP International,2025
		Naumovska, Z., Nestorovska, A., Grozdanova, A., Hristova, K., Dimovski, A., Suturkova, L. and Sterjev, Z.,	Assessment of Statin Utilization in the Republic of North Macedonia during 2013–2022. <i>Pharmaceutical Science: New Insights and Developments Vol. 3, pp.44-64.</i>	BP International,2025
		Zorica Naumovska, Aleksandra Grozdanova, Katerina Anceska Netkovska	Pharmacovigilance of Biological Medicines, Springer Handbook of Medical Biotechnology,	Springer Nature, <i>in press</i>
	10.4.	Printed Professional Publications in the Last Five Years (up to five)		
		Authors	Titile	Publisher / year
		/	/	/

11.	Supervisions			
11.1.	Bachelor Theses	20		
11.2.	Master's Theses	/		
11.3.	Doctoral Dissertations	/		
12.	For Doctoral Thesis Supervisors: Selected Results from the Last Four/Five Years			
12.1.	Evidence of Published Research Articles in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
	Serial number	Authors	Titile	Publisher / year
	1.	/	/	/
12.2.	Evidence of at Least Two Published Research Articles in International Scientific Journals with Impact Factor in the Given Field in the Last Five Years			
	Serial number	Authors	Titile	Publisher / year
	1.	Rafailovska, E., Xhemaili, E., Naumovska, Z., Gigopulu, O., Miova, B., Suturkova, L. and Stefkov, G	Unlocking the antidiabetic potential of CBD: in vivo preclinical studies.	2025 <i>Pharmaceuticals</i> , 18(4), p.446.
		Elshani, N., Ukella, K., Staninova, S.M., Naumovska, Z., Kurshumliu, M., Gorani, D. and Kapedanovska, N.A.	Association of CYP2C19* 2 c. 681G> A (rs4244285) Loss-of-function Allele with Cardiovascular Disease Risk in the Kosovo Population	2025 <i>Balkan Journal of Medical Genetics: BJMG</i> , 27(2), p.77.
		Miceva, D., Naumovska, Z., Gjorgieva Ackova, D., Smilkov, K., Lazarova, B., Krstic Nakovska, O., Jovanovski, S., Karkinski, D., Angelovska, B. and Drakalska, E.,	Measuring medication adherence in asthma patients in developing countries: insights from North Macedonia.	2025 <i>Farmacia</i> , 73(4), pp.833-841.
		Aliaga, L., Aliaga, A., Smilkov, K., Naumovska, Z. and Gjorgieva Ackova, D	Improving medication adherence: A review of assessment methods and interventions.	2025 <i>International Journal of Innovative Research and Scientific Studies</i> , 8(3), pp.2896-2905.
		Mihajloska, E., Dimkovski, A., Grozdanova, A., Vasilevska, A., Antova, D., Naumovska, Z., Nestorovska, A.K.,	Early predictive factors in routine clinical practice for rituximab therapy response in patients with rheumatoid arthritis.	2024, <i>Reumatologia</i> , 62(3), p.150.

		Sterjev, Z., Osmani, B. and Shuturkova, L.,			
		Nestorovska, K.A., Naumovska, Z., Stojovska, M.S., Sterjev, Z., Dimovski, A. and Suturkova, L	Co-Existence of CYP2C19*1/*2 and ABCB1c. 3435 CT Genotype has a Potential Impact on Clinical Outcome in CAD Patients Treated with Clopidogrel	<i>Balkan Journal of Medical Genetics: BJMG</i> , 26(2), p.35.	
12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
	Serial number	Authors	Titile	Publisher / year	Serial number
	1	Krstic Nakovska Olivera, Lazarova Biljana, Tashkov Tamara, Qyra Fiola, Bajraktar Yldaz, Kovaceva Maja, Naumovska Zorica	Pharmaceutical care in a multidrug-resistant respiratory infection: a case report of a copd patient with extensive antimicrobial resistance	4th Croatian congress of clinical pharmacy with international participation, 16. – 18. 10. 2025. / Zagreb, Croatia	2025
	2	Korab Ukela, Nora Elshani, Marija Staninova-Stojovska, Zorica Naumovska	Frequency of ABCB1 C3435T and C1236T Polymorphisms in th Kosovo population	15 th Balkan Congress of Human Genetics and 3 rd Aple Adria Meeting of Human Genetics 09-11.2025 Bled, Slovenia	2025
	3	Jeton Mucaj, Zorica Naumovska, Maja Simonoska Crcarevska, 2025 Challenges and opportunities in community pharmacists' role in chronic obstructive pulmonary disease management in Kosovo.	Challenges and opportunities in community pharmacists' role in chronic obstructive pulmonary disease management in Kosovo	83rd FIP World Congress of Pharmacy and Pharmaceutical Sciences, Copenhagen, Denmark, 31 August to 3 September 2025.	2025
	4.	Lazarova B, Kovaceva M, Crcareka MS, Nestorovska	Cost – effectiveness analysis of pertuzumab as	EAHP(European Journal of Hospital Pharmacy) 2024	2024

			AK, Naumovska Z	first line neoadjuvant treatment option for patients her2 + breast cancer in Republic of Macedonia. 5PSQ-095 Hospital pharmacists' engagement in pharmacovigilance practices during COVID-19 in the North Macedonia.		
		5	Miceva, Dijana and Dima, L. Alexandra and Smilkov, Katarina and Gjorgieva Ackova, Darinka and Lazarova, Biljana and Angelovska, Bistra, Naumovska, Zorica and Drakalska, Elena	Translation and adaptation of the MIS-A (Medication Intake Survey-Asthma) questionnaire in Macedonian language.	Research in Social and Administrative Pharmacy, 20(12), p.21.In: 9th PCNE Working Symposium 2024, 20 - 22 June 2024, Basel, Switzerland. https://www.sciencedirect.com/science/article/abs/pii/S1551741124002882?via%3Dihub	2024
		6	Miceva, Dijana and Dima, Alexandra L. and Lizano-Barrantes, Catalina and Ferrer, Montse and Garin, Olatz and Smilkov, Katarina and Gjorgieva Ackova, Darinka and Lazarova, Biljana and Angelovska, Bistra, Naumovska, Zorica and	Macedonian Translation and Cross-Cultural Adaptation of the Inhaler Technique Questionnaire (InTeQ).	31st Annual Conference of the International Society for Quality of Life Research, 13-16 Oct 2024, Cologne, Germany. https://link.springer.com/article/10.1007/s11136-024-03786-x	2024

			Drakalska, Elena			
		7	Zorica Naumovska, Maja Simonoska, Crcarevska, Aleksandra Kapedanovska, Nestorovska, Teodora Tasevska, Biljana Bozinovska, Joana Andonovska, Suzana Atanasovic, Dafina Boshkoska, Sanda Krmova, Adrijana Shajnovska, Marta Tundgeva, Saska Janevska, Katerina Stavrikj	CSP- Education and training strategy supported by The International Primary Care Respiratory Group (IPCRG) for the community pharmacist in asthma care in the Republic of North Macedonia	Vol. 24 No. 7 (2024): FIP World Congress Cape Town 2024 Abstracts Pharmacy Education (2024) 24(7) 144-145 https://doi.org/10.46542/pe.2024.247.75157	2024
		8	Biljana Lazarova, Maja Kovaceva, Krume Bogeski, Olivera Krstic, Nikolovska, Gabriela Gjorgjievska, Blazevska, Zorica Naumovska	Engagement of hospital pharmacists in evaluation of drug utilisation, management of antimicrobial programmes and shortages during COVID -19 pandemic in the Republic of North Macedonia Vol. 24 No. 7 (2024) 249-250	FIP World Congress Cape Town 2024 Abstracts https://doi.org/10.46542/pe.2024.247.211294	2024

No.8	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Nadica Matevska-Geshkovska		
2.	Date of Birth	08.08.1979		
3.	Educational Qualification	VIII (Doctor of Science)		
4.	Academic and Professional Titles	Full Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate studies	2005	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master studies	2011	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral studies	2015	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmacogenetics, Immunochemistry
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmacogenetics, Immunochemistry
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Medical Sciences and Health	Pharmacy	Pharmacogenetics, Immunochemistry
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Molecular biology and genetics	Laboratory biomedical engineering / UKIM – Faculty of Pharmacy, Skopje	
	2.	Molecular genetic analyses	Laboratory biomedical engineering / UKIM – Faculty of Pharmacy, Skopje	
	3.	Immunological analyses	Laboratory biomedical engineering / UKIM – Faculty of Pharmacy, Skopje	
	4.	Basic Pharmacology	Master of pharmacy/ UKIM – Faculty of Pharmacy, Skopje	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	Molecular Diagnostics	Master Studies in Laboratory Analysis and Engineering in Pharmacy/ UKIM – Faculty of Pharmacy, Skopje	
	2.			
	3			
9.	List of courses taught by the instructor in the third cycle of studies			
3.	No.	Course Title	Study Program / Institution	
	1.	Methods in Molecular Biology and Genetic Engineering	Doctoral Studies in Pharmacy / UKIM – Faculty of Pharmacy, Skopje	

		2.	Cell signaling	Doctoral Studies in Pharmacy / UKIM – Faculty of Pharmacy, Skopje
		3.	Molecular diagnostics of inherited, malignant and infectious diseases	Doctoral Studies in Pharmacy / UKIM – Faculty of Pharmacy, Skopje
10.	Selected Results in the Last Five Years			
10	Relevant Published Scientific Papers (up to five)			
.1.	No.	Authors	Title	Publisher / Year
		Staninova Stojovska M, Matevska-Geshkovska N , Krstevska Bozhinovikj E, Jovanovic R, Kubelka Sabit K, Angelovska B, Mitrevski N, Dimovski A.	Quantification of MSI and detection of Lynch Syndrome – step forward in improving the MMR testing in clinical practice.	JCO Precision Oncology 2025;9: e2400901. DOI: 10.1200/PO-24-00901
		Krstevska Bozhinovikj E, Matevska-Geshkovska N , Marija Staninova Stojovska M, Gjorgievska G, Kocheva S, Dimovski AJ.	CREBP is a major prognostic marker for relapse in pediatric patients with acute lymphoblastic leukemia: a national prospective study.	Balkan Journal of Medical Genetics 2024; 27(2):5-12. DOI: 10.2478/bjmg-2024-0020
		Krstevska Bozhinovikj E, Matevska-Geshkovska N. , Staninova Stojovska M, Gjorgievska E, Jovanovska A, Ridova N, Panovska Stavrdis I, Kocheva S, Dimovski A.	Presence of minimal residual disease determined by nextgeneration sequencing is not a reliable prognostic biomarker in children with acute lymphoblastic leukemia.	Leukemia & Lymphoma, 2025, 66(6): 1121–1128. DOI: 10.1080/10428194.2025.2456100

			Dzekova-Vidimliski P, Eftimovska-Otovikj N, Nikolov IG, Selim G, Rambabova-Bushljetik I, Pushevski V, Karanfilovski V, Matevska-Geshovska N , Dimovski A.	Association Between the Polymorphism of Angiotensin-Converting Enzyme Gene and Interleukin-1 Beta Gene and the Response to Erythropoietin Therapy in Dialysis Patients with Anemia.	Balkan Journal of Medical Genetics 2024; 26(2):27-34. DOI: 10.2478/bjmg-2023-0022
			Geskovski N, Matevska-Geshkovska N , Dimchevska Sazdovska S, Glavash Dodov M, Mladenovska K, Goracinova K.	The impact of molecular tumor profiling on the design strategies for targeting myeloid leukemia and EGFR/CD44-positive solid tumors.	Beilstein Journal of Nanotechnology 2021; 12:375-401. DOI: 10.3762/bjnano.12.31
	10 .2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	Application of Genetic Polymorphisms Related to Nutrient Metabolism in Designing Individualized Nutrition	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, 2025–2026
		2.	Work Package 3 Coordinator / Participant	Development of methods using vibrational spectroscopy techniques coupled with multivariate analysis in various areas of pharmaceutical interest	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, 2022–2024
		3.	Principal Investigator	Introduction of a new method for determining low concentrations of somatic mutations using liquid biopsy and dPCR	Ministry of Education and Science & Faculty of Pharmacy, UKIM, Skopje, 2021–2023

		4.	Participant	Detection of minimal residual disease through the analysis of individually specific rearrangements of immunoglobulin and/or T-cell receptor genes	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, 2020–2021
		5.	Participant	Genetic factors for the development and therapy of colorectal cancer	ICGEB, Trieste, Italy, 2015–2018
	10 .3.	Printed Books in the Last Five Years (up to five) participant			
		No.	Authors	Title	Publisher / Year
		1.	Noveski P, Matevska-Geshkovska N , Plashevska-Karanfilska E, Dimovski A	<i>Comprehensive Pharmacogenetic Allele Landscape from Whole Exome Sequencing: Single-Center Cohort Analysis in the Population of North Macedonia.</i> In: Pharmacokinetics and Pharmacogenetics - Principles, Applications, and Challenges	IntechOpen, ISBN: 978-1-83635-357-7, ISSN: 3033-3318/2025
	10 .4.	Published Professional Papers in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	/	/	/
		2.			
		3.			
		4.			
		5.			
11.	Mentorships				
	11 .1.	Diploma Theses		15	
	11 .2.	Master's Theses		/	

	11 .3.	Doctoral Dissertations	2 (ongoing)		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years				
	No	Authors	Title	Publisher / Year	
	1.	Staninova-Stojovska M, Matevska-Geshkovska N , Krstevska-Bozhinovikj E, Jovanovic R, Kubelka Sabit K, Angelovska B, Mitrevski N, Dimovski A.	Qualitative and quantitative aspects of discrepancies between various methods for microsatellite instability detection.	Balkan Journal of Medical Genetics, 28(1):1-10,2025	
	2.	Staninova Stojovska M, Matevska-Geshkovska N , Krstevska Bozhinovikj E, Jovanovic R, Kubelka Sabit K, Angelovska B, Mitrevski N, Dimovski A.	Quantification of MSI and detection of Lynch Syndrome – step forward in improving the MMR testing in clinical practice.	JCO Precision Oncology 2025;9: e2400901. DOI: 10.1200/PO-24-00901	
	3.	Krstevska Bozhinovikj E, Matevska-Geshkovska N , Marija Staninova Stojovska M, Gjorgievska G, Kocheva S, Dimovski AJ.	CREBP is a major prognostic marker for relapse in pediatric patients with acute lymphoblastic leukemia:a national prospective study.	Balkan Journal of Medical Genetics 2024; 27(2):5-12. DOI: 10.2478/bjmg-2024-0020	
	4.	Krstevska Bozhinovikj E, Matevska-Geshkovska N. , Staninova Stojovska M, Gjorgievska E, Jovanovska A, Ridova N, Panovska Stavrdis I, Kocheva S. Dimovski A.	Presence of minimal residual disease determined by next-generation sequencing is not a reliable prognostic biomarker in children with acute lymphoblastic leukemia.	Leukemia & Lymphoma, 2025, 66(6): 1121–1128. DOI: 10.1080/10428194.2025.2456100	

		5.	Dzekova-Vidimliski P, Eftimovska-Otovikj N, Nikolov IG, Selim G, Rambabova-Bushljetik I, Pushevski V, Karanfilovski V, Matevska-Geshovska N , Dimovski A.	Association Between the Polymorphism of Angiotensin-Converting Enzyme Gene and Interleukin-1 Beta Gene and the Response to Erythropoietin Therapy in Dialysis Patients with Anemia.	Balkan Journal of Medical Genetics 2024; 26(2):27-34. DOI: 10.2478/bjmg-2023-0022
		6.	Geskovski N, Matevska-Geshkovska N , Dimchevska Sazdovska S, Glavash Dodov M, Mladenovska K, Goracinova K.	The impact of molecular tumor profiling on the design strategies for targeting myeloid leukemia and EGFR/CD44-positive solid tumors.	Beilstein Journal of Nanotechnology 2021; 12:375-401. DOI: 10.3762/bjnano.12.31
	12				
	.2.	1.	Staninova Stojovska M, Matevska-Geshkovska N , Krstevska Bozhinovikj E, Jovanovic R, Kubelka Sabit K, Angelovska B, Mitrevski N, Dimovski A.	Quantification of MSI and detection of Lynch Syndrome – step forward in improving the MMR testing in clinical practice.	JCO Precision Oncology 2025;9: e2400901. DOI: 10.1200/PO-24-00901
		2.	Krstevska Bozhinovikj E, Matevska-Geshkovska N , Marija Staninova Stojovska M, Gjorgievska G, Kocheva S, Dimovski AJ.	CREBP is a major prognostic marker for relapse in pediatric patients with acute lymphoblastic leukemia: a national prospective study.	Balkan Journal of Medical Genetics 2024; 27(2):5-12. DOI: 10.2478/bjmg-2024-0020

		3.	Krstevska Bozhinovikj E, Matevska-Geshkovska N. , Staninova Stojovska M, Gjorgievska E, Jovanovska A, Ridova N, Panovska Stavrdis I, Kocheva S, Dimovski A.	Presence of minimal residual disease determined by nextgeneration sequencing is not a reliable prognostic biomarker in children with acute lymphoblastic leukemia.	Leukemia & Lymphoma, 2025, 66(6): 1121–1128. DOI: 10.1080/10428194.2025.2456100
12 .3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
	No	Authors	Title	Publisher / Year	Authors
	1.	Krstevska Bozhinovikj E, Staninova Stojovska M, Matevska Geshkovska N , Kocheva S, Dimovski A.	The role of CREBBP in refining stratification of pediatric patients with B-cell acute lymphoblastic leukemia.	European Human Genetics Conference, Milan, Italy	2025
	2.	Staninova Stojovska M, Matevska Geshkovska N , Krstevska Bozhinovikj E, Jovanovic R, Dzambaz D, Battke F, Kästle B, Dimovski A.	Co-inheritance of KMT2C germline mutations may influence the phenotype of MSI-L/MSS Lynch syndrome patients	ASCO Annual Meeting 2025, Chicago, Il, USA	2025
	3.	Staninova Stojovska M, Krstevska Bozhinovk E, Matevska-Geshkovska N , Grozdanovska B, Mitreski N, Panovski M, Dimovski A.	Fumarate hydratase gene mutation in a family with familial colorectal cancer type X	57th European Human Genetics Conference, Berlin, Germany	2024

No.9	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Marija Staninova Stojovska		
2.	Date of Birth	04.12.1988		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Assistant professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate studies 2017 Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	2012	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master studies 2017 Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	2012	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral studies 2025 Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	2019	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health Pharmacy	Pharmacy	Pharmacogenetics
7.		Scientific Area	Field	Discipline

	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Medical Sciences and Health	Pharmacy	Pharmacogenetics
8.	If employed, the institution where the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Institution Ss. Cyril and Methodius University in Skopje,	Academic Title Assistant professor	Scientific Field Pharmacogenetics
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	

		1.	Molecular biology and genetics	Laboratory biomedical engineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		2.	Molecular genetic analyses	Laboratory biomedical engineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		3.	Immunological analyses	Laboratory biomedical engineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		4.	General and molecular biology with human genetics	Dietetics and Dietotherapy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		5.	Modeling and optimization in nutrition and dietetics	Dietetics and Dietotherapy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	9.	List of courses taught by the instructor in the second cycle of studies			
	2.	No.	Course Title	Study Program / Institution	
	1.	Application of modern techniques for analysis: CE (in molecular analyses)	Master studies in laboratory biomedical engineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy		
	2.	Molecular genetic tests in forensics and anthropology	Master studies in laboratory biomedical engineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy		
		3			
	9.	List of courses taught by the instructor in the third cycle of studies			
	3.	No.	Course Title	Study Program / Institution	
	1.				
	2.				
		3.			
10.	Selected Results in the Last Five Years				
10	Relevant Published Scientific Papers (up to five)				
.1.	No.	Authors	Title	Publisher / Year	

		Krstevska Bozhinovikj E, Matevska- Geshkovska N, Staninova Stojovska M, Gjorgievska E, Jovanovska A, Ridova N, Panovska Stavridis I, Kocheva S, Dimovski A	Presence of minimal residual disease determined by next- generation sequencing is not a reliable prognostic biomarker in children with acute lymphoblastic leukemia.	Leuk Lymphoma. 2025 Jan 22:1- 8.
		Staninova- Stojovska M, Matevska- Geshkovska N, Krstevska- Bozhinovikj E, Jovanovic R, Kubelka Sabit K, Angelovska B, Mitreski N, Dimovski A	Quantification of Microsatellite Instability Testing and Detection of Lynch Syndrome: Step Forward in Improving Mismatch Repair Testing in Clinical Practice	JCO Precis Oncol. 2025 Feb;9:e2400901.
		Krstevska Bozhinovikj E, Matevska- Geshkovska N, Staninova Stojovska M, Gjorgievska E, Jovanovska A, Kocheva S, Dimovski A.	CREBBP is a Major Prognostic Biomarker for Relapse in Childhood B-cell Acute Lymphoblastic Leukemia: A National Study of Unselected Cohort.	Balkan J Med Genet. 2025 Mar 6;27(2):5-12.
		Staninova Stojovska M, Matevska- Geshkovska N, Krstevska Bozhinovikj E, Jovanovic R, Kubelka Sabit K, Angelovska B, Mitreski N, Noveski P, Dimovski A.	Qualitative and quantitative aspects of discrepancies between various methods for microsatellite instability detection	Balkan J Med Genet. 2025 Oct 8; 28 (1): 1-10

		Grozdanova A, Mihajloska E, Naumovska Z, Staninova Stojovska M, Sterjev Z, Dimkovski A and Anchevska Netkovska K.	Toward value in healthcare: opportunities and challenges for implementing Value-Based Healthcare in North Macedonia.	Front. Public Health 13:1646870
10	Participation in National and International Research Projects (up to five)			
.2.	No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
	1.	participant	Implementation of an Electrochemical Method Using a Potentiostat for Simulation and Analysis of Drug Metabolism in the Central Nervous System (CNS)	Ministry of Education and Science, North Macedonia (2025–2027)
	2.	participant	Design, development and characterization of combined solid dosage forms using 3D printing and electrospinning with application of machine learning models	Ministry of Education and Science, North Macedonia (2025–2027)
	3.	participant	Application of Genetic Polymorphisms Related to Nutrient Metabolism in Designing Individualized Nutrition	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy (2025–2026)

		4.	participant	EU Health Policies – Harmonization and Advancement of National Needs for Implementing Value-Based Healthcare	
	10 .3.	Printed Books in the Last Five Years (up to five) participant			
		No.	Authors	Title	Publisher / Year
		1.			
	10 .4.	Published Professional Papers in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.			
		2.			
		3.			
		4.			
		5.			
11.	Mentorships				
	11 .1.	Diploma Theses			
	11 .2.	Master's Theses			
	11 .3.	Doctoral Dissertations			
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.			
		2.			
		3.			
	12 .2.	4.			
		5.			

	12	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
	.3.	No	Authors	Title	Publisher / Year
		1.			
		2.			
		3.			

No. 10	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Elizabeta Krstevska Bozinovikj		
2.	Date of Birth	04.09.1993		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Assistant professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate studies	2017	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master studies	2017	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral studies	2025	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmacogenetics, immunochemistry
8.	If employed, the institution where the	Institution	Academic Title	Scientific Field

	person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Assistant professor	Pharmacogenetics and immunochemistry
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.1.	List of courses taught by the instructor in the first cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Molecular biology and genetics	Laboratory biomedical engineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	2.	Molecular genetic analyses	Laboratory biomedical engineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	3.	Immunological analyses	Laboratory biomedical engineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
9.2.	List of courses taught by the instructor in the second cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	/	/	
9.3.	List of courses taught by the instructor in the third cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	/	/	
10.	Selected Results in the Last Five Years			
10.1.	Relevant Published Scientific Papers (up to five)			
	No.	Authors	Title	Publisher / Year

		1.	Krstevska Bozhinovikj E, Matevska-Geshkovska N, Staninova Stojovska M, Gjorgievska E, Jovanovska A, Kocheva S, Dimovski A.	CREBBP is a major prognostic biomarker for relapse in childhood B-cell acute lymphoblastic leukemia: A national study of unselected cohort.	Balkan Journal of Medical Genetics, 27(2), 2024;5-12. DOI: 10.2478/bjmg-2024-0020
		2.	Krstevska Bozhinovikj E, Matevska-Geshkovska N, Staninova Stojovska M, Gjorgievska E, Jovanovska A, Ridova N, Panovska Stavrdis I, Kocheva S, Dimovski A.	Presence of minimal residual disease determined by next-generation sequencing is not a reliable prognostic biomarker in children with acute lymphoblastic leukemia.	Leukemia & Lymphoma, 2025;1–8. DOI: 10.1080/10428194.2025.2456100
		3.	Staninova Stojovska M, Matevska-Geshkovska N, Krstevska Bozhinovikj E, Jovanovic R, Kubelka Sabit K, Angelovska B, Mitreski N, Dimovski A.	Quantification of Microsatellite Instability Testing and Detection of Lynch Syndrome: Step Forward in Improving Mismatch Repair Testing in Clinical Practice.	JCO Precision Oncology 9, e2400901 2025. DOI:10.1200/PO-24-00901
		4.	Staninova Stojovska M, Matevska-Geshkovska N, Krstevska Bozhinovikj E, Jovanovic R, Kubelka Sabit K, Angelovska B, Mitreski N, Noveski P, Dimovski A.	Qualitative and quantitative aspects of discrepancies between various methods for microsatellite instability detection.	Balkan J Med Genet. 2025 Oct 8; 28 (1): 1-10
	10.2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project

		1.	participant	Implementation of an Electrochemical Method Using a Potentiostat for Simulation and Analysis of Drug Metabolism in the Central Nervous System (CNS)	Ministry of Education and Science, North Macedonia (2025–2027)
		2.	participant	Design, development and characterization of combined solid dosage forms using 3D printing and electrospinning with application of machine learning models	Ministry of Education and Science, North Macedonia (2025–2027)
		3.	participant	EU Health Policies – Harmonization and Advancement of National Needs for Implementing Value-Based Healthcare	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy (2024–2025)
		4.	participant	Application of Genetic Polymorphisms Related to Nutrient Metabolism in Designing Individualized Nutrition	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy (2025–2026)
	10.3.	Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	/	/	/
	10.4.	Published Professional Papers in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	/	/	/
11.	Mentorships				
	11.1.	Diploma Theses		/	
	11.2.	Master’s Theses		/	
	11.3.	Doctoral Dissertations		/	
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				

	12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	/	/	/
	12.2.				
	12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	/	/	/

No. 11	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Evgenija Mihajloska		
2.	Date of Birth	15.05.1990		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Assistant professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate studies	2015	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master studies	2015	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral studies	2025	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	/
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Clinical pharmacy
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Assistant professor	Pharmaceutical Chemistry, Immunochemistry, Social Pharmacy
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.1.	List of courses taught by the instructor in the first cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Pharmaceutical chemistry 2	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	2.	Social pharmacy and methodology	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	3.	Fundamentals of Clinical Pharmacy	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	4.	Clinical Pharmacy and Therapeutics	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	5.	Microbiology with immunology	Laboratory Bioengineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	6.	Nutrition and Epidemiology	Dietetics and Diet Therapy/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	7.	Information Retrieval and Database Utilization	Dietetics and Diet Therapy/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	

		8	Immunology for dieticians	Dietetics and Diet Therapy/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
	9.2.	List of courses taught by the instructor in the second cycle of studies		
		No.	Course Title	Study Program / Institution
		1.	/	/
		2.	/	/
		3	/	/
	9.3.	List of courses taught by the instructor in the third cycle of studies		
		No.	Course Title	Study Program / Institution
		1.	Molecular Basis of Therapeutics	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		2.	Clinical Pharmacy	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		4.	Research Methods and Policies in Social Pharmacy	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		5.	Development and Application of Pharmaceutical Practice – Modern Models and Advanced Technologies	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
10.	Selected Results in the Last Five Years			
	10.1.	Relevant Published Scientific Papers (up to five)		
		No.	Authors	Title
		1.	Grozdanova A., Mihajloska E., Naumovska Z., Staninova Stojovska M., Sterjev Z., Dimkovski A., Anchevska Netkovska K.	Toward value in healthcare: opportunities and challenges for implementing Value-Based Healthcare in North Macedonia.
				Publisher / Year
				Frontiers in Public Health, 2025, Volume 13. doi:10.3389/fpubh.2025.1646870

		2.	Mihajloska E., Velichkovska B., Dimkovski A., Staninova Stojovska M., Vasilevska A., Antova D., Shuminoski T., Grozdanova A., Shuturkova L.	Machine Learning approaches for DAS28 score prediction after rituximab treatment in rheumatoid arthritis patients.	Journal of Medical Artificial Intelligence (J Med Artif Intell), 2025; doi:10.21037/jmai-24
		3.	Dimkovski A., Dobričić V., Simić M.R., Jurhar Pavlova M., Mihajloska E., Sterjev Z., Poceva Panovska A.	Synthesis, Biological Evaluation, and Molecular Docking Studies of Novel Coumarin–Triazole– Isatin Hybrids as Selective Butyrylcholinesterase Inhibitors.	Molecules, 2025; 30(10):2121. doi:10.3390/molecules3010212 1
		4.	Mihajloska E., Dimkovski A., Grozdanova A., Vasilevska A., Antova D., Naumovska Z., Nestorovska A.K., Sterjev Z., Osmani B., Shuturkova L.	Early predictive factors in routine clinical practice for rituximab therapy response in patients with rheumatoid arthritis.	Reumatologia, 2024; 62(3):150– 156. doi:10.5114/reum/189780.
		5.	Mustafa Z, Memeti S, Karadzovski Z, Arsova Sarafinovska Z, Mihajloska E, Anchevska Netkovska K, Grozdanova. A.	The influence of COVID-19 pandemic on the vaccination of the population with the influenza vaccine in the Republic of North Macedonia	MEDIS – International Journal of Medical Sciences and Research. 2022;1(2):49-53. DOI:10.35120/medisij010249m.
	10.2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	EU Health Policies – Harmonization and Advancement of National Needs for the Introduction of Value- Based Healthcare	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, 2024-2025

	2.	Participant	Development of a New Software Package: Electronic Database for Drug Information – INFOLEK	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, 2023-2025
10.3.	Printed Books in the Last Five Years (up to five)			
	No.	Authors	Title	Publisher / Year
	1.	/	/	/
10.4.	Published Professional Papers in the Last Five Years (up to five)			
	No.	Authors	Title	Publisher / Year
	1.	Dimkovski A., Mihajloska E., Poceva Panovska A.	Recent advances in isatin-derived hybrids: promising multifunctional agents for drug development.	Macedonian Pharmaceutical Bulletin, 2025; 71(2).
	2.	Micik J., Mihajloska E., Dimkovski A., Atanasova G.G., Dimovski A., Shuturkova Lj., Sterjev Z., Grozdanova A.	Evaluation of inflammatory markers in patients with confirmed bacterial infection according to the type of isolated pathogen.	Macedonian Pharmaceutical Bulletin, 2025; 71(2).
	3.	Kuzmanova K., Dimkovski A., Mihajloska E., Grozdanova A., Netkovska A.K.	Challenges to patients' rights during the COVID-19 pandemic: survey of public perceptions in North Macedonia.	Macedonian Pharmaceutical Bulletin, 2024; 70(1).
	4.	Zerde S.G., Mihajloska E., Dimkovski A., Naumovska Z., Sterjev Z., Netkovska K.A.	Regulatory framework for advertising of medical products in the Republic of North Macedonia and the European Union.	KNOWLEDGE–International Journal, 2024; 62(4):541–546
	5.	Djemaili E., Rafailovska E., Dimkovski A., Mihajloska E., Naumovska Z., Stefkov Gj., Miova B., Suturkova Lj.	Analysis of hypoglycemic effects of cannabidiol following oral and intraperitoneal administration in healthy rats.	Macedonian Pharmaceutical Bulletin, 2022; 68(2)

11.	Mentorships					
	11.1.	Diploma Theses	/			
	11.2.	Master's Theses	/			
	11.3.	Doctoral Dissertations	/			
12.	For PhD Mentors: Selected Results in the Last Four/Five Years					
	12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years				
		No	Authors	Title	Publisher / Year	
		1.	/	/	/	
		2.	/	/	/	
		3.	/	/	/	
	12.2.	4.				
		5.	/	/	/	
			/	/	/	
			/	/	/	
	12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
		No	Authors	Title	Publisher / Year	Authors
		1.	/	/	/	/
		2.	/	/	/	/
		3.	/	/	/	/

No. 12	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Aleksandar Dimkovski		
2.	Date of Birth	06.01.1991		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Assistant professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate studies	2015	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master studies	2015	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral studies	2025	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	/
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical Chemistry
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Assistant professor	Pharmaceutical Chemistry, Drug Information, Social Pharmacy
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.1.	List of courses taught by the instructor in the first cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Pharmaceutical chemistry 1	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	2.	Pharmaceutical chemistry 2	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	3.	Drug Information	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	4.	Medicinal chemistry	Laboratory Bioengineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	5.	Searching and Using Information Sources	Laboratory Bioengineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	6.	Nutrition and Epidemiology	Dietetics and Diet Therapy/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	

		7.	Information Retrieval and Database Utilization	Dietetics and Diet Therapy/ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
	9.2.	List of courses taught by the instructor in the second cycle of studies		
		No.	Course Title	Study Program / Institution
		1.	/	/
		2.	/	/
		3	/	/
	9.3.	List of courses taught by the instructor in the third cycle of studies		
		No.	Course Title	Study Program / Institution
		1.	Molecular Basis of Therapeutics	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		2.	Clinical Pharmacy	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		3.	Modern Strategies in the Synthesis, Structural Analysis, and Characterization of Novel Pharmacologically Active Molecules	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		4.	Research Methods and Policies in Social Pharmacy	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		5.	Development and Application of Pharmaceutical Practice – Modern Models and Advanced Technologies	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
10.	Selected Results in the Last Five Years			
	10.1.	Relevant Published Scientific Papers (up to five)		
		No.	Authors	Title Publisher / Year

		1.	Grozdanova A., Mihajloska E., Naumovska Z., Staninova Stojovska M., Sterjev Z., Dimkovski A., Anchevska Netkovska K.	Toward value in healthcare: opportunities and challenges for implementing Value- Based Healthcare in North Macedonia.	Frontiers in Public Health, 2025, Volume 13. doi:10.3389/fpubh.2025.164687 0
		2.	Dimkovski A., Dobričić V., Simić M.R., Jurhar Pavlova M., Mihajloska E., Sterjev Z., Poceva Panovska A.	Synthesis, Biological Evaluation, and Molecular Docking Studies of Novel Coumarin–Triazole– Isatin Hybrids as Selective Butyrylcholinesterase Inhibitors.	Molecules, 2025; 30(10):2121. doi:10.3390/molecules3010212 1
		3.	Mihajloska E., Dimkovski A., Grozdanova A., Vasilevska A., Antova D., Naumovska Z., Nestorovska A.K., Sterjev Z., Osmani B., Shuturkova L.	Early predictive factors in routine clinical practice for rituximab therapy response in patients with rheumatoid arthritis.	Reumatologia, 2024; 62(3):150– 156. doi:10.5114/reum/189780.
		4.	Mihajloska E., Velichkovska B., Dimkovski A., Staninova Stojovska M., Vasilevska A., Antova D., Shuminoski T., Grozdanova A., Shuturkova L.	Machine Learning approaches for DAS28 score prediction after rituximab treatment in rheumatoid arthritis patients.	Journal of Medical Artificial Intelligence (J Med Artif Intell), 2025; doi:10.21037/jmai-24

		5.	Panovska-Stavridis I., Ridova N., Stojanoska T., Demiri I., Stevanovic M., Stojanovska S., Ristevska T., Dimkovski A., Filipce V., Dimovski A., Grozdanova A.	Insight in the Current Progress in the Largest Clinical Trials for COVID-19 Drug Management (As of January 2021).	Prilozi (Contributions), 2021; 42(1).
	10.2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	EU Health Policies – Harmonization and Advancement of National Needs for the Introduction of Value-Based Healthcare	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, 2024-2025
		2.	Participant	In vitro Estimation of Passive Gastrointestinal (GI) Absorption and Blood-Brain Barrier Permeability of Novel Coumarin-1,2,3-Triazole-Isatin Hybrid Molecules as Potential Alzheimer's Disease Drug Candidates	Western Balkans Mobility Scheme under the POLICY ANSWERS Programme, implemented by DLR Projektträger (Grant agreement N. 101058873), 2024-2025
		3.	Participant	Development of a New Software Package: Electronic Database for Drug Information – INFOLEK	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, 2023-2025
	10.3.	Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	/	/	/
	10.4.	Published Professional Papers in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year

		1.	Dimkovski A., Mihajloska E., Poceva Panovska A.	Recent advances in isatin-derived hybrids: promising multifunctional agents for drug development.	Macedonian Pharmaceutical Bulletin, 2025; 71(2).
		2.	Micik J., Mihajloska E., Dimkovski A., Atanasova G.G., Dimovski A., Shuturkova Lj., Sterjev Z., Grozdanova A.	Evaluation of inflammatory markers in patients with confirmed bacterial infection according to the type of isolated pathogen.	Macedonian Pharmaceutical Bulletin, 2025; 71(2).
		3.	Kuzmanova K., Dimkovski A., Mihajloska E., Grozdanova A., Netkovska A.K.	Challenges to patients’ rights during the COVID-19 pandemic: survey of public perceptions in North Macedonia.	Macedonian Pharmaceutical Bulletin, 2024; 70(1).
		4.	Zerde S.G., Mihajloska E., Dimkovski A., Naumovska Z., Sterjev Z., Netkovska K.A.	Regulatory framework for advertising of medical products in the Republic of North Macedonia and the European Union.	KNOWLEDGE–International Journal, 2024; 62(4):541–546
		5.	Djemaili E., Rafailovska E., Dimkovski A., Mihajloska E., Naumovska Z., Stefkov Gj., Miova B., Suturkova Lj.	Analysis of hypoglycemic effects of cannabidiol following oral and intraperitoneal administration in healthy rats.	Macedonian Pharmaceutical Bulletin, 2022; 68(2)
11.	Mentorships				
	11.1.	Diploma Theses	/		
	11.2.	Master’s Theses	/		
	11.3.	Doctoral Dissertations	/		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year

		1.	/	/	/
		2.	/	/	/
		3.	/	/	/
	12.2.	4.			
		5.	/	/	/
			/	/	/
			/	/	/
	12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	/	/	/
		2.	/	/	/
		3.	/	/	/

No. 13		Information on Teaching Staff and PhD Mentors		
1.	Name and Surname	Katerina Gorachinova		
2.	Date of Birth	29.05.1962		
3.	Education Qualification	VIII, PhD in Pharmaceutical Sciences (Doctor of Philosophy)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		BSc degree in Pharmacy	1984	Faculty of Pharmacy, University “Ss Cyril & Methodius” in Skopje, Macedonia
		M.Sc. in Pharmacy	1991	Faculty of Pharmacy Belgrade, University of Belgrade, Serbia
		PhD in Pharmaceutical Sciences	1994	Faculty of Pharmacy, University “Ss Cyril & Methodius” in Skopje, Macedonia
6.	Scientific Area, Field and Discipline of the Master’s Degree	Scientific area	Field	Discipline
		Medical and Health Sciences	Pharmaceutical Sciences	Controlled Release Drug Delivery Systems
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		3. Medical and Health Sciences 301. Basic Medicine 30104. Pharmacology and Pharmacy (pharmaceutics/drug delivery and bioavailability)	Pharmaceutical Sciences	Controlled release and Targeted Drug Delivery Systems
8.	If employed, the institution where the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Institution	Academic Title	Scientific Title
		Faculty of Pharmacy, University “Ss Cyril & Methodius” in Skopje, Macedonia	Full professor	Pharmaceutical technology and biopharmacy 3 — Medical and Health Sciences → 301 — Basic medicine → 30104 — Pharmacology and Pharmacy.

9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies		
9.1.	List of courses taught by the instructor in the first cycle of studies		
	No	Course Title Study Program / Institution	Study Program / Institution
	1.	Pharmaceutical Technological Analyses	Laboratory Bioengineering Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Pharmacy – Skopje
	2.	Fundamentals of Pharmaceutical Technology	<i>Master of Pharmacy – Integrated Studies</i> , Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Pharmacy – Skopje
	3.	Pharmaceutical Technology	<i>Master of Pharmacy – Integrated Studies</i> , Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Pharmacy – Skopje
	4.	Advanced Pharmaceutical technology	<i>Master of Pharmacy – Integrated Studies</i> , Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Pharmacy – Skopje
	5.	Biopharmacy	<i>Master of Pharmacy – Integrated Studies</i> , Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Pharmacy – Skopje
9.2.	List of courses taught by the instructor in the second cycle of studies		
	No	Course title	Study Program / Institution
	1.	Biostatistics – advanced level	MSc in Laboratory Analysis and Bioengineering Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Pharmacy – Skopje
	2.	Pharmaceutical engineering and bioengineering I	MSc in Laboratory Analysis and Bioengineering Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Pharmacy – Skopje
	3.	Pharmaceutical engineering and bioengineering II	MSc in Laboratory Analysis and Bioengineering Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Pharmacy – Skopje
	4.	Biostatistics – advanced level	MSc in Dietetics and Dietotherapy in Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Pharmacy – Skopje
9.3.	List of courses taught by the instructor in the second cycle of studies		
	No Study Program / Institution	Course Title	Study Program / Institution
	1.	Industrial Pharmacy 2	Doctoral Studies in Pharmaceutical Sciences Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Pharmacy – Skopje
	2.	Pharmaceutical nanotechnology	Doctoral Studies in Pharmaceutical Sciences Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Pharmacy – Skopje

		3.	Molecular Biopharmacy and Pharmacokinetic	Doctoral Studies in Pharmaceutical Sciences Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Pharmacy – Skopje
		4.	Biostatistics	Doctoral Studies in Pharmaceutical Sciences Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Pharmacy – Skopje
10. Selected Results in the Last Five Years				
10.1. Relevant Published Scientific Papers (up to five)				
	No.	Authors	Title	Publisher/Year
	1.	Tasevska, T., Adamov, I., Geskovski, N., Ibrić, S., Goracinova, K., & Crcarevska, M. S.	3D printed extended-release hydrochlorothiazide tablets	<i>Elsevier; European Journal of Pharmaceutical Sciences</i> , 106998.(2025) https://doi.org/10.1016/j.ejps.2024.106998 impact factor 4.7; Cite score 9.1
	2	Filip Gorachinov, Fatima Mraiche, Diala Alhaj Moustafa, Ola Hishari, Yomna Ismail, Jensa Joseph, Maja Simonoska Crcarevska, Marija Glavash Dodov, Nikola Geskovski, Katerina Gorachinova	Nanotechnology - a robust tool for fighting the challenges of drug resistance in non-small cell lung cancer	Beilstein J Nanotechnol. 2023 Feb 22;14:240-261. doi: 10.3762/bjnano.14.23. PMCID: PMC9972888 PMID: 36865093 Impact factor 3.272
	3.	Koummich SA, Zoukh IM, Gorachinov F, Geskovski N, Makreski P, Dodov MG, Goracinova K.	Design of ophthalmic micelles loaded with diclofenac sodium: effect of chitosan and temperature on the block-copolymer micellization behaviour.	Drug Deliv Transl Res. 2022 Jun (6):1488-1507. doi: 10.1007/s13346-021-01030-4. PMID: 34258717 Impact factor: 5.671
	4.	Al-Thani HF, Shurbaji S, Zakaria ZZ, Hasan MH, Goracinova K, Korashy HM, Yalcin HC.	Reduced Cardiotoxicity of Ponatinib-Loaded PLGA-PEG-PLGA Nanoparticles in Zebrafish Xenograft Model.	Materials (Basel). 2022 Jun 2;15(11):3960. doi: 10.3390/ma15113960. PMID: 35683259; PMCID: PMC9182153. Impact factor: 3.748
	5.	Silvana Gjoseva, Nikola Geskovski, Simona Dimchevska Sazdovska, Riste Popeski Dimovski, Gjorgji Petruševski, Kristina Mladenovska, Katerina Gorachinova.	Design and biological response of doxycycline loaded chitosan microparticles for periodontal disease treatment.	Carbohydrate polymers 186, (2018) 260-272 https://doi.org/10.1016/j.carbpol.2018.01.043 Impact factor: 10.723
	6.	Simona Dimchevska, Nikola Geskovski, Rozafa	Efficacy assessment of self-assembled PLGA-PEG-PLGA	International Journal of Pharmaceutics, 533 (2), 389-

		Koliki, Nadica Matevska-Geskovska, Vanessa Gomez Vallejo, Boguslaw Szczupak, Eneko San Sebastian, Jordi Llop, Delyan R. Hristov, Marco P. Monopoli, Gjorgji Petruševski, Sonja Ugarkovic, Aleksandar Dimovski, Katerina Gorachinova.	nanoparticles: correlation of nano-bio interface interactions, biodistribution, internalization and gene expression studies.	401. https://www.sciencedirect.com/science/article/pii/S0378517317304660 Impact factor: 6.51
10.2.	Participation in National and International Research Projects (up to five)			
	Ред. број	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
	1.	Principal Investigator	Design of multifunctional nanocarriers for lung cancer targeting	2018-2020, Qatar national research fund
	2.	Principal Investigator	Nanomicelles – drug delivery systems for improved ophthalmic therapy	2020, Qatar University (QU) grant
	3.	Principal Investigator	Glucose and transferrin decorated PLGA nanoparticles internalization in lung cancer cells	2019, QU grant
	4.	Investigator	Ultrasound assisted synthesis of tailored silica and organomodified silica nanoparticles as therapeutic tools to combat biofilm infections and antibiotic resistant bacteria	Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Pharmacy – Skopje 2020 - 2022
	5.	CEEPUS Network project	CEEPUS - Central European Exchange Program For University Studies	2017-2026 CEEPUS, CEKA Network - Central European Alliance for excellence in teaching, learning and research in pharmaceutical technology
		Investigator	“Design, Development and Characterization of Combined Solid Dosage Forms via 3D Printing and Electrospinning, Applying Machine-Learning Models (3DOSE-IT)”	Ministry for Science and Education, R.Macedonia (2025-2027)
10.3.	Printed Books in the Last Five Years (up to five)			
	No	Authors	Title	Publisher/Year

	1.	Katerina Gorachinova, Nikola Geskovski, Simona Dimchevska, Xue Li, Ruxandra Gref	Multifunctional core-shell polymeric and hybrid nanoparticles as anticancer nanomedicines	Pharmaceutical Nanotechnology, https://doi.org/10.1016/B978-0-12-813669-0.00004-X , Elsevier, (2018)
10.4.	Printed Books in the Last Five Years (up to five)			
	No ,	Authors	Title	Publisher/Yea
	1.	Hristina Pislevikj, Katerina Gorachinova	Excipients in pediatric dosage forms and related regulatory aspects with review to propylene glycol	DOI:10.33320/maced.pharm.bull.2022.68.03.123
	2.	Hadzieva, Jasmina Glavash Dodov, Marija Simonoska-Crcarevska, Maja Koprivica, Blagorodna Dimchevska, Simona Geskovski, Nikola Petreska-Ivanovska, Tanja Petrushevska-Tozi, Lidija Goracinova, Katerina Mladenovska, Kristina	Tablets of soy protein-alginate microparticles with Lactobacillus casei 01: Physicochemical and biopharmaceutical properties	Chemical Industry and Chemical Engineering Quarterly, 2019 DOI: 10.2298/ciceq170616019h
	3.	Maja Stojanoska, Marina Todorovska Ackovska; Krume Toshev, Katerina Gorachinova, Marija Glavash Dodov	The effect of critical process parameters in manufacturing (filling process) of dry powders for oral suspensions	Macedonian pharmaceutical bulletin, 68 (Suppl 1) 299 - 300 (2022)
	4.	Teodora Mazneva, Dushko Shalabalija, Ljubica Mihailova, Nikola Geskovski, Katerina Gorachinova	Preparation of Oxaliplatin loaded PLGA-Glucose nanoparticles by nanoprecipitation and emulsification/solvent evaporation techniques	Macedonian pharmaceutical bulletin, 68 (Suppl 1) 581 - 582 (2022)
11.	Менторства			
	11.1.	Diploma Theses	28	
	11.2.	Master's Theses	16	
	11.3.	Doctoral Disertations	9	
12.	For PhD Mentors: Selected Results in the Last Four/Five Years			
	12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years		
	No	Authors	Title	Publisher/Year
	1.	Tasevska, T., Adamov, I., Geskovski, N., Ibrić, S., Goracinova, K., & Crcarevska, M. S.	3D printed extended-release hydrochlorothiazide tablets	<i>Elsevier; European Journal of Pharmaceutical Sciences</i> , 106998.(2025)

			https://doi.org/10.1016/j.ejps.2024.106998 impact factor 4.7; Cite score 9.1
2.	Filip Gorachinov, Fatima Mraiche, Diala Alhaj Moustafa, Ola Hishari, Yomna Ismail, Jensa Joseph, Maja Simonoska Crcarevska, Marija Glavash Dodov, Nikola Geskovski, Katerina Gorachinova	Nanotechnology - a robust tool for fighting the challenges of drug resistance in non-small cell lung cancer	Beilstein J Nanotechnol. 2023 Feb 22;14:240-261. doi: 10.3762/bjnano.14.23. PMCID: PMC9972888 PMID: 36865093 Impact factor 3.272
3.	Koummich SA, Zoukh IM, Gorachinov F, Geskovski N, Makreski P, Dodov MG, Goracinova K.	Design of ophthalmic micelles loaded with diclofenac sodium: effect of chitosan and temperature on the block-copolymer micellization behaviour.	Drug Deliv Transl Res. 2022 Jun (6):1488-1507. doi: 10.1007/s13346-021-01030-4. PMID: 34258717 Impact factor: 5.671
4.	Al-Thani HF, Shurbaji S, Zakaria ZZ, Hasan MH, Goracinova K, Korashy HM, Yalcin HC.	Reduced Cardiotoxicity of Ponatinib-Loaded PLGA-PEG-PLGA Nanoparticles in Zebrafish Xenograft Model.	Materials (Basel). 2022 Jun 2;15(11):3960. doi: 10.3390/ma15113960. PMID: 35683259; PMCID: PMC9182153. Impact factor: 3.748
5.	Silvana Gjoseva, Nikola Geskovski, Simona Dimchevska Sazdovska, Riste Popeski Dimovski, Gjorgji Petruševski, Kristina Mladenovska, Katerina Gorachinova.	Design and biological response of doxycycline loaded chitosan microparticles for periodontal disease treatment	Carbohydrate polymers 186, (2018) 260-272 https://doi.org/10.1016/j.carbpol.2018.01.043 Impact factor: 10.723
6.	Simona Dimchevska, Nikola Geshkovski, Rozafa Koliqi, Nadica Matevska-Geskovska, Vanessa Gomez Vallejo, Boguslaw Szczupak, Eneko San Sebastian, Jordi Llop, Delyan R. Hristov, Marco P. Monopoli, Gjorgji Petruševski, Sonja Ugarkovic,	Efficacy assessment of self-assembled PLGA-PEG-PLGA nanoparticles: correlation of nano-bio interface interactions, biodistribution, internalization and gene expression studies.	International Journal of Pharmaceutics, 533 (2), 389-401. https://www.sciencedirect.com/science/article/pii/S0378517317304660 Impact factor: 6.51

		Aleksandar Dimovski, Katerina Gorachinova			
	7.	Geskovski N, Matevska-Geshkovska N, Dimchevska Sazdovska S, Glavash Dodov M, Mladenovska K, Goracinova K.	The impact of molecular tumor profiling on the design strategies for targeting myeloid leukemia and EGFR/CD44-positive solid tumors.	Beilstein J Nanotechnol. 2021 Apr 29;12:375-401. doi: 10.3762/bjnano.12.31. PMID: 33981532; PMCID: PMC8093552. Impact factor 3.272	
12.2.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years				
	Ред. број	Автори	Наслов	Издавач / година	
	1. h	Tasevska, T., Adamov, I., Geskovski, N., Ibrić, S., Goracinova, K., & Crcarevska, M. S.	3D printed extended-release hydrochlorothiazide tablets ,	Elsevier; European Journal of Pharmaceutical Sciences, 106998.(2025) https://doi.org/10.1016/j.ejps. 2024.106998 impact factor 4.7; Cite score 9.1	
	1.	Filip Gorachinov, Fatima Mraiche, Diala Alhaj Moustafa, Ola Hishari, Yomna Ismail, Jensa Joseph, Maja Simonoska Crcarevska, Marija Glavash Dodov, Nikola Geskovski, Katerina Gorachinova	Nanotechnology - a robust tool for fighting the challenges of drug resistance in non-small cell lung cancer	Beilstein J Nanotechnol. 2023 Feb 22;14:240-261. doi: 10.3762/bjnano.14.23. PMCID: PMC9972888 PMID: 36865093 Impact factor 3.272	
	2.	Koummich SA, Zoukh IM, Gorachinov F, Geskovski N, Makreski P, Dodov MG, Goracinova	Design of ophthalmic micelles loaded with diclofenac sodium: effect of chitosan and temperature on the block-copolymer micellization behaviour.	Drug Deliv Transl Res. 2022 Jun (6):1488-1507. doi: 10.1007/s13346-021-01030- 4. PMID: 34258717 Impact factor: 5.671	
	3.	Al-Thani HF, Shurbaji S, Zakaria ZZ, Hasan MH, Goracinova K, Korashy HM, Yalcin HC.	Reduced Cardiotoxicity of Ponatinib-Loaded PLGA-PEG- PLGA Nanoparticles in Zebrafish Xenograft Model.	Materials (Basel). 2022 Jun 2;15(11):3960. doi: 10.3390/ma15113960. PMID: 35683259; PMCID: PMC9182153. Impact factor: 3.748	
12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
	No	Authors	Title	International Conference	Year
	1.	Teodora Tasevska1 , Nikola Geskovski1 , Katerina Gorachinova1 , Riste Popeski Dimovski2 ,	PREDICTING 3D PRINTABILITY OF SEMI-SOLID EXTRUSION FORMULATIONS USING RHEOLOGICAL DATA AND MACHINE	15th Central European Symposium on Pharmaceutical Technology (Ohrid, Macedonia 28-30 Sptember)	2025

			Maja Simonoska Crcarevska1	LEARNING MODELS		
	2.	Katerina Arsova, Oja Ali Memed, Tamara Ivanovska, Elena Cvetkovska Bogatinovska, , Lina Livrinska,, Dushko Shalabalija, Maja Simonoska Crcarevska,Nikol a Geskovski,, Marija Glavash Dodov, Katerina Gorachinova1*	Fluid bed film coating of cohesive Geldart group C Ibuprofen Lysine powder	14th Central European Symposium on Pharmaceutical Technology (Ohrid, Macedonia 28-30 Sptember)	2023	
	3..	Nikola Geskovski, , Fatima Mraiche, Huseyin C. Yalcin,, Filip Gorachinov, Diala A. Moustafa, Simona Dimchevska, Marija Glavash Dodov, Maja Simonoska Crcarevska, , Katerina Gorachinova*	Nanotechnology in medicine – our experience	8th Congress of Pharmacy with International Participation, Ohrid, Macedonia, September 2022	2022	
	4..	Filip Gorachinov*, Fatima Mraiche, Diala Alhaj Moustafa, Ola Hisari, Damjan Georgievski, Jensa Joseph, Katerina Gorachinova	DESIGN AND EVALUATION OF HYALURONIC ACID DECORATED MULTIFUNCTION AL PCL-b-PEI NANOPARTICLES	9th BBBB International Conference on Pharmaceutical Sciences Pharma Sciences of Tomorrow Ljubljana, Slovenia, 15th-17th September, 2022	2022	

No.14		Information on Teaching Staff and PhD Mentors		
1.	Name and Surname	Kristina Mladenovska		
2.	Date of Birth	30.09.1963		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		High Education	1987	UKIM, Faculty of Pharmacy in Skopje
		Master of Science	2000	UKIM, Faculty of Pharmacy in Skopje
		PhD	2005	UKIM, Faculty of Pharmacy in Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical and Health Sciences	Pharmacy	Biopharmacy
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical and Health Sciences	Pharmacy	Biopharmacy
8.	If employed, the institution where the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level discipline	Institution	Academic Title	Scientific Field
		UKIM, Faculty of Pharmacy in Skopje	Full Professor	Biopharmacy and Pharmaceutical Chemistry
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
	9.1.	List of courses taught by the instructor in the first cycle of studies		
		No.	Course title	Study Program / Institution
		1.	Cell and Animal Experimental models	Laboratory bioengineering/UKIM, Faculty of Pharmacy in Skopje

	2.	Basic Pharmacology	Master of Pharmacy/UKIM, Faculty of Pharmacy in Skopje	
	3.	Biopharmacy	Master of Pharmacy/UKIM, Faculty of Pharmacy in Skopje	
	4.	Pharmaceutical Chemistry 3	Master of Pharmacy/UKIM, Faculty of Pharmacy in Skopje	
9.2.	List of courses taught by the instructor in the second cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Preclinical and Clinical Studies of Medicines and Documentation	Specialist Studies in Pharmaceutical Regulation/UKIM, Faculty of Pharmacy in Skopje	
	2.	Preclinical and Clinical Studies of Medicines	Specialist Studies in Industrial Pharmacy/UKIM, Faculty of Pharmacy in Skopje	
	3.	Clinical Nutrition	Master Studies in Diethetics and Diethotherapy/UKIM, Faculty of Pharmacy in Skopje	
	4.	Nutrition in Chronic Diseases	Master Studies in Diethetics and Diethotherapy/UKIM, Faculty of Pharmacy in Skopje	
9.3.	List of courses taught by the instructor in the third cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Preclinical and Clinical Studies of Medicines	Doctoral Studies in the Field of Pharmacy/UKIM, Faculty of Pharmacy in Skopje	
	2.	Molecular Biopharmacy and Pharmacokinetics	Doctoral Studies in the Field of Pharmacy/UKIM, Faculty of Pharmacy in Skopje	
	3.	Ethics in Scientific-Research	Doctoral Studies in the Field of Pharmacy/UKIM, Faculty of Pharmacy in Skopje	
10.	Selected Results in the Last Five Years			
10.1.	Relevant Published Scientific Papers (up to five)			
	No.	Authors	Title	Publisher / Year
	1.	Milenkovska R., Geskovski N., Shalabalija D. Mihailova Lj., Makreski P., Lukarski D., Stojkovski I., Simonoska Crcarevska M., Mladenovska K	Radiosensitizing properties of dual-functionalized carbon nanostructures loaded with temozolomide	Beilstein J Nanotechnology. 2025, 16, 229-251. IF 2.9
	2.	Vanova Nakjinova N., Godzo H., Brezovska K., Jovanovikj N., Livrinska L., Acevska J., Simonoska Crcarevska M., Mladenovska K.	RP-HPLC method for simultaneous determination of rosuvastatin and ezetimibe in novel synthesized lipid-polymer hybrid nanoparticles	Acta Chromatographica(2025) doi: 10.1556/1326.2025.01334. IF 1.7
	3.	Milenkovska R., Geskovski N., Makreski P., Grozdanov A., Popovski E., Petrushevski Gj., Simonoska Crcarevska M., Mladenovska K	Functionalized carbon nanostructures as temozolomide carriers; physicochemical and biopharmaceutical characterization.	Chemical engineering and Chemical Industry Quaterly 2024, 30 (3): 243 – 256. IF 1.0

		4.	Ana Vavlukis, Kristina Mladenovska, Katarina Davalieva, Marija Vavlukis, Aleksandar Dimovski	Rosuvastatin effects on the HDL proteome in hyperlipidemic patients	Acta Pharm. 73 (2023) 363–384, IF 2.4
		5.	Ana Vavlukis, Marija Vavlukis, Aleksandar Dimovski, Gordana Petrushevska, Aleksandar Eftimov, Sashka Domazetovska, Kristina Mladenovska.	Anti-inflammatory and immunomodulatory effects of rosuvastatin in patients with low-to-moderate cardiovascular risk.	Acta Pharmaceutica, 72 (2022), 303-3015, IF 2.4
	10.2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	Design, development, and characterization of combined solid dosage forms using 3D printing and electrospinning with the application of machine learning models (3DOSE-IT)	UKIM-Faculty of Pharmacy in Skopje, Ministry of Education and Science of RN Macedonia, 2025-2026
		2.	Participant	Wearable Smart Patches for Multimodal Wound Healing	UKIM-Faculty of Pharmacy in Skopje, NATO SPSS, 2023-2026
		3.	Participant	Application of vibrational spectroscopic techniques in pharmaceutical analyses	UKIM-Faculty of Pharmacy in Skopje, 2022-2024
		4.	Participant	Improving the technical competence of the Center for Pharmaceutical Nanotechnology by introducing standard analytical procedures in the field of rheometry and 3D bioprinting	UKIM-Faculty of Pharmacy in Skopje, Ministry of Education and Science of RN Macedonia, 2021-2023
		5.	Participant	Introduction of novel wet granulation methods in research and development of modern dosage forms	UKIM-Faculty of Pharmacy in Skopje, Ministry of Education and Science of RN Macedonia, 2021-2023
		6.	Management Committee Member	CA24165 - Network for Cardiovascular Pharmacogenomics and Precision Medicine (CardioPharmaGENET)	COST Association 2025-2029
	10.3.	Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year

		1.	Kristina Mladenovska, Anita Dinevska	Pharmaceutical Chemistry, Book for 3 rd Year Secondary School, Pharmaceutical Laboratory Technician	Ministry of Education and Science of RN Macedonia / 2025
		2.	Mladenovska Kristina, Gorachinova Katerina, Geskovski Nikola, Mihailova Ljubica, Shalabalija Dushko	BIOPHARMACY: Guideline for Practical Teaching	UKIM-Faculty of Pharmacy, 2024, ISBN 978-608-5037-09-4
		3.	Mladenovska Kristina, Zafirov Dimce, Sterjev Zoran, Matevska-Geskovska Nadica, Kapedanovska-Nestorovska Aleksandra, Naumovska Zorica, Jakjoski Krume, Trojacanec Jasmina, Staninova Marija	HANDBOOK for Practical Teaching in Basic Pharmacology	UKIM-Faculty of Pharmacy in Skopje, 2024, ISBN 978-608-5037-04-9
10.4.	Published Professional Papers in the Last Five Years (up to five)				
	No.	Authors	Title		Publisher / Year
	1.	Angela Bozhinoska, Dragana Dimkovic Faton Veseli, Aleksandra Kapedanovska Nestorovska, Kristina Mladenovska	Clinical pharmacist interventions in patients with mental health disorders		Macedonian pharmaceutical bulletin, 69 (2) 55 - 64 (2023)
	2.	Elena Karabeleski, Lidija Petrushevska-Tozi, Emilija Kostoska, Irena Radivojska, Kristina Mladenovska	Enteral nutrition in Macedonian hospitals		Macedonian Pharmaceutical Bulletin, 66 (Suppl 1) 13 - 14 (2020)
	3.	Elona Chilku, Goran Kochinski, Kristina Mladenovska	Patient registries in regulatory decision making - a survey of Macedonian registries		Macedonian Pharmaceutical Bulletin, 66 (Suppl 1) 79 - 80 (2020)
11.	Mentorships				
	11.1.	Diploma Theses		20	
	11.2.	Master's Theses		2	
	11.3.	Doctoral Dissertations		3	
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No.	Authors	Title	Year / Publisher
		1.	Milenkovska R., Geskovski N., Shalabalija D. Mihailova Lj., Makreski P., Lukarski D.,	Radiosensitizing properties of dual-functionalized carbon nanostructures loaded with temozolomide	Beilstein J Nanotechnology. 2025, 16, 229-251. IF 2.9

			Stojkovski I., Simonoska Crcarevska M., Mladenovska K		
	2.	Geskovski N., Matevska-Geshkovska N., Dimchevska Sazdovska S., Glavash Dodov M., Mladenovska K., Goracinova K.	The impact of molecular tumor profiling on the design strategies for targeting myeloid leukemia and EGFR/CD44-positive solid tumors.	Beilstein J Nanotechnol. 29 (2021) 12: 375-401, IF 3.0	
	3.	Ana Vavlukis, Kristina Mladenovska, Katarina Davalieva, Marija Vavlukis, Aleksandar Dimovski	Rosuvastatin effects on the HDL proteome in hyperlipidemic patients	Acta Pharm. 73 (2023) 363–384, IF 2.4	
	4.	Liljana Makraduli, Petre Makreski, Filip Makraduli, Irena Slaveska Spirevska, Tanja Bakovska Stoimenova, Elena Lazarevska Todevska, Marjan Piponski, Maja Anevska, Marija Glavash Dodov, Maja Simonoska Crcarevska, Kristina Mladenovska, Katerina Gorachinova, Nikola Geskovski	Design of Experiments (DoE)-based approach for improvement of dry mixing processes in the production of low-dose Alprazolam tablets using Raman spectroscopy for content uniformity monitoring.	Arh. farm. 2023; 73: 35 – 61	
	5.	Ana Vavlukis, Marija Vavlukis, Aleksandar Dimovski, Gordana Petrushevska, Aleksandar Eftimov, Sashka Domazetovska, Kristina Mladenovska	Anti-inflammatory and immunomodulatory effects of rosuvastatin in patients with low-to-moderate cardiovascular risk.	Acta Pharm. 72 (2022) 303-3015, IF 2.4	
	6.	Simonoska Crcarevska M., Dimitrovska A., Sibinovska N., Mladenovska K., Slavevska Raicki R., Glavash Dodov M.	Microsponge technology: A promising targeted topical drug delivery.	Pharmaceutical Sciences and Drug Design (2022) 2(1): 71-87.	
	12.2.	Evidence of at Least Two Published Scientific Research Papers in International Scientific Journals with Impact Factor in the Given Field in the Last Five Years			
		No.	Authors	Title	Publisher / Year
	1.	Milenkovska R., Geskovski N., Shalabalija D. Mihailova Lj., Makreski P., Lukarski D., Stojkovski I., Simonoska	Radiosensitizing properties of dual-functionalized carbon nanostructures loaded with temozolomide	Beilstein J Nanotechnology. 2025, 16, 229-251. IF 2.9	

			Crcarevska M., Mladenovska K		
	2.		Vanova Nakjinova N., Godzo H., Brezovska K., Jovanovikj N., Livrinska L., Acevska J., Simonoska Crcarevska M., Mladenovska K.	RP-HPLC method for simultaneous determination of rosuvastatin and ezetimibe in novel synthesized lipid- polymer hybrid nanoparticles	Acta Chromatographica. (2025) doi: 10.1556/1326.2025.01334. IF 1.7
	3.		Milenkovska R., Geskovski N., Makreski P., Grozdanov A., Popovski E., Petrushevski Gj., Simonoska Crcarevska M., Mladenovska K	Functionalized carbon nanostructures as temozolomide carriers; physicochemical and biopharmaceutical characterization.	Chemical engineering and Chemical Industry Quarterly 2024, 30 (3): 243 – 256. IF 1.0
	4.		Ana Vavlukis, Kristina Mladenovska, Katarina Davalieva, Marija Vavlukis, Aleksandar Dimovski	Rosuvastatin effects on the HDL proteome in hyperlipidemic patients	Acta Pharm. 73 (2023) 363–384, IF 2.4
	5.		Ana Vavlukis, Marija Vavlukis, Aleksandar Dimovski, Gordana Petrushevka, Aleksandar Eftimov, Sashka Domazetovska, Kristina Mladenovska.	Anti-inflammatory and immunomodulatory effects of rosuvastatin in patients with low-to-moderate cardiovascular risk.	Acta Pharmaceutica, 72 (2022), 303-3015, IF 2.2
	6.		Nikola Geskovski, Nadica Matevska- Geshkovska, Simona Dimchevska Sazdovska, Marija Glavash Dodov, Kristina Mladenovska, Katerina Gorachinova	The impact of molecular tumor profiling on the design strategies for targeting myeloid leukemia and EGFR/CD44-positive solid tumors.	Beilstein J. Nanotechnol. 2021, 12, 375–401, IF 3.0
	12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
		No.	Authors	Title	International Meeting/Conference
		1.	Nadica Vanova Nakjinova, Nikola Jovanovikj, Maja Simonoska Crcarevska, Nikola Geskovski, Lina Livrinska, Kristina Mladenovska	Effect of phospholipid- polymer conjugate on physical properties of Rosuvastatin/Ezetimibe loaded lipid-polymer hybrid nanoparticles	Macedonian pharmaceutical bulletin, 69 (Suppl 1) 77 - 78 (2023), 14 th CESPT, Ohrid, 28-30 September, 2023
		2.	Nadica Vanova Nakjinova, Nikola Jovanovikj, Maja Simonoska	DSPE-PEG-PLGA nanoparticles as carriers of fixed dose drug combination;	Macedonian pharmaceutical bulletin, 69 (Suppl 1) 79 - 80 (2023), 14 th CESPT,

			Crcarevska, Lina Livrinska, Kristina Mladenovska	effect of polymer type and concentration on their physical characteristics	Ohrid, 28-30 September, 2023	
		3.	Teodora Tasevska, Lina Livrinska, Ljubica Mihailova, Dushko Shalabalija, Nikola Geskovski, Marija Glavash Dodov, Katerina Gorachinova, Kristina Mladenovska, Renata Slaveska Raichki, Maja Simonoska Crcarevska	Validation of method for rheological characterization of poloxamer 407 hydrogels used for 3D bioprinting	Macedonian pharmaceutical bulletin, 69 (Suppl 1) 261 - 262 (2023), 14 th CESPT, Ohrid, 28-30 September, 2023	2023
		4.	Marija Popova Katarina Smilkov, Kristina Mladenovska	Compliance of clinical practice with guidelines on prophylactic antibiotic use in urologic cancer surgery	2nd Symposium of Macedonian Pharmaceutical Association. Clinical- Pharmaceutical Services for Special Populations: Improving Pediatric, Geriatric and Diethotherapy Care, 31.10.-2.11.2025, Struga	2025
		5.	Jeton Mucaj, Beti Djurdjic, Zorica Naumovska, Kristina Mladenovska, Maja Simonoska Crcarevska	Hospitalization and Medication Trends in COPD: A Comparative Analysis and Proposal for Pharmaceutical Care in Kosovo	Congress of Medical Sciences, 21.11-23.11 2025, Tirana, Albania	2025

No. 15	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Renata Slaveska Raicki		
2.	Date of Birth	16.02.1965		
3.	Educational Qualification	VIII (Doctor of Sciences)		
4.	Academic and Professional Titles	Full Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Higher Education	1987	Ss. Cyril and Methodius University (UKIM), Faculty of Pharmacy – Skopje
		Master's Studies	1990	Faculty of Pharmacy and Biochemistry, University of Zagreb, Croatia
		Doctoral Studies	2001	Ss. Cyril and Methodius University (UKIM), Faculty of Pharmacy – Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical Technology
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmacognosy

8.	If employed, the institution where the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Institution	Academic Title	Scientific Field
		Ss. Cyril and Methodius University (UKIM), Faculty of Pharmacy – Skopje	Full Professor	Pharmaceutical Technology with Industrial Pharmacy, Biotechnology, and Micro/Nanotechnology
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
	9.	List of courses taught by the instructor in the first cycle of studies		
	1.	No.		
		1.	Sterile Techniques and Their Application	Bachelor of Laboratory Bioengineering, UKIM, Faculty of Pharmacy – Skopje
		2.	Pharmaceutical-Technological Analyses	Bachelor of Laboratory Bioengineering, UKIM, Faculty of Pharmacy – Skopje
		3.	Medical Biotechnology	Bachelor of Laboratory Bioengineering, UKIM, Faculty of Pharmacy – Skopje
		4.	Fundamentals of Pharmaceutical Biotechnology	Master of Pharmacy, UKIM, Faculty of Pharmacy – Skopje
		5.		
		6.		
		7.		
		8.		
		9.		
		10.		
	9.	List of courses taught by the instructor in the second cycle of studies		
	2.	No.		

		1.	Sterile Techniques and Their Application (participant)	Master's Studies in Laboratory Analysis and Engineering in Pharmacy, UKIM, Faculty of Pharmacy – Skopje
		2.	Quality Assurance of Modern Cosmetic Raw Materials and Products (participant)	Master's Studies in Laboratory Analysis and Engineering in Pharmacy, UKIM, Faculty of Pharmacy – Skopje
		3		
		4.		
	9.	List of courses taught by the instructor in the third cycle of studies		
	3.	No.	Course Title	Study Program / Institution
		1.	Industrial Pharmacy I (participant)	PhD in Pharmaceutical Sciences, UKIM, Faculty of Pharmacy – Skopje
		2.	In situ, In vitro, and In silico Methods in Biopharmaceutical Drug Testing	PhD in Pharmaceutical Sciences, UKIM, Faculty of Pharmacy – Skopje
		3.		
10. Selected Results in the Last Five Years				
	10	Relevant Published Scientific Papers (up to five)		
	.1.	No.	Authors	Publisher / Year
		1.	B. Koshi, A.Daka Grapci, P.Breznica Selmani, M.Glavas Dodov, D.Nebija, R.Morina, M. Simonoska Crcarevska R. Slaveska Raichki	The potentially harmful excipients in prescribed medications in a Neonatal Intensive Care Unit in Kosovo and available safer alternatives The Turkish Journal of Pediatrics 2022; 64: 49-58 https://doi.org/10.24953/turkjped.2021.4136
		2.	B. Koshi, A.Daka Grapci, P.Breznica Selmani, M.Glavas Dodov, D.Nebija, R.Morina, M. Simonoska Crcarevska R. Slaveska Raichki	Off-label and unlicensed medication prescribing in Neonatal Intensive Care Unit: current practice in the Kosovo University Hospital Gazzetta Medica Italiana Archivio per le Scienze Mediche 182(1-2) DOI: 10.23736/S0393-3660.22.04870-7

		3.	S.Angelevski, I. Slaveska Spirevska, E. Lazarevska Todevska. T.Bakovska - Stoimenova, M.Glavash Dodov, M. Simonoska Crcarevska R. Slaveska-Raički	Comparative risk assessment study of elemental impurities in Montelukast chewable tablets and film-coated tablets	Arhiv za farmaciju, 2023 73(1):74-87 DOI: 10.5937/arhfarm73-41263
		4.	S.Angelevski, I. Slaveska Spirevska, E. Lazarevska Todevska. T.Bakovska - Stoimenova, M.Glavash Dodov, M. Simonoska Crcarevska R. Slaveska-Raički	Risk assessment study of potential elemental impurities in montelukast film coated tablets	Macedonian Pharmaceutical Bulletin, 68 (Suppl 1) 53 -54 (2022) Online ISSN 1857 – 8969 DOI:10.33320/maced.pharm.bul 1.2022.68.03.022
		5.	Krenar Dobroshi, Marija Glavash Dodov, Maja Simonovska Crcarevska, Renata Slaveska Raichki, Selvete Shuleta-Qehaja, Blerim Krasniqi	Assessment of Clients' Perceptions and Satisfaction With Eyebrow Mesotherapy Treatment	Journal of Cosmetic Dermatology 24/2, 2025 (IF 2.5)
	10 .2.	Participation in National and International Research Projects (up to five)			
	No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project	

	1.	Participant	Central European Knowledge Alliance for Teaching, Learning & Research in Pharmaceutical Technology (CEKA PharmTech) Angament: participant Type of project: International (Austria, Bosnia and Hercegovina, Hungary, Macedonia, Poland, Romania, Slovakia, Slovenia, Serbia	CEEPUS/ 2017-2018
	2.	Participant	Formulation Development of Bioinspired Nanoliposomes as Carriers of Active Substances for the Treatment of Alzheimer's Disease	University of Ss. Cyril and Methodius in Skopje, 2017
	3.	Participant	Design and Development of Microsponge Systems as Carriers of Active Substances Applying QbD Principles	Faculty of Pharmacy, UKIM – Skopje, 2015–2017
	4.	Participant	Improvement of Technical Competence of the Center for Pharmaceutical Nanotechnology through Implementation of Standard Analytical Procedures in Rheometry and 3D Bioprinting	Funded by Ministry of Education and Science, Republic of North Macedonia, 2021–2023

		5.	Participant	Design, Development, and Characterization of Combined Solid Dosage Forms Using 3D Printing and Electrospinning with Machine Learning Models (3DOSE-IT)	Funded by Ministry of Education and Science, Republic of North Macedonia, 2025–2026
	10	Printed Books in the Last Five Years (up to five)			
	.3.	No.	Authors	Title	Publisher / Year
		1.	/	/	/
	10	Published Professional Papers in the Last Five Years (up to five)			
	.4.	No.	Authors	Title	Publisher / Year
		1.	B. Koshi, A.Daka Grapci, P.Breznica Selmani M.Glavas Dodov, D.Nebija, R.Morina, M. Simonoska Crcarevska R. Slaveska Raichki	The potentially harmful excipients in prescribed medications in a Neonatal Intensive Care Unit in Kosovo and available safer alternatives	The Turkish Journal of Pediatrics 2022; 64: 49-58 https://doi.org/10.24953/turkjped.2021.4136 (IF 0.76)
		2.	B. Koshi, A.Daka Grapci, P.Breznica Selmani M.Glavas Dodov, D.Nebija, R.Morina, M. Simonoska Crcarevska R. Slaveska Raichki	Off-label and unlicensed medication prescribing in Neonatal Intensive Care Unit: current practice in the Kosovo University Hospital	Gazzetta Medica Italiana Archivio per le Scienze Mediche 182(1-2) DOI: 10.23736/S0393-3660.22.04870-7
		3.	S.Angelevski, I. Slaveska Spirevska, E. Lazarevska Todevska. T.Bakovska - Stoimenova, M.Glavash Dodov, M. Simonoska Crcarevska R. Slaveska-Raički	Comparative risk assessment study of elemental impurities in Montelukast chewable tablets and film-coated tablets	Arhiv za farmaciju, 2023 73(1):74-87 DOI: 10.5937/arhfarm73-41263

		4.	Krenar Dobroshi, Marija Glavash Dodov, Maja Simonovska Crcarevska, Renata Slaveska Raichki, Selvete Shuleta-Qehaja, Blerim Krasniqi	Assessment of Clients' Perceptions and Satisfaction with Eyebrow Mesotherapy Treatment	Journal of Cosmetic Dermatology 24/2, 2025 (IF 2.5) doi: 10.1111/jocd.16699. Epub 2024
		5.	Krenar Dobroshi, Marija Glavash Dodov, Maja Simonovska Crcarevska, Renata Slaveska Raichki, Selvete Shuleta-Qehaja, Blerim Krasniqi, Qendresa Hoti, Merita Krasniqi, Gabriela Sterian	Clinical evaluation of a Mesotherapy Formulation for weakened and sparse eyebrows with assessment of some psychological and social aspects	Dermatological Reviews 2025 https://doi.org/10.1002/der2.70056
11.	Mentorships				
	11 .1.	Diploma Theses	65		
	11 .2.	Master's Theses	6		
	11 .3.	Doctoral Dissertations	1 and 2 ongoing		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	B. Koshi, A.Daka Grapci, P.Breznica Selmani M.Glavas Dodov, D.Nebija, R.Morina, M. Simonoska Crcarevska R. Slaveska Raichki	The potentially harmful excipients in prescribed medications in a Neonatal Intensive Care Unit in Kosovo and available safer alternatives	The Turkish Journal of Pediatrics 2022; 64: 49-58 https://doi.org/10.24953/turkjped.2021.4136 (IF 0.76)

		2.	B. Koshi, A.Daka Grapci, P.Breznica Selmani M.Glavas Dodov, D.Nebija, R.Morina, M. Simonoska Crcarevska R. Slaveska Raichki	Off-label and unlicensed medication prescribing in Neonatal Intensive Care Unit: current practice in the Kosovo University Hospital	Gazzetta Medica Italiana Archivio per le Scienze Mediche 182(1-2) DOI: 10.23736/S0393- 3660.22.04870-7
		3.	Krenar Dobroshi, Marija Glavash Dodov, Maja Simonovska Crcarevska, Renata Slaveska Raichki, Selvete Shuleta-Qehaja, Blerim Krasniqi	Assessment of Clients' Perceptions and Satisfaction with Eyebrow Mesotherapy Treatment	Journal of Cosmetic Dermatology 24/2, 2025 (IF 2.5) doi: 10.1111/jocd.16699. Epub 2024
		4.			
		5.			
		6.			
	12	Evidence of at least two published scientific-research papers in international peer-reviewed journals with an impact factor in the given field within the last five years.”			
	.2.	1.	B. Koshi, A.Daka Grapci, P.Breznica Selmani M.Glavas Dodov, D.Nebija, R.Morina, M. Simonoska Crcarevska R. Slaveska Raichki	The potentially harmful excipients in prescribed medications in a Neonatal Intensive Care Unit in Kosovo and available safer alternatives	The Turkish Journal of Pediatrics 2022; 64: 49-58 https://doi.org/10.24953/turkjped.2021.4136 (IF 0.76)
		2.	Krenar Dobroshi, Marija Glavash Dodov, Maja Simonovska Crcarevska, Renata Slaveska Raichki, Selvete Shuleta- Qehaja, Blerim Krasniqi	Assessment of Clients' Perceptions and Satisfaction with Eyebrow Mesotherapy Treatment	Journal of Cosmetic Dermatology 24/2, 2025 (IF 2.5) doi: 10.1111/jocd.16699. Epub 2024
		3.			
		4.			
		5.			
		6.			

12	.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
		No	Authors	Title	International Conferences
		1.	T. Tasevska, L.Livrinska, Lj.Mihailova, D.Shalabaliya, N.Geskovski, M.Glavas Dodov, K.Goracinova, K.Mladenovska, R.Slaveska Raichki, M. Simonoska Crcarevska	Validation of a method for rheological characterization of poloxamer 407 hydrogels used for 3D bioprinting	Macedonian Pharmaceutical Bulletin, 69 (Suppl 1) 261 - 262 Online ISSN 1857 - 8969 DOI: 10.33320/maced.pharm.bull.2023.69.03.128
		2.	S.Ristevska, H.Litovin, H. Godzo, T.Tasevska, L. Livrinska, N.Geskovski, K. Gorachinova, K. Mladenovska, R. Slaveska Raichki, M.Glavash Dodov, M.Simonoska Crcarevska	Effect of surfactant stabilizers on physico-chemical properties of PLGA nanoparticles loaded with tetrahydrocannabinol	Macedonian Pharmaceutical Bulletin, 69 (Suppl 1) 295 - 296 Online ISSN 1857 - 8969 DOI: 10.33320/maced.pharm.bull.2023.69.03.143
		3.	Metodi Naumovski, Teodora Dodov, Ljubica Mihailova, Maja Simonoska Crcarevska, Renata Slaveska Raicki, Marija Glavas Dodov	Pharmacy students' experience during the Covid-19 pandemic and its impact on their health, academic endeavors and overall perceptions-a study	Macedonian Pharmaceutical Bulletin, 68 (Suppl 1) 555 - 556 Online ISSN 1857 - 8969 DOI:10.33320/maced.pharm.bull.2022.68.03.265
		4.			
		5.			

No. 16	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Marija Glavash Dodov		
2.	Date of Birth	23.07.1971		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate Studies	1994	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master's Studies	2002	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral Studies	2008	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical Technology with Industrial Pharmacy and Micro/Nanotechnology
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical Technology with Industrial Pharmacy and Micro/Nanotechnology
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Full Professor	Pharmaceutical Technology with Industrial Pharmacy and Micro/Nanotechnology – Other
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
	9.1.	List of courses taught by the instructor in the first cycle of studies		
		No.	Course Title	Study Program / Institution
		1.	Fundamentals of Pharmaceutical Technology (participant)	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		2	Pharmaceutical Technology (course coordinator)	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		3	Pharmaceutical Technology – advanced level (participant)	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		4	Pharmaceutical-Technological Analyses (participant)	Laboratory Bioengineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		5	Cosmetology (course coordinator)	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
	9.2.	List of courses taught by the instructor in the second cycle of studies		
		No.	Course Title	Study Program / Institution

		1.	Pharmaceutical Engineering and Bioengineering 1 (participant)	Master's Studies in Laboratory Analysis and Pharmaceutical Engineering, Faculty of Pharmacy / Ss. Cyril and Methodius University in Skopje	
		2.	Quality Assurance of Modern Cosmetic Raw Materials and Products	Master's Studies in Laboratory Analysis and Pharmaceutical Engineering, Faculty of Pharmacy / Ss. Cyril and Methodius University in Skopje	
	9.3.	List of courses taught by the instructor in the third cycle of studies			
	No.	Course Title	Study Program / Institution		
	1.	Cosmetology	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy		
	2.	Advanced Therapeutic Systems	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy		
10.	Selected Results in the Last Five Years				
	10.1.	Relevant Published Scientific Papers (up to five)			
		No.	Authors	Title	Publisher / Year
		1	D. Shalabaliya, Lj. Mihailova, M. Simonoska Crcarevska, I. Cvetkovikj Karanfilova, V. Ivanovski, A. Kapedanovska Nestorovska, G. Novotni, M. Glavash Dodov	Formulation and optimization of bioinspired rosemary extract loaded PEGylated nanoliposomes for potential treatment of Alzheimer's disease using design of experiments	Journal of Drug Delivery Science and Technology 63 (2021) 102434 https://doi.org/10.1016/j.jddst.2021.102434

		2	I. Dimitrovska, T. Olumceva, E. Markova, M. Kostoska, L. Taneska, M. Petrushevska, V. Makrievski, J. Todorov, D. Shalabalija, Lj. Mihailova, R. PopeskiDimovski, M. Glavash Dodov, M. Simonoska Crcarevska	Topical gel with ethyl cellulose based microsponges loaded with clindamycin hydrochloride for acne treatment. Cell	Cellulose volume 27 (2020), 7109 7126. https://doi.org/10.1007/s10570-020-03283-7
10.2. Participation in National and International Research Projects (up to five)					
		N o .	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1 .	Participant	“Wearable Smart Patches for Multimodal Wound Healing”,	финансиран од NATO SPSS, 2023-2026
		2 .	Participant	Дизајн, развој и карактеризација на комбинирани цврсти дозирани форми со примена на 3Д печатење и електроспининг со примена на модели на машинско учење (3DOSE-IT)	финансисран од МОН, РС Македонија, 2025-2026

		3	Participant	Протеомичко профилирање на протеинската корона формирана на површината на наночестичките по нивна инкубација во hCMEC/D3 клеточен медиум	Joint Research Centre на Европската комисија / 2022 - 2023
		4	Participant	ВетаЛипоФер-додаток во исхрана за профилактички третман на анемија кај животни	Фонд за иновации и технолошки развој, РС Македонија / 2022 - 2024
		5	Main investigator	Иновативен биомиметички систем-носач на природни производи за третман на хронични рани,	2023-2024 , FITD program Start up 4
	10.3.	Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1			
		2			
	10.4.	Published Professional Papers in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1	BlerinaKoshi, ArlindaDakaGrape i, DashnorNebija, PranveraBreznicaSelmani, RinaMorina, Maja Simonoska Crcarevska, MarijaGlavasDodov, RenataSlaveskaRaichki,	Study on potentially harmful excipients in prescribed medicines in the Neonatal Intensive Care Unit in Kosovo and safer alternatives available	The Turkish Journal of Pediatrics, 64 (1) (2022), 49-58. https://doi.org/10.24953/turkjped.2021.4136

		2 .	Markova, E., Taneska, L., Kostovska, M., Shalabalija, D., Mihailova, L., GlavasDodov, M., Makreski, P., Geskovski, N., Petrushevska, M., N. Taravari, A. and Simonoska Crcarevska, M., 2022.	Design and evaluation of nanostructured lipid carriers loaded with Salvia officinalis extract for Alzheimer's disease treatment.	Journal of Biomedical Materials Research Part B: Applied Biomaterials, 110 (6) (2022), 1368- 1390. https://doi.org/10.1002/jbm.b.35006
		3 .	D. Shalabalija, Lj. Mihailova, M. Simonoska Crcarevska, I. CvetkovikjKaranfil ova, V. Ivanovski, A. KapedanovskaNest orovska, G. Novotni, M. GlavasDodov	Formulation and optimization of bioinspired rosemary extract loaded PEGylated nanoliposomes for potential treatment of Alzheimer's disease using design of experiments	Journal of Drug Delivery Science and Technology 63 (2021) 102434 https://doi.org/10.1016/ j.jddst.2021.102434
		4 .	I. Dimitrovska, T. Olumceva, E. Markova, M. Kostoska, L. Taneska, M. etrushevska, V. Makrievski, J. Todorov, D. Shalabalija, Lj. Mihailova, R. PopeskiDimovski, M. GlavasDodov, M. Simonoska Crcarevska	Topical gel with ethyl cellulose based microsponges loaded with clindamycin hydrochloride for acne treatment. Cell	Cellulose volume 27 (2020), 7109 7126. https://doi.org/10.1007/ s10570_020_03_283_7
		5 .	Trajanovska, E., Crcarevska, M.S., Mirchev, M., Jovanovikj, F., Atanasova, A., Ugarkovic, S. and Dodov, M.G.,	Optimization of self- emulsifying drug delivery system of cefuroxime axetil	Macedonian pharmaceutical bulletin, 66 (2) (2020) 67 - 79 https://doi.org/10.33320/ maced.pharm.bull.2020.66.02.007

11.	Mentorships				
	11.1.	Diploma Theses	78		
	11.2.	Master’s Theses	8		
	11.3.	Doctoral Dissertations	7 + 3 ongoing		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	BlerinaKoshi, ArlindaDakaGrapci , DashnorNebija, PranveraBreznicaSelmani, RinaMorina, Maja Simonoska Crcarevska, MarijaGlavasDodov, RenataSlaveskaRaichki,	Study on potentially harmful excipients in prescribed medicines in the Neonatal Intensive Care Unit in Kosovo and safer alternatives available	The Turkish Journal of Pediatrics, 64 (1) (2022), 49-58. https://doi.org/10.24953/turkjped.2021.4136
		2.	Markova, E., Taneska, L., Kostovska, M., Shalabalija, D., Mihailova, L., GlavasDodov, M., Makreski, P., Geskovski, N., Petrushevska, M., N. Taravari, A. and Simonoska Crcarevska, M., 2022.	Design and evaluation of nanostructured lipid carriers loaded with Salvia officinalis extract for Alzheimer's disease treatment.	Journal of Biomedical Materials Research Part B: Applied Biomaterials, 110 (6) (2022), 1368-1390. https://doi.org/10.1002/jbm.b.35006

		3.	D. Shalabalija, Lj. Mihailova, M. Simonoska Crcarevska, I. CvetkovikjKaranfilova, V. Ivanovski, A. KapedanovskaNestorovska, G. Novotni, M. GlavasDodov	Formulation and optimization of bioinspired rosemary extract loaded PEGylated nanoliposomes for potential treatment of Alzheimer's disease using design of experiments	Journal of Drug Delivery Science and Technology 63 (2021) 102434 https://doi.org/10.1016/j.jddst.2021.102434
		4.	I. Dimitrovska, T. Olumceva, E. Markova, M. Kostoska, L. Taneska, M. etrushevska, V. Makrievski, J. Todorov, D. Shalabalija, Lj. Mihailova, R. PopeskiDimovski, M. GlavasDodov, M. Simonoska Crcarevska	Topical gel with ethyl cellulose based icrosponges loaded with clindamycin hydrochloride for acne treatment. Cell	Cellulose volume 27 (2020), 7109 7126. https://doi.org/10.1007/s10570_020_03_283_7
		5.	Trajanovska, E., Crcarevska, M.S., Mirchev, M., Jovanovikj, F., Atanasova, A., Ugarkovic, S. and Dodov, M.G.,	Optimization of self-emulsifying drug delivery system of cefuroxime axetil	Macedonian pharmaceutical bulletin, 66 (2) (2020) 67 - 79 https://doi.org/10.33320/maced.pharm.bull.2020.66.02.007
		12.2.	Evidence of at least two published research papers in international scientific journals with an impact factor in the given field over the past five years		
		No	Authors	Title	Publisher / Year

		1.	Mihailova, L., Shalabalija, D., Zimmer, A., Geskovski, N., Makreski, P., Petrushevska, M., Simonoska Crcarevska, M., Glavash Dodov, M	Comparative Studies of the Uptake and Internalization Pathways of Different Lipid Nano-Systems Intended for Brain Delivery	Pharmaceutics 15(8), 2082 / 2023 https://doi.org/10.3390/pharmaceutics15082082 IF: 5.4
		2.	Filip Gorachinov, Petre Makreski, Dushko Shalabalija, Ljubica Mihailova, Maja Simonoska Crcarevska, Marija Glavash Dodov, Katerina Gorachinova, Gligor Jovanovski, Nikola Geskovski	Micro-raman spectroscopy for detection of label- free and oil red O labeled PEGylated nanoliposomes in hCmec/d3 cell internalization studies	Croatia Acta Chemica, 2023 (IF 0,659)
		3.	Markova, E., Taneska, L., Kostovska, M., Shalabalija, D., Mihailova, L., Glavash Dodov, M., Makreski, P., Geskovski, N., Petrushevska, M., Taravari, A.N., Simonoska Crcarevska, M.	Design and evaluation of nanostructured lipid carriers loaded with <i>Salvia officinalis</i> extract for Alzheimer's disease treatment.	Journal of Biomedical Materials Research Part B: Applied Biomaterials, 2022, 110 (6), 1368- 1390 (IF 3,405), Wiley.
		4.	Mihailova, L., Tchekalarova, J., Shalabalija, D., Geskovski, N., Gjorgievska, V.S., Stefkov, G., Krasteva, P., Simonoska Crcarevska, M. and Glavash Dodov, M.	Lipid nano-carriers loaded with Cannabis sativa extract for epilepsy treatment–in vitro characterization and in vivo efficacy studies	Journal of Pharmaceutical Sciences 111 (12), 3384-3396 / 2022. https://doi.org/10.1016/j.xphs.2022.09.012 IF: 4.063

		5.	D. Shalabalija, Lj. Mihailova, M. Simonoska Crcarevska, I. Cvetkovikj Karanfilova, V. Ivanovski, A. Kapedanovska Nestorovska, G. Novotni, M. Glavash Dodov	Formulation and optimization of bioinspired rosemary extract loaded PEGylated nanoliposomes for potential treatment of Alzheimer's disease using design of experiments	Journal of Drug Delivery Science and Technology 63 (2021) 102434 https://doi.org/10.1016/ j.jddst.2021.102434 IF=2,734
	12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	Shalabalija, D., Draskovic, N., Livrinska, L., Geskovski, N., Glavash Dodov, M., Mihailova, Lj.	Sustained clamicin ery using sponges: a ising strategy rodental ions 15th Central European Symposium on Pharmaceutica l Technology 2025	15th Central European Symposium on Pharmaceutical Technology 2025

		5	Mihailova, Lj., Shalabalija, D., Zimmer, A., Geshkovski, N., Stefkov, G., Simonoska Crcarevska, M., Glavash Dodov, M.	Cytotoxicity and cellular uptake of Cannabis sativa extract loaded nanostructure d lipid carriers on hCMEC/D3 cells 12th World Meeting on Pharmaceutics , Biopharmaceutics and Pharmaceutica l Technology, Virtual meeting 2021	12th World Meeting on Pharmaceutics, Biopharmaceutics and Pharmaceutical Technology, Virtual meeting	2021

No. 17	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Maja Simonoska Crcarevska		
2.	Date of Birth	04.05.1976		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate Studies	2000	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master's Studies	2007	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral Studies	2012	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical Technology with Industrial Pharmacy and Micro/Nanotechnology
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical Technology with Industrial Pharmacy and Micro/Nanotechnology
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Full Professor	Pharmaceutical Technology with Industrial Pharmacy and Micro/Nanotechnology – Other
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.1.	List of courses taught by the instructor in the first cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Fundamentals of Pharmaceutical Technology (course coordinator)	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	2	Pharmaceutical Technology (participant)	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	3	Pharmaceutical Technology – advanced level (participant)	Master of Pharmacy / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	4	Pharmaceutical-Technological Analyses (course coordinator)	Laboratory Bioengineering / Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
9.2.	List of courses taught by the instructor in the second cycle of studies			
	No.	Course Title	Study Program / Institution	

		1.	Pharmaceutical Engineering and Bioengineering 1 (participant)	Master's Studies in Laboratory Analysis and Pharmaceutical Engineering, Faculty of Pharmacy / Ss. Cyril and Methodius University in Skopje
		2.	Pharmaceutical Engineering and Bioengineering 2 (participant)	Master's Studies in Laboratory Analysis and Pharmaceutical Engineering, Faculty of Pharmacy / Ss. Cyril and Methodius University in Skopje
		3	Sterile Techniques and Their Application (course coordinator)	Master's Studies in Laboratory Analysis and Pharmaceutical Engineering, Faculty of Pharmacy / Ss. Cyril and Methodius University in Skopje
		4	Experimental Design in the Formulation of Novel Therapeutic Systems (course coordinator)	Master's Studies in Laboratory Analysis and Pharmaceutical Engineering, Faculty of Pharmacy / Ss. Cyril and Methodius University in Skopje
	9.3.	List of courses taught by the instructor in the third cycle of studies		
		No.	Course Title	Study Program / Institution
		1.	In situ, In vitro and In silico Methods in Biopharmaceutical Drug Testing (course coordinator)	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		2.	Industrial Pharmacy 1 (participant)	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		3.	Advanced Therapeutic Systems (participant)	Doctoral Studies in the Scientific-Research Field of Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
10.	Selected Results in the Last Five Years			
	10.1.	Relevant Published Scientific Papers (up to five)		
		N o .	Authors	Title
		1	Tasevska, T., Adamov, I., Geskovski, N., Ibrić, S., Goracinova, K. and Crcarevska, M.S.,	3D printed extended-release hydrochlorothiazide tablets. European Journal of Pharmaceutical Sciences, 206, p.106998., 2025

		2	Milenkovska, R., Geskovski, N., Shalabalija, D., Mihailova, L., Makreski, P., Lukarski, D., Stojkovski, I., Crcarevska, M.S. and Mladenovska, K	Radiosensitizing properties of dual-functionalized carbon nanostructures loaded with temozolomide.	Beilstein Journal of Nanotechnology, 16(1), pp.229-251. 2025
		3	Miceva, D., Crcarevska, M.S., Naumovska, Z., Smilkov, K., Ackova, D.G., Lazarova, B., Angelovska, B. and Sersemova, E.D.	The role of pharmacists in asthma management: patient opinions and expectations in North Macedonia	Pharmacia, 72, pp.1-9. 2025
		4	Stavrova, V., Simonoska Crcarevska, M., Naumovska, Z., Bozhinovska, B., Andonoska, J., Stavric, K., Maksimova, V., Meštrović, A., & Rouse, M. J.	What a SMART Pharmacist Can Discover in Only One Day: A Public Health Initiative Focused on Diabetes in North Macedonia.	Healthcare, 13(17), 2107. 2025
		5	Lazarova, B., Eftimova, B., Simonoska Crcarevska, M., Tashkov, T., Miceva, D. & Naumovska, Z.,	Evaluation of hospital antibiotic consumption during COVID-19 pandemic	Current Drug Safety; 20, e15748863385928, 2025
10.2.	Participation in National and International Research Projects (up to five)				
	N o .	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project	

		1 ·	Principal Investigator	Design, Development and Characterization of Combined Solid Dosage Forms Using 3D Printing and Electrospinning Supported by Machine Learning Models (3DOSE-IT)	Funded by the Ministry of Education and Science, Republic of North Macedonia, 2025–2026
		2 ·	Participant	Wearable Smart Patches for Multimodal Wound Healing	Funded by NATO SPS Programme, 2023–2026
		3 ·	Participant	VetaLipoFer – Nutritional Supplement for the Prophylactic Treatment of Anemia in Animals	Fund for Innovation and Technological Development, Republic of North Macedonia, 2022–2024
		4	Principal Investigator	Implementation of Innovation Models in the Process of Developing New Products for Wound Treatment in the Healthcare Sector	Bilateral project funded by the Ministry of Education and Science, Republic of North Macedonia, and OeAD – Austrian Agency for Education and Internationalisation, Austria, 2022–2023
		5	Principal Investigator	Enhancement of the Technical Competence of the Center for Pharmaceutical Nanotechnology through the Introduction of Standard Analytical Procedures in the Field of Rheometry and 3D Bioprinting	Funded by the Ministry of Education and Science, Republic of North Macedonia, 2021–2023
	10.3.	Printed Books in the Last Five Years (up to five)			
		N o ·	Authors	Title	Publisher / Year

		1	Maja Simonoska Crcarevska, Aleksandra Kapedanovska Nestorovska, Anita Dinevska Gegovska, Vasilka Dineva, Enfele Ismaili	Community pharmacy Practice	MON, ISBN 978-608-273-114-8, COBIS.MK-ID 58578437/ 2022
		2	Zorica Naumovska, Biljana Lazarova, Maja Kovaceva, Aleksandra Kapedanovska Nestorovska, Maja Simonoska Crcarevska, Evgenija Mihajlova, Aleksandar Dimkovski	Book chapter: Frontline Care: The Role of Hospital Pharmacists During the COVID-19 Pandemic in North	Pharmaceutical Science: New Insights and Developments. 2025. ISBN 978-93-49970-61-8 (Print) ISBN 978-93-49970-24-3 (eBook) https://doi.org/10.9734/bpi/psnid/v6/5179
	10.4.	Published Professional Papers in the Last Five Years (up to five)			
		No	Authors	Title	Publisher / Year
		1	Naumovska, Z., Lazarova, B., Kovaceva, M., Nestorovska, A.K., Crcarevska, M.S., Mihajlova, E. and Dimkovski, A.	Role of the hospital pharmacists during COVID-19 pandemic in the RN Macedonia.	Macedonian Pharmaceutical Bulletin/ 70(1), 69-72. 2024

		2	Djurdjic, B., Maric, S., Kapedanovska Nestorovska, A., Naumovska, Z., Glavash Dodov, M., Geshkovski, N., Grozdanova, A., Sterjev, Z. and Simonoska Crcarevska, M.,	Community pharmacy practice in Montenegro in the period January-April 2020.	Macedonian pharmaceutical bulletin 68 (Suppl. 1), 451- 452. 2022
		3	Simonoska Crcarevska, M., Naumovska, Z., Glavash Dodov, M., Grozdanova, A., Sterjev, Z., Geshkovski, N. and Kapedanovska Nestorovska, A.,	Role and activities of pharmacists in RN Macedonia at the beginning of COVID-19 pandemic: March- April 2020.	Macedonian pharmaceutical bulletin 68 (Suppl. 1), 439- 440. 2022
		4	Kapedanovska Nestorovska, A., Naumovska, Z., Glavash Dodov, M., Geshkovski, N., Sterjev, Z., Grozdanova, A., Sterjeva, T. and Simonoska Crcarevska, M.,	Community pharmacists in RN Macedonia at the frontline of COVID- 19 pandemic beginning: March- April 2020.	Macedonian pharmaceutical bulletin 68 (Suppl. 1), 437- 438. 2022
		5	Djurdjic, B., Milosevic, K., Mudresa, J., Maric, S., Naumovska, Z., Kapedanovska Nestorovska, A. and Simonoska Crcarevska, M.,	Antibiotic dispensing and over the counter drug sale: case study in “Villa” community pharmacy in Montenegro 2019- 2021.	Macedonian pharmaceutical bulletin 68 (Suppl. 1) 435- 436. 2022
11.	Mentorships				
	11.1.	Diploma Theses		11	

	11.2.	Master's Theses	3		
	11.3.	Doctoral Dissertations	3 (ongoing)		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	Tasevska, T., Adamov, I., Geskovski, N., Ibrić, S., Goracinova, K. and Crcarevska, M.S.,	3D printed extended-release hydrochlorothiazide tablets.	European Journal of Pharmaceutical Sciences, 206, p.106998., 2025
		2.	Milenkovska, R., Geskovski, N., Shalabaliya, D., Mihailova, L., Makreski, P., Lukarski, D., Stojkovski, I., Crcarevska, M.S. and Mladenovska, K	Radiosensitizing properties of dual-functionalized carbon nanostructures loaded with temozolomide.	Beilstein Journal of Nanotechnology, 16(1), pp.229-251. 2025
	3.	Miceva, D., Crcarevska, M.S., Naumovska, Z., Smilkov, K., Ackova, D.G., Lazarova, B., Angelovska, B. and Sersemova, E.D.	The role of pharmacists in asthma management: patient opinions and expectations in North Macedonia	Pharmacia, 72, pp.1-9. 2025	

		4	Stavrova, V., Simonoska Crcarevska, M., Naumovska, Z., Bozhinovska, B., Andonoska, J., Stavric, K., Maksimova, V., Meštrović, A., & Rouse, M. J.	What a SMART Pharmacist Can Discover in Only One Day: A Public Health Initiative Focused on Diabetes in North Macedonia.	Healthcare, 13(17), 2107. 2025
		5	Lazarova, B., Eftimova, B., Simonoska Crcarevska, M., Tashkov, T., Miceva, D. & Naumovska, Z.,	Evaluation of hospital antibiotic consumption during COVID-19 pandemic	Current Drug Safety; 20, e15748863385928, 2025
		6	Markova, E., Taneska, L., Kostovska, M., Shalabalija, D., Mihailova, L., Glavash Dodov, M., Makreski, P., Geskovski, N., Petrushevska, M., N. Taravari, A. and Simonoska Crcarevska, M.	Design and evaluation of nanostructured lipid carriers loaded with Salvia officinalis extract for Alzheimer's disease treatment.	Journal of Biomedical Materials Research Part B: Applied Biomaterials, 110(6), pp.1368- 1390., 2022
	12.2.	Evidence of at least two published research papers in international scientific journals with an impact factor in the given field over the past five years			
		No	Authors	Title	Publisher / Year
		1	Tasevska, T., Adamov, I., Geskovski, N., Ibrić, S., Goracinova, K. and Crcarevska, M.S.,	3D printed extended-release hydrochlorothiazide tablets.	European Journal of Pharmaceutical Sciences, 206, p.106998., 2025

		2	Milenkovska, R., Geskovski, N., Shalabalija, D., Mihailova, L., Makreski, P., Lukarski, D., Stojkovski, I., Crcarevska, M.S. and Mladenovska, K	Radiosensitizing properties of dual-functionalized carbon nanostructures loaded with temozolomide.	Beilstein Journal of Nanotechnology, 16(1), pp.229-251. 2025
		3	Miceva, D., Crcarevska, M.S., Naumovska, Z., Smilkov, K., Ackova, D.G., Lazarova, B., Angelovska, B. and Sersemova, E.D.	The role of pharmacists in asthma management: patient opinions and expectations in North Macedonia	Pharmacia, 72, pp.1-9. 2025
		4	Stavrova, V., Simonoska Crcarevska, M., Naumovska, Z., Bozhinovska, B., Andonoska, J., Stavric, K., Maksimova, V., Meštrović, A., & Rouse, M. J.	What a SMART Pharmacist Can Discover in Only One Day: A Public Health Initiative Focused on Diabetes in North Macedonia.	Healthcare, 13(17), 2107. 2025
		5	Lazarova, B., Eftimova, B., Simonoska Crcarevska, M., Tashkov, T., Miceva, D. & Naumovska, Z.,	Evaluation of hospital antibiotic consumption during COVID-19 pandemic	Current Drug Safety; 20, e15748863385928, 2025

		6	Markova, E., Taneska, L., Kostovska, M., Shalabaliya, D., Mihailova, L., Glavash Dodov, M., Makreski, P., Geskovski, N., Petrushevska, M., N. Taravari, A. and Simonoska Crcarevska, M.	Design and evaluation of nanostructured lipid carriers loaded with Salvia officinalis extract for Alzheimer's disease treatment.	Journal of Biomedical Materials Research Part B: Applied Biomaterials, 110(6), pp.1368- 1390., 2022	
	12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
		No	Authors	Title	Publisher / Year	Authors
		1.	Tasevska, T., Geskovski, N., Goracinova, K., Popeski Dimovski, R. & Simonoska Crcarevska, M., 2025.	Predicting 3D printability of semi-solid extrusion formulations using rheological data and machine learning models.	15th Central European Symposium on Pharmaceutical Technology, Bled, Slovenia	25–27 September 2025
		2.	Todeska, M., Gjorgjevska, M., Velickovski, D., Petrusevska, D., Geskovski, N., Goracinova, K., Tasevska, T., Livrinska, L. & Simonoska Crcarevska, M.,	Development and characterizati on of rapid- release metformin granules using QbD principles.	15th Central European Symposium on Pharmaceutical Technology, Bled, Slovenia	25–27 September 2025,

		3.	Jeton Mucaj, Zorica Naumovska, Maja Simonoska Crcarevska,	Challenges and opportunities in community pharmacists' role in chronic obstructive pulmonary disease management in Kosovo.	83rd FIP World Congress of Pharmacy and Pharmaceutical Sciences, Copenhagen, Denmark,	31 August to 3 September 2025
		4	Naumovska Z, Simonoska Crcarevska M, Kapedanovska Nestorovska A, Tasevska T, Bozinovska B, Andonovska J, Atanasovic S, Boshkoska D, Krmova S, Shajnovska A, Tundgeva M, Janevska S, Stavrikj K.	Education and training strategy supported by The International Primary Care Respiratory Group (IPCRG) for the community pharmacist in asthma care in the Republic of North Macedonia.	82rd FIP World Congress of Pharmacy and Pharmaceutical Sciences, Cape Town, South Africa,	September 1-4, 2024

		5	Karanfilova, I. C., Crcarevska, M. S., Karapandzo va, M., Gjorgievska, V. S., Trajkovska, A., Davkova, I., & Stefkov, G.	Application of multivariate regression analysis for prediction of essential oil composition from 46 different sage populations.	CMAPSEEC, Izmir, Turkey	17-19 October 2024

No.1 8	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Nikola Geshkovski		
2.	Date of Birth	19.06.1983		
3.	Educational Qualification	VIII (Doctor of science)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		BSc Pharm	2006	UKIM, Faculty of Pharmacy - Skopje
		MSc	2011	UKIM, Faculty of Pharmacy - Skopje
		PhD	2015	UKIM, Faculty of Pharmacy - Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical sciences and healthcare	Pharmacy	Pharmacognosy
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical sciences and healthcare	Pharmacy	Biopharmacy
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	UKIM, Faculty of Pharmacy - Skopje	Full professor	Biopharmaceutics, Pharmaceutical Technology with Industrial Pharmacy and Micro/Nanotechnology
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
		Preparation and Analysis of Radiopharmaceuticals (course coordinator)	Laboratory bioengineer, UKIM, Faculty of Pharmacy - Skopje	
		Techniques for Particle Size Determination (course coordinator)	Laboratory bioengineer, UKIM, Faculty of Pharmacy - Skopje	
		Nutraceuticals and Their Technological and Biopharmaceutical Characteristics	Dietetics and dietotherapy, UKIM, Faculty of Pharmacy – Skopje	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	Therapeutic Systems and Technologies for Controlled and Targeted Drug Release	Specialist Studies in Industrial Pharmacy, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
		Modern Excipients	Specialist Studies in Industrial Pharmacy, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	

			Technology of Cosmetic Product Packaging	Specialist Studies in Cosmetology, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje
	9.	List of courses taught by the instructor in the third cycle of studies		
	3.	No.	Course Title	Study Program / Institution
		1.	Bioavailability and Bioequivalence	Doctoral studies in the scientific research field of pharmacy, Faculty of Pharmacy, UKIM, Skopje
		2.		
10.	Selected Results in the Last Five Years			
10	Relevant Published Scientific Papers (up to five)			
.1.	No.	Authors	Title	Publisher / Year
	1.	Gorachinov F.; Koviloska M.; Tnokovska K.; Atanasova A.; Antovska P.; Lazova J.; Geskovski N.	FT-NIR models for predicting film quality parameters in titanium dioxide-free tablet coatings	European Journal of Pharmaceutical sciences - Elsevier/ 2025
	2.	Atanaskova E.; Angelovska V.; Chachorovska M.; Anevska Stojanovska N.; Petrushevski G.; Makreski P.; Geskovski N.	Development of novel portable NIR spectroscopy process analytical technology (PAT) tool for monitoring the transition of ibuprofen to ibuprofen sodium during wet granulation process	Spectrochimica acta Part A - Elsevier/ 2024
	3.	Shutevska K.; Bajatovska A.M.; Anastasova L.; Zhivikj Z.; Zafirova Gjorgievska M.; Spasikj S.; Petreska Ivanovska T.; Makreski P.; Geskovski N.	Rapid quantification models for assessing melamine adulteration in sport nutrition supplements via benchtop and portable NIRS instruments	Spectrochimica acta Part A - Elsevier/ 2024
	4.	Djurdjic B.; Makreski P.; Boev I.; Goracinova K.; Geskovski N.	ORMOSIL nanoparticles as drug delivery carriers for oxaliplatin: formulation development and characterization	Chemical papers - Springer/ 2024

		5.	Stoilkovska Gjorgievska V.; Geskovski N.; Makreski P.; Trajkovska A.; Cvetkovikj Karanfilova I.; Karapandzova M.; Kulevanova S.; Stefkov G.	Differentiation of Cannabis seeds employing digital morphological screening and infrared spectroscopy coupled with multivariate modeling	Industrial crops and products - Elsevier/ 2024
10 .2.	Participation in National and International Research Projects (up to five)				
	No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project	
	1.	Principal investigator	Introduction of New Wet Granulation Methods in Research and Development of Modern Dosage Forms	Ministry of Education and Science of the Republic of North Macedonia 2021–2023	
	2.	Principal investigator	Development of Vibrational Spectroscopic Methods for Rapid Monitoring of Phytocannabinoids in Hemp and Related Products	Bilateral project with the Republic of Austria. Ministry of Education and Science of the Republic of North Macedonia 2022–2023	
	3.	Principal investigator	Application of Vibrational Spectroscopic Techniques in Pharmaceutical Analysis	Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje 2022–2024	
	4.	Principal investigator	VetaLipoFer – Dietary Supplement for the Prophylactic Treatment of Anemia in Animals	Fund for Innovation and Technological Development (FITD), Republic of North Macedonia 2022–2024	
	5.	Principal investigator	Wearable Smart Patches for Multimodal Wound Healing	NATO Science for Peace and Security (SPS) Programme 2023–2026	
10 .3.	Printed Books in the Last Five Years (up to five)				
	No.	Authors	Title	Publisher / Year	
	1.				

		2			
10 .4.	Published Professional Papers in the Last Five Years (up to five)				
	No.	Authors	Title	Publisher / Year	
	1.	1.	Cvetkovska Bogatinovska E.; Najkov K.; Petrushevski G.; Geskovski N.; Koleva V.; Stefov V.	Infrared and Raman spectra of racemic ibuprofen sodium dihydrate – Spectra-structure correlations	
	2.	2.	Jordanov I.; Dimova V.; Geskovski N.; Mirakovski D.	Environmentally Friendly Nanocoating for Rapid Detection of Nerve Agents on Textile Fabric	
	3.	3.	Atanaskova E.; Poms J.; Wolfgang M.; Alva C.; Mussner N.; Zimmer A.; Geskovski N.; Salar-Behzadi S.	Novel development of lipid-based formulations: Improved wettability and homogeneous API solid dispersion visualised via near-infrared hyperspectral imaging	
	4.	4.	Milenkovska R.; Geskovski N.; Shalabalija D.; Mihailova L.; Makreski P.; Lukarski D.; Stojkovski I.; Crcarevska M.S.; Mladenovska K.	Radiosensitizing properties of dual-functionalized carbon nanostructures loaded with temozolomide	
	5.	5.	Gorachinov F.; Koviloska M.; Tnokovska K.; Atanasova A.; Antovska P.; Lazova J.; Geskovski N.	FT-NIR models for predicting film quality parameters in titanium dioxide-free tablet coatings	
11.	Mentorships				
	11 .1.	Diploma Theses	12		
	11 .2.	Master’s Theses	9		
	11 .3.	Doctoral Dissertations	2		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
	No	Authors	Title	Publisher / Year	

		1.	Cvetkovska Bogatinovska E.; Najkov K.; Petrushevski G.; Geskovski N.; Koleva V.; Stefov V.	Infrared and Raman spectra of racemic ibuprofen sodium dihydrate – Spectra-structure correlations	Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy – Elsevier /2025
		2.	Jordanov I.; Dimova V.; Geskovski N.; Mirakovski D.	Environmentally Friendly Nanocoating for Rapid Detection of Nerve Agents on Textile Fabric	ACS Omega – ACS/ 2025
		3.	Atanaskova E.; Poms J.; Wolfgang M.; Alva C.; Mussner N.; Zimmer A.; Geskovski N.; Salar-Behzadi S.	Novel development of lipid-based formulations: Improved wettability and homogeneous API solid dispersion visualised via near-infrared hyperspectral imaging	European Journal of Pharmaceutics and Biopharmaceutics – Elsevier/ 2025
		4.	Milenkovska R.; Geskovski N.; Shalabalija D.; Mihailova L.; Makreski P.; Lukarski D.; Stojkovski I.; Crcarevska M.S.; Mladenovska K.	Radiosensitizing properties of dual-functionalized carbon nanostructures loaded with temozolomide	Beilstein Journal of Nanotechnology – Beilstein Institute/ 2025
		5.	Gorachinov F.; Koviloska M.; Tnokovska K.; Atanasova A.; Antovska P.; Lazova J.; Geskovski N.	FT-NIR models for predicting film quality parameters in titanium dioxide-free tablet coatings	European Journal of Pharmaceutical sciences - Elsevier/ 2025
		6.	Tasevska T.; Adamov I.; Geskovski N.; Ibrić S.; Goracinova K.; Crcarevska M.S.	3D printed extended-release hydrochlorothiazide tablets	European Journal of Pharmaceutical sciences - Elsevier/ 2025
	12	Evidence of at least two published scientific research papers in international scientific journals with an impact factor in the given field in the last five years			
	.2.	No	Authors	Title	Publisher / Year

	1.	Gigopulu O.; Geskovski N.; Stefkov G.; Poceva Panovska A.; Piponski M.; Slaveska Spirevska I.; Makreski P.	Real-time monitoring of CBDA decarboxylation in solid state and cannabis flowers using mid infrared spectroscopy coupled with multivariate analysis	Vibrational Spectroscopy Elsevier /2024
	2.	Bogatinovska E.C.; Geškovski N.; Petrushevski G.; Stefov V.	Multivariate analysis for rapid screening and prediction of solid- state compatibility in pharmaceutical preformulation studies – paving the road for machine learning;	Macedonian Journal of Chemistry and Chemical Engineering – MSCCE /2024
	3.	Shutevska, K.; Bajatovska, A.M.; Anastasova, L.; Zhivikj, Z.; Zafirova Gjorgievska, M.; Spasikj, S.; Petreska Ivanovska, T.; Makreski, P.; Geškovski, N.	Rapid quantification models for assessing melamine adulteration in sport nutrition supplements via benchtop and portable NIRS instruments	Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy – Elsevier /2024
	4.	Atanaskova, E.; Angelovska, V.; Chachorovska, M.; Anevsk- Stojanovska, N.; Petrushevski, G.; Makreski, P.; Geškovski, N.	Development of novel portable NIR spectroscopy process analytical technology (PAT) tool for monitoring the transition of ibuprofen to ibuprofen sodium during wet granulation process	Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy – Elsevier /2024

		5.	Gigopulu, O.; Geškovski, N.; Stefkov, G.; Poceva-Panovska, A.; Piponski, M.; Slaveska-Spirevska, I.; Makreski, P.	Real-time monitoring of CBDA decarboxylation in solid state and cannabis flowers using mid infrared spectroscopy coupled with multivariate analysis	Vibrational Spectroscopy - Elsevier 2024
		6.	Djurdjic, B.; Makreski, P.; Boev, I.; Goracinova, K.; Geškovski, N.	ORMOSIL nanoparticles as drug delivery carriers for oxaliplatin: formulation development and characterization	Chemical papers – Springer 2024
12 .3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
	No	Authors	Title	International meeting/conference	year
	1.	V. Stoilkovska Gjorgievska; N. Matevska- Geshkovska; E. Krstevska Bozhinovikj; I. Cvetkovikj Karanfilova; A. Trajkovska; I. Davkova; N. Geskovski; M. Karapandzova ; G. Stefkov	Exploring link between cannabinoid content and molecular markers in Cannabis sativa L. cultivated plants from wild and commercial origin	PSE Meeting 2025 - Phytochemicals as drugs, foods and biocommunicators At: Funchal, Madeira Island, Portugal	2025

		2.	A. Dimoski; T.Tasevska; L. Livrinska; M. Simonoska Crcarevska; D. Shalabaliya; K. Goracinova; N. Geskovski	Development of a multimodal release diclofenac sodium tablet using semi-solid extrusion 3D printing	15th Central European Symposium on Pharmaceutical Technology, Bled, Slovenia	2025
		3.	E. Atanaskova; J. Poms; M. Wolfgang; C. Alva; N. Mussner, N. Geskovski; A. Zimmer; S. Salar-Behzadi	NIR hyperspectral imaging for monitoring of drug content uniformity in lipid-based formulation development	15th Central European Symposium on Pharmaceutical Technology, Bled, Slovenia	2025
		4.	L. Livrinska; M. Petrushevska; N. Geškovski; U. Jančič; V. Vuksanović; B. Djurdjic; M. Simonoska Crcarevska; S. Gorgieva	Gentamicin-loaded chitosan nanoparticles embedded in nanocellulose wound healing nanocomposite	15th Central European Symposium on Pharmaceutical Technology, Bled, Slovenia	2025
		5.	D. Shalabaliya; N. Draskovic; L. Livrinska; N. Geskovski; M. Glavas Dodov; Lj. Mihailova	Sustained clindamycin delivery using microsponges: a promising strategy for orodental infections	15th Central European Symposium on Pharmaceutical Technology, Bled, Slovenia	2025
		6.	T.Tasevska; N. Geskovski; K. Goracinova; R. Popeski Dimovski; M. Simonoska Crcarevska	Predicting 3D printability of semi-solid extrusion formulations using rheological data and machine learning models	15th Central European Symposium on Pharmaceutical Technology, Bled, Slovenia	2025

		7.	O. Gigopulu; G. Stefkov; N. Geskovski; P. Makreski	Advanced Vibrational Spectroscopic Approaches for Medical Cannabis Quality Control	6th International Conference on Natural Products Utilisation: from Plant to Pharmacy Shelf, Bansko, Bulgaria	2025
		8.	G. Stefkov; D. Petrevska; P. Makreski; G. Jovanovski; O. Gigopulu; N. Geskovski	Authentication of Ohrid Pearls Using Vibrational Spectroscopic Techniques	6th International Conference on Natural Products Utilisation: from Plant to Pharmacy Shelf, Bansko, Bulgaria	2025

No. 19	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Ljubica Mihailova		
2.	Date of Birth	10.07.1993		
3.	Educational Qualification	VIII (Doctor of Sciences)		
4.	Academic and Professional Titles	Assistant Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Master of Pharmacy	2017	Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje
		Doctor of Sciences	2023	Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical Technology
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	UKIM, Faculty of Pharmacy – Skopje	Assistant Professor	Pharmaceutical Technology with Industrial Pharmacy and Micro/Nanotechnology and Biopharmacy
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.			
	1.	Pharmaceutical-Technological Analyses (participates)	Graduated Laboratory Bioengineer / Faculty of Pharmacy, UKIM, Skopje	
	2.	Cellular and Animal Experimental Models (participates)	Graduated Laboratory Bioengineer / Faculty of Pharmacy, UKIM, Skopje	
	3.	Basics of Pharmacy (participates)	Master of Pharmacy / Faculty of Pharmacy, UKIM, Skopje	
	4.	Basics of Pharmaceutical Technology (participates)	Master of Pharmacy / Faculty of Pharmacy, UKIM, Skopje	
	5.	Pharmaceutical Technology (participates)	Master of Pharmacy / Faculty of Pharmacy, UKIM, Skopje	
	6.	Pharmaceutical Technology – Advanced Level (participates)	Master of Pharmacy / Faculty of Pharmacy, UKIM, Skopje	
	7.	Biopharmacy (participates)	Master of Pharmacy / Faculty of Pharmacy, UKIM, Skopje	

		8.	Basic Technological Operations (participates)	Dietetics and Diet Therapy / Faculty of Pharmacy, UKIM, Skopje	
	9.	List of courses taught by the instructor in the second cycle of studies			
	2.	No.			
		1.	Industrial Pharmacy 1 (participates)	Specialist studies in Industrial Pharmacy	
		2.	Industrial Pharmacy 2 (participates)	Specialist studies in Industrial Pharmacy	
		3	Quality Assurance in the Production of Pharmaceutical Dosage Forms – Case Studies	Specialist studies in Industrial Pharmacy	
		4.	Therapeutic Systems and Technologies for Controlled and Targeted Release	Specialist studies in Industrial Pharmacy	
	9.	List of courses taught by the instructor in the third cycle of studies			
	3.	No.	Course Title	Study Program / Institution	
		1.			
		2.			
		3.			
10.	Selected Results in the Last Five Years				
	10	Relevant Published Scientific Papers (up to five)			
	.1.	No.	Authors	Title	Publisher / Year
		1.	Milenkovska, R., Geskovski, N., Shalabalija, D., Mihailova, Lj., Mekreski, P., Lukarski, D., Stojkovski, I., Simonoska Crcarevska, M., Mladenovska, K	Radiosensitizing properties of dual-functionalized carbonnanostuctures loaded with temozolomide	Beilstein J. Nanotechnol. 16, 229–251 / 2024. https://doi.org/10.3762/bjnano.16.18 IF: 2.9
		2.	Mihailova, L., Shalabalija, D., Zimmer, A., Geskovski, N., Makreski, P., Petrushevska, M., Simonoska Crcarevska, M., Glavash Dodov, M.	Comparative Studies of the Uptake and Internalization Pathways of Different Lipid Nano-Systems Intended for Brain Delivery	Pharmaceutics 15(8), 2082 / 2023 https://doi.org/10.3390/pharmaceutics15082082 IF: 5.4

		3.	Filip Gorachinov, Petre Makreski, Dushko Shalabalija, Ljubica Mihailova, Maja Simonoska Crcarevska, Marija Glavash Dodov, Katerina Gorachinova, Gligor Jovanovski, Nikola Geskovski	Micro-raman spectroscopy for detection of label-free and oil red O labeled PEGylated nanoliposomes in hCmec/d3 cell internalization studies	Croatia Acta Chemica, 2023 (IF 0,659)
		4.	Mihailova, L., Tchekalarova, J., Shalabalija, D., Geskovski, N., Gjorgievska, V.S., Stefkov, G., Krasteva, P., Simonoska Crcarevska, M. and Glavash Dodov, M.	Lipid nano-carriers loaded with Cannabis sativa extract for epilepsy treatment–in vitro characterization and in vivo efficacy studies	Journal of Pharmaceutical Sciences 111 (12), 3384-3396 / 2022. https://doi.org/10.1016/j.xphs.2022.09.012 IF: 4.063
		5.	Shalabalija, D., Mihailova, Lj., Simonoska Crcarevska, M., Cvetkovikj Karanfilova, I., Ivanovski, V., Kapedanovska Nestorovska, A., Novotni, G., Glavash Dodov, M.	Formulation and optimization of bioinspired rosemary extract loaded PEGylated nanoliposomes for potential treatment of Alzheimer's disease using design of experiments	Journal of Drug Delivery Science and Technology Volume 63, 102434 / 2021. https://doi.org/10.1016/j.jddst.2021.102434 IF: 5.062
10 .2.	Participation in National and International Research Projects (up to five)				
	No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project	
	1.	Project Leader	Development of 3D Cell Bioreactor Systems and Application of Fluorescence Microscopy in Various Areas of Pharmaceutical Interest	Faculty of Pharmacy / 2025– 2027	

		2.	Participant	Wearable Smart Patches for Multimodal Wound Healing	NATO / 2023–2026
		3.	Principal Investigator	Proteomic Profiling of the Protein Corona Formed on the Surface of Nanoparticles After Their Incubation in hCMEC/D3 Cell Medium	Joint Research Centre of the European Commission / 2022–202
		4.	Participant	Implementation of Innovation Models in the Process of New Product Development for Wound Healing in the Health Sector	Ministry of Education and Science of the Republic of N. Macedonia and OeAD – Austria’s Agency for Education and Internationalisation, Austria / 2022–2023
		5.	Participant	VetaLipoFer – Dietary Supplement for Prophylactic Treatment of Anemia in Animals	Fund for Innovation and Technology Development, Republic of N. Macedonia / 2022–2024
	10	Printed Books in the Last Five Years (up to five)			
	.3.	No.	Authors	Title	Publisher / Year
		1.			
	10	Published Professional Papers in the Last Five Years (up to five)			
	.4.	No.	Authors	Title	Publisher / Year
		1.			
		2.			
		3.			
		4.			
		5.			
11.	Mentorships				
	11	Diploma Theses		2	
	.1.	Master’s Theses		/	
	.2.	Doctoral Dissertations		/	
	11				
	.3.				
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				

12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
	No	Authors	Title	Publisher / Year
	1.	Shalabalija, D., Mihailova, Lj., Geskovski, N., Zimmer, A., Glavash Dodov, M.	Cytotoxic potential of nanoliposomes on hCMEC/D3 and SH-SY5Y cell lines	Macedonian Pharmaceutical Bulletin 69 (Suppl 1), 279-280 / 2023
	2.	Mihailova, Lj., Shalabalija, D., Geskovski, N., Geiss, O., Gioria, S., Scaccabarozzi, D., Zimmer, A., Glavash Dodov, M.	DLS and AF4-MALS/DLS as powerful techniques for in vitro evaluation of nanoliposomes stability in biorelevant medium	Macedonian Pharmaceutical Bulletin 69 (Suppl 1), 17-18 / 2023
	3.	Tasevska, T., Livrinska, L., Mihailova, Lj., Shalabalija, D., Geskovski, N., Glavash Dodov, M., Goracinova, K., Mladenovska, K., Slaveska Raichki, R., Simonoska Crcarevska, M.	Validation of method for rheological characterization of poloxamer 407 hydrogels used for 3D bioprinting	Macedonian Pharmaceutical Bulletin 69 (Suppl 1), 261-262 / 2023
	4.	Livrinska, L., Tasevska, T., Shalablija, D., Mihailova, L., Glavash Dodov, M., Polenakovikj, R., Velkovski, T., Simonoska Crcarevska, M	Effect of calcium chloride on physical properties of blended alginate carboxymethyl cellulose wound dressings.	Macedonian Pharmaceutical Bulletin 69 (Suppl 1), 297-298. / 2023
	5.	Mihailova, Lj., Shalabalija, D., Geskovski, N., Simonoska Crcarevska, M. and Glavash Dodov, M	Insight into the efficacy of lipid nanosystems for brain delivery – uptake and internalization pathways in different cell culture lines	Macedonian pharmaceutical bulletin 68 (Suppl. 1), 219-220 / 2022

	6.	Shalabalija, D., Mihailova, Lj., Geskovski, N., Simonoska Crcarevska, M., Glavash Dodov, M.	Lipid nano-carriers with herbal extracts for targeted brain delivery and treatment of CNS disorders	Macedonian pharmaceutical bulletin 68 (Suppl. 1) / 2022
12	Evidence of at least two published scientific-research papers in international peer-reviewed journals with an impact factor in the given field within the last five years.”			
.2.	1.	Milenkovska, R., Geskovski, N., Shalabalija, D., Mihailova, Lj., Mekreski, P., Lukarski, D., Stojkovski, I., Simonoska Crcarevska, M., Mladenovska, K	Radiosensitizing properties of dual- functionalized carbonnanostructur es loaded with temozolomide	Beilstein J. Nanotechnol. 16, 229–251 / 2024. https://doi.org/10.3762/bjnano.16.18 IF: 2.9
	2.	Mihailova, L., Shalabalija, D., Zimmer, A., Geskovski, N., Makreski, P., Petrushevska, M., Simonoska Crcarevska, M., Glavash Dodov, M.	Comparative Studies of the Uptake and Internalization Pathways of Different Lipid Nano-Systems Intended for Brain Delivery	Pharmaceutics 15(8), 2082 / 2023 https://doi.org/10.3390/pharmaceutics15082082 IF: 5.4
	3.	Filip Gorachinov, Petre Makreski, Dushko Shalabalija, Ljubica Mihailova, Maja Simonoska Crcarevska, Marija Glavash Dodov, Katerina Gorachinova, Gligor Jovanovski, Nikola Geskovski	Micro-raman spectroscopy for detection of label- free and oil red O labeled PEGylated nanoliposomes in hCmec/d3 cell internalization studies	Croatia Acta Chemica, 2023 (IF 0,659)
	4.	Mihailova, L., Tchekalarova, J., Shalabalija, D., Geskovski, N., Gjorgievska, V.S., Stefkov, G., Krasteva, P., Simonoska Crcarevska, M. and Glavash Dodov, M.	Lipid nano-carriers loaded with Cannabis sativa extract for epilepsy treatment–in vitro characterization and in vivo efficacy studies	Journal of Pharmaceutical Sciences 111 (12), 3384-3396 / 2022. https://doi.org/10.1016/j.xphs.2022.09.012 IF: 4.063

		5.	Markova, E., Taneska, L., Kostovska, M., Shalabaliya, D., Mihailova, Lj., Glavash Dodov, M., Makreski, P., Geskovski, N., Petrushevska, M., Taravari, N.A., Simonoska Crcarevska, M.	Design and evaluation of nanostructured lipid carriers loaded with Salvia officinalis extract for Alzheimer's disease treatment	Journal of Biomedical Materials Research Part B Applied Biomaterials/ 2022 https://doi.org/10.1002/jbm.b.35006 IF: 3.405
		6.	Shalabaliya, D., Mihailova, Lj., Simonoska Crcarevska, M., Cvetkovikj Karanfilova, I., Ivanovski, V., Kapedanovska Nestorovska, A., Novotni, G., Glavash Dodov, M.	Formulation and optimization of bioinspired rosemary extract loaded PEGylated nanoliposomes for potential treatment of Alzheimer's disease using design of experiments	Journal of Drug Delivery Science and Technology Volume 63, 102434 / 2021. https://doi.org/10.1016/j.jddst.2021.102434 IF: 5.062
	12	Evidence of at Least Three Participations in International Conferences in the Last Five			
	3.	Years			
		No	Authors	Title	International Conferences
		1.	Mihailova, L., Nikolovski, M., Naumovski, M., Petrushevska, M., Tasevska, T., Glavash Dodov, M., Shalabaliya, D.	Mucoadhesive films embedded with dexamethason e loaded nanostructured lipid carriers for oral lichen planus treatment	15th Central European Symposium on Pharmaceutical Technology
		2.	Mihailova, Lj., Tchekalarova, J., Shalabaliya, D., Glavash Dodov, M., Stefkov, G.	Exploring the anticonvulsant potential of CBD oil and CBDA-rich extract: A path toward the brain	BiOrgaMCT - Bioactive Organic and Inorganic advanced materials and Clean Technologies Conference

		3.	Mihailova, Lj., Shalabalija, D., Geskovski, N., Geiss, O., Gioria, S., Scaccabarozi, D., Zimmer, A., Glavash Dodov, M.	DLS and AF4-MALS/DLS as powerful techniques for in vitro evaluation of nanoliposomes stability in biorelevant medium	14th Central European Symposium on Pharmaceutical Technology	2023
		4.	Mihailova, Lj., Shalabalija, D., Geskovski, N., Simonoska Crcarevska, M. and Glavash Dodov, M	Insight into the efficacy of lipid nanosystems for brain delivery – uptake and internalization pathways in different cell culture lines	7th Congress of Pharmacy in Macedonia with International participation	2022
		5.	Mihailova, Lj., Shalabalija, D., Zimmer, A., Geshkovski, N., Stefkov, G., Simonoska Crcarevska, M., Glavash Dodov, M.	Cytotoxicity and cellular uptake of Cannabis sativa extract loaded nanostructured lipid carriers on hCMEC/D3 cells	12th World Meeting on Pharmaceutics, Biopharmaceutics and Pharmaceutical Technology, Virtual meeting	2021

No. 20	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Dushko Shalabaliija		
2.	Date of Birth	14.08.1993		
3.	Educational Qualification	VIII (Doctor of Sciences)		
4.	Academic and Professional Titles	Assistant Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Master of Pharmacy	2017	Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje
		Doctor of Sciences	2023	Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical Technology
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	UKIM, Faculty of Pharmacy – Skopje	Assistant Professor	Pharmaceutical Technology with Industrial Pharmacy and Micro/Nanotechnology and Biotechnology
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.			
	1.	Pharmaceutical-Technological Analyses (participates)	Graduated Laboratory Bioengineer / Faculty of Pharmacy, UKIM, Skopje	
	2.	Basics of Biotechnology (participates)	Graduated Laboratory Bioengineer / Faculty of Pharmacy, UKIM, Skopje	
	3.	Basics of Pharmacy (leads)	Master of Pharmacy / Faculty of Pharmacy, UKIM, Skopje	
	4.	Basics of Pharmaceutical Technology (participates)	Master of Pharmacy / Faculty of Pharmacy, UKIM, Skopje	
	5.	Pharmaceutical Technology (participates)	Master of Pharmacy / Faculty of Pharmacy, UKIM, Skopje	
	6.	Pharmaceutical Technology – Advanced Level (participates)	Master of Pharmacy / Faculty of Pharmacy, UKIM, Skopje	
	7.	Biopharmaceutics (participates)	Master of Pharmacy / Faculty of Pharmacy, UKIM, Skopje	

		8.	Basics of Pharmaceutical Biotechnology (participates)	Master of Pharmacy / Faculty of Pharmacy, UKIM, Skopje		
		9.	Basic Technological Operations (participates)	Dietetics and Diet Therapy / Faculty of Pharmacy, UKIM, Skopje		
		10.	Nutraceuticals and Their Technological and Biopharmaceutical Characteristics	Dietetics and Diet Therapy / Faculty of Pharmacy, UKIM, Skopje		
	9.	List of courses taught by the instructor in the second cycle of studies				
	2.	No.				
	1.	Industrial Pharmacy 1 (participates)	Specialist studies in Industrial Pharmacy			
	2.	Industrial Pharmacy 2 (participates)	Specialist studies in Industrial Pharmacy			
	3	Stability	Specialist studies in Industrial Pharmacy			
	4.	Therapeutic Systems and Technologies for Controlled and Targeted Release	Specialist studies in Industrial Pharmacy			
	9.	List of courses taught by the instructor in the third cycle of studies				
	3.	No.	Course Title	Study Program / Institution		
	1.					
	2.					
		3.				
10.	Selected Results in the Last Five Years					
	10	Relevant Published Scientific Papers (up to five)				
	.1.	No.	Authors	Title	Publisher / Year	

		1.	Milenkovska, R., Geskovski, N., Shalabalija, D., Mihailova, Lj., Mekreski, P., Lukarski, D., Stojkovski, I., Simonoska Crcarevska, M., Mladenovska, K Radiosensitizing properties of dual-functionalized carbonnanosstructures loaded with temozolomide Beilstein J. Nanotechnol. 16, 229–251 / 2024. https://doi.org/10.3762/bjnano.16.18 IF: 2.9	Radiosensitizing properties of dual-functionalized carbonnanosstructures loaded with temozolomide Beilstein J. Nanotechnol. 16, 229–251 / 2024. https://doi.org/10.3762/bjnano.16.18 IF: 2.9	Beilstein J. Nanotechnol. 16, 229–251 / 2024. https://doi.org/10.3762/bjnano.16.18 IF: 2.9
		2.	Mihailova, L., Shalabalija, D., Zimmer, A., Geskovski, N., Makreski, P., Petrushevska, M., Simonoska Crcarevska, M., Glavash Dodov, M. Comparative Studies of the Uptake and Internalization Pathways of Different Lipid Nano-Systems Intended for Brain Delivery Pharmaceutics 15(8), 2082 / 2023 https://doi.org/10.3390/pharmaceutics15082082 IF: 5.4	Comparative Studies of the Uptake and Internalization Pathways of Different Lipid Nano-Systems Intended for Brain Delivery Pharmaceutics 15(8), 2082 / 2023 https://doi.org/10.3390/pharmaceutics15082082 IF: 5.4	Pharmaceutics 15(8), 2082 / 2023 https://doi.org/10.3390/pharmaceutics15082082 IF: 5.4

		3.	Filip Gorachinov, Petre Makreski, Dushko Shalabalija, Ljubica Mihailova, Maja Simonoska Crcarevska, Marija Glavash Dodov, Katerina Gorachinova, Gligor Jovanovski, Nikola Geskovski Micro-raman spectroscopy for detection of label- free and oil red O labeled PEGylated nanoliposomes in hCmec/d3 cell internalization studies Croatia Acta Chemica, 2023 (IF 0,659)	Micro-raman spectroscopy for detection of label-free and oil red O labeled PEGylated nanoliposomes in hCmec/d3 cell internalization studies Croatia Acta Chemica, 2023 (IF 0,659)	Croatia Acta Chemica, 2023 (IF 0,659)

		4. Mihailova, L., Tchekalarova, J., Shalabalija, D., Geskovski, N., Gjorgievska, V.S., Stefkov, G., Krasteva, P., Simonoska Crcarevska, M. and Glavash Dodov, M. Lipid nano-carriers loaded with Cannabis sativa extract for epilepsy treatment–in vitro characterization and in vivo efficacy studies Journal of Pharmaceutical Sciences 111 (12), 3384-3396 / 2022. https://doi.org/10.1016/j.xphs.2022.09.012 IF: 4.063	Lipid nano-carriers loaded with Cannabis sativa extract for epilepsy treatment–in vitro characterization and in vivo efficacy studies Journal of Pharmaceutical Sciences 111 (12), 3384-3396 / 2022. https://doi.org/10.1016/j.xphs.2022.09.012 IF: 4.063	Journal of Pharmaceutical Sciences 111 (12), 3384-3396 / 2022. https://doi.org/10.1016/j.xphs.2022.09.012 IF: 4.063

		5.	Shalabalija, D., Mihailova, Lj., Simonoska Crcarevska, M., Cvetkovikj Karanfilova, I., Ivanovski, V., Kapedanovska Nestorovska, A., Novotni, G., Glavash Dodov, M. Formulation and optimization of bioinspired rosemary extract loaded PEGylated nanoliposomes for potential treatment of Alzheimer's disease using design of experiments Journal of Drug Delivery Science and Technology Volume 63, 102434 / 2021. https://doi.org/10.1016/j.jddst.2021.102434 IF: 5.062	Formulation and optimization of bioinspired rosemary extract loaded PEGylated nanoliposomes for potential treatment of Alzheimer's disease using design of experiments Journal of Drug Delivery Science and Technology Volume 63, 102434 / 2021. https://doi.org/10.1016/j.jddst.2021.102434 IF: 5.062	Journal of Drug Delivery Science and Technology Volume 63, 102434 / 2021. https://doi.org/10.1016/j.jddst.2021.102434 IF: 5.062
10	Participation in National and International Research Projects (up to five)				
.2.	No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project	
	1.	Project Leader	Development of 3D Cell Bioreactor Systems and Application of Fluorescence Microscopy in Various Areas of Pharmaceutical Interest	Faculty of Pharmacy / 2025–2027	

		2.	Participant	Wearable Smart Patches for Multimodal Wound Healing	NATO / 2023–2026
		3.	Principal Investigator	Proteomic Profiling of the Protein Corona Formed on the Surface of Nanoparticles After Their Incubation in hCMEC/D3 Cell Medium	Joint Research Centre of the European Commission / 2022–202
		4.	Participant	Implementation of Innovation Models in the Process of New Product Development for Wound Healing in the Health Sector	Ministry of Education and Science of the Republic of N. Macedonia and OeAD – Austria’s Agency for Education and Internationalisation, Austria / 2022–2023
		5.	Participant	VetaLipoFer – Dietary Supplement for Prophylactic Treatment of Anemia in Animals	Fund for Innovation and Technology Development, Republic of N. Macedonia / 2022–2024
	10	Printed Books in the Last Five Years (up to five)			
	.3.	No.	Authors	Title	Publisher / Year
		1.			
	10	Published Professional Papers in the Last Five Years (up to five)			
	.4.	No.	Authors	Title	Publisher / Year
		1.			
		2.			
		3.			
		4.			
		5.			
11.	Mentorships				
	11	Diploma Theses		2	
	.1.	Master’s Theses		/	
	.2.	Doctoral Dissertations		/	
	11				
	.3.				
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				

12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
	No	Authors	Title	Publisher / Year
	1.	Shalabaliija, D., Mihailova, Lj., Geskovski, N., Zimmer, A., Glavash Dodov, M.	Cytotoxics potential of nanoliposomes on hCMEC/D3 and SH-SY5Y cell lines	Macedonian Pharmaceutical Bulletin 69 (Suppl 1), 279-280 / 2023
	2.	Mihailova, Lj., Shalabaliija, D., Geskovski, N., Geiss, O., Gioria, S., Scaccabarozzi, D., Zimmer, A., Glavash Dodov, M.	DLS and AF4-MALS/DLS as powerful techniques for in vitro evaluation of nanoliposomes stability in biorelevant medium	Macedonian Pharmaceutical Bulletin 69 (Suppl 1), 17-18 / 2023
	3.	Tasevska, T., Livrinska, L., Mihailova, Lj., Shalabaliija, D., Geskovski, N., Glavash Dodov, M., Goracinova, K., Mladenovska, K., Slaveska Raichki, R., Simonoska Crcarevska, M.	Validation of method for rheological characterization of poloxamer 407 hydrogels used for 3D bioprinting	Macedonian Pharmaceutical Bulletin 69 (Suppl 1), 261-262 / 2023
	4.	Livrinska, L., Tasevska, T., Shalabliija, D., Mihailova, L., Glavash Dodov, M., Polenakovikj, R., Velkovski, T., Simonoska Crcarevska, M	Effect of calcium chloride on physical properties of blended alginate carboxymethyl cellulose wound dressings.	Macedonian Pharmaceutical Bulletin 69 (Suppl 1), 297-298. / 2023
	5.	Mihailova, Lj., Shalabaliija, D., Geskovski, N., Simonoska Crcarevska, M. and Glavash Dodov, M	Insight into the efficacy of lipid nanosystems for brain delivery – uptake and internalization pathways in different cell culture lines	Macedonian pharmaceutical bulletin 68 (Suppl. 1), 219-220 / 2022

	6.	Shalabalija, D., Mihailova, Lj., Geskovski, N., Simonoska Crcarevska, M., Glavash Dodov, M.	Lipid nano-carriers with herbal extracts for targeted brain delivery and treatment of CNS disorders	Macedonian pharmaceutical bulletin 68 (Suppl. 1) / 2022
12	Evidence of at least two published scientific-research papers in international peer-reviewed journals with an impact factor in the given field within the last five years.”			
.2.	1.	Milenkovska, R., Geskovski, N., Shalabalija, D., Mihailova, Lj., Mekreski, P., Lukarski, D., Stojkovski, I., Simonoska Crcarevska, M., Mladenovska, K	Radiosensitizing properties of dual- functionalized carbonnanostructur es loaded with temozolomide	Beilstein J. Nanotechnol. 16, 229–251 / 2024. https://doi.org/10.3762/bjnano.16.18 IF: 2.9
	2.	Mihailova, L., Shalabalija, D., Zimmer, A., Geskovski, N., Makreski, P., Petrushevska, M., Simonoska Crcarevska, M., Glavash Dodov, M.	Comparative Studies of the Uptake and Internalization Pathways of Different Lipid Nano-Systems Intended for Brain Delivery	Pharmaceutics 15(8), 2082 / 2023 https://doi.org/10.3390/pharmaceutics15082082 IF: 5.4
	3.	Filip Gorachinov, Petre Makreski, Dushko Shalabalija, Ljubica Mihailova, Maja Simonoska Crcarevska, Marija Glavash Dodov, Katerina Gorachinova, Gligor Jovanovski, Nikola Geskovski	Micro-raman spectroscopy for detection of label- free and oil red O labeled PEGylated nanoliposomes in hCmec/d3 cell internalization studies	Croatia Acta Chemica, 2023 (IF 0,659)

		4.	Mihailova, L., Tchekalarova, J., Shalabaliija, D., Geskovski, N., Gjorgievska, V.S., Stefkov, G., Krasteva, P., Simonoska Crcarevska, M. and Glavash Dodov, M.	Lipid nano-carriers loaded with Cannabis sativa extract for epilepsy treatment–in vitro characterization and in vivo efficacy studies	Journal of Pharmaceutical Sciences 111 (12), 3384-3396 / 2022. https://doi.org/10.1016/j.xphs.2022.09.012 IF: 4.063
		5.	Markova, E., Taneska, L., Kostovska, M., Shalabaliija, D., Mihailova, Lj., Glavash Dodov, M., Makreski, P., Geskovski, N., Petrushevska, M., Taravari, N.A., Simonoska Crcarevska, M.	Design and evaluation of nanostructured lipid carriers loaded with Salvia officinalis extract for Alzheimer’s disease treatment	Journal of Biomedical Materials Research Part B Applied Biomaterials/ 2022 https://doi.org/10.1002/jbm.b.35006 IF: 3.405
		6.	Shalabaliija, D., Mihailova, Lj., Simonoska Crcarevska, M., Cvetkovikj Karanfilova, I., Ivanovski, V., Kapedanovska Nestorovska, A., Novotni, G., Glavash Dodov, M.	Formulation and optimization of bioinspired rosemary extract loaded PEGylated nanoliposomes for potential treatment of Alzheimer’s disease using design of experiments	Journal of Drug Delivery Science and Technology Volume 63, 102434 / 2021. https://doi.org/10.1016/j.jddst.2021.102434 IF: 5.062
12	Evidence of at Least Three Participations in International Conferences in the Last Five				
.3.	Years				
	No	Authors	Title	International Conferences	Year
	1.	Shalabaliija, D., Draskovic, N., Livrinska, L., Geskovski, N., Glavash Dodov, M., Mihailova, Lj.	Sustained Clyndamicin delivery using microsponges: a promising strategy for orodental infections	15th Central European Symposium on Pharmaceutical Technology	2025

	2.	Shalabaliya, D., Mihailova, Lj., Kostov, H., Glavash Dodov, M.	Will the artificial intelligence become an integral part in the practice of healthcare professionals in N. Macedonia	Pharmacy Practice and Interprofessional Collaboration – How fast can we grow?	2024
	3.	Shalabaliya, D., Mihailova, Lj., Geskovski, N., Zimmer, A., Glavash Dodov, M.	Cytotoxic potential of nanoliposomes on hCMEC/D3 and SH-SY5Y cell lines	14th Central European Symposium on Pharmaceutical Technology	2023
	4.	Shalabaliya, D., Mihailova, Lj., Geskovski, N., Simonoska Crcarevska, M., Glavash Dodov, M.	Lipid nano-carriers with herbal extracts for targeted brain delivery and treatment of CNS disorders	7th Congress of Pharmacy in Macedonia with International participation	2022
	5.	Mihailova, Lj., Shalabaliya, D., Zimmer, A., Geskovski, N., Stefkov, G., Simonoska Crcarevska, M., Glavash Dodov, M.	Cytotoxicity and cellular uptake of Cannabis sativa extract loaded nanostructured lipid carriers on hCMEC/D3 cells	12th World Meeting on Pharmaceutics, Biopharmaceutics and Pharmaceutical Technology, Virtual meeting	2021

No. 21	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Tatjana Kadifkova Panovska		
2.	Date of Birth	12.05.1965		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		University Degree	1988	UKIM, Faculty of Pharmacy - Skopje
		Master's degree	1996	UKIM, Faculty of Pharmacy - Skopje
		PhD	2004	UKIM, Faculty of Pharmacy - Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical sciences and health	Pharmacy	Toxicology
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical sciences and health	Pharmacy	Toxicology
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	UKIM, Faculty of Pharmacy - Skopje	Full Professor	Toxicology, General Biochemistry, Clinical Biochemistry
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Fundamentals of biochemistry	Laboratory Bioengineering / UKIM, Faculty of Pharmacy - Skopje	
	2.	Clinical biochemical analyses	Laboratory Bioengineering / UKIM, Faculty of Pharmacy - Skopje	
	3.	Toxicology	Master of Pharmacy / UKIM, Faculty of Pharmacy - Skopje	
	4.	Biochemistry	Master of Pharmacy / UKIM, Faculty of Pharmacy - Skopje	
	5.	Clinical Biochemistry	Master of Pharmacy / UKIM, Faculty of Pharmacy - Skopje	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	Environmental Analyses and Monitoring	Master's studies in laboratory analysis and pharmaceutical engineering UKIM, Faculty of Pharmacy - Skopje	
	2.	Workplace Analyses and Monitoring	Master's studies in laboratory analysis and pharmaceutical engineering UKIM, Faculty of Pharmacy - Skopje	

		3	Sampling Protocols and Standards for Analytical Testing	Master's studies in laboratory analysis and pharmaceutical engineering UKIM, Faculty of Pharmacy - Skopje
	9.	List of courses taught by the instructor in the third cycle of studies		
	3.	No.	Course Title	Study Program / Institution
		1.	Principles, Methods, and Diagnostics in Clinical Biochemistry	PhD studies in Pharmaceutical Sciences UKIM, Faculty of Pharmacy - Skopje
		2.	Biochemical Toxicology	PhD studies in Pharmaceutical Sciences UKIM, Faculty of Pharmacy - Skopje
		3.	Pharmaceutical Toxicology	PhD studies in Pharmaceutical Sciences UKIM, Faculty of Pharmacy - Skopje
10.	Selected Results in the Last Five Years			
	10	Relevant Published Scientific Papers (up to five)		
	.1.	No.	Authors	Title Publisher / Year
		1.	Spasovska, M., Kadifkova Panovska, T.	Correlation between adiponectin level and obesity as a risk factor for allergy disease Ukr Biochem J, 2022, 94(3), 39-46
		2.	Zhivikj, Z., Petreska Ivanovska, T., Petrushevska-Tozi, L., Kadifkova Panovska, T.	Toxicity of food supplements as an adjuvant for COVID-19 treatment or prevention Brawijaya University/ 2022, Journal of Tropical Life Science 12(1):37-51
		3.	Zhivikj, Z., Petreska Ivanovska, T., Karapandzova, M., Kulevanova, S., Kadifkova Panovska, T., Petrushevska-Tozi, L.	Safety issues of herbal weight loss dietary supplements: Hepatotoxicity and adulteration Pharmaceutical Association of Serbia/2024, Archives of Pharmacy 74:316-334
	10	Participation in National and International Research Projects (up to five)		
	.2.	No.	Role (Principal Investigator or Participant)	Title Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	“Innovative Biomimetic Carrier System for Natural Products in the Treatment of Chronic Wounds” Faculty of Pharmacy, Skopje, 2021-2024

		2.	Participant	“Determination of Pesticide Residues in Cereal-Based Food Products”	Faculty of Pharmacy in collaboration with Pharmahem, Skopje, 2020–2022
		3.	Participant	“Evaluation of Toxic Effects and Drug Interactions of Weight-Loss Dietary Supplements”	Ss. Cyril and Methodius University, Skopje, 2021
	10	Printed Books in the Last Five Years (up to five)			
	.3.	No.	Authors	Title	Publisher / Year
	10	Published Professional Papers in the Last Five Years (up to five)			
	.4.	No.	Authors	Title	Publisher / Year
		1.	Zhivikj, Z., Shutevska, K., Bajatovska, AM., Sofronievska, S., Karapandzova, M., Cvetkovikj Karanfilova, I., Davkova, I., Petrushevska-Tozi, L., Stefkov, Gj., Kadifkova Panovska, T.	Cytotoxic screening of selected <i>Cannabis</i> cultivars using brineshrimp lethality assay	Macedonian Pharmaceutical Bulletin, 68(1), 2022
		2.	Zhivikj, Z., Petrushevska-Tozi, L., Geskovski, N., Shutevska, K., Kadifkova Panovska, T., Hiljadnikova Bajro, M., Petreska Ivanovska, T.	Toxicity assessment of weight loss supplements and possible interaction risk with lipid-lowering and antihypertensive drugs in HepG2 cell line	Macedonian Pharmaceutical Bulletin, 68(1), 2022
		3.	Shutevska, K., Zhivikj, Z., Sofronievska, S., Bajatovska, AM., Karapandzova, M., Trajkovska, N., Petreska Ivanovska, T., Kadifkova Panovska, T.	Evaluation of <i>Tanacetum vulgare</i> L. and <i>Juniperus communis</i> L. biocompatibility limitations in eukaryotic cells	Macedonian Pharmaceutical Bulletin, 68(1), 2022

		4.	Bujaroska, M., Bozhinoska, Z., Bitoljanu, N., Petreska Ivanovska, T., Stankov, A., Poposka, V., Kadifkova Panovska, T.	Pattern of benzodiazepine use among death cases in Republic of North Macedonia	Macedonian Pharmaceutical Association/ 2021, Macedonian Pharmaceutical Bulletin 67(2):in press
11.	Mentorships				
	11 .1.	Diploma Theses	300		
	11 .2.	Master's Theses	8		
	11 .3.	Doctoral Dissertations	3 (3 ongoing)		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	Zhivikj, Z., Petreska Ivanovska, T., Petrushevska-Tozi, L., Kadifkova Panovska, T.	Toxicity of food supplements as an adjuvant for COVID-19 treatment or prevention	Brawijaya University/ 2022, Journal of Tropical Life Science 12(1):37-51
		2.	Shutevska, K., Zhivikj, Z., Dimkovski, A., Geshkovski, N., Petreska Ivanovska, T., Kadifkova Panovska, T., Kapedanovska Nestorovska, A.	The importance of AKR1D1 enzyme in drug metabolism	Mac Pharm Bull, 2022, 68 (Suppl 1), 323-324
		3.	Shutevska, K., Zhivikj, Z., Sofronievska, S., Bajatovska, AM., Karapandzova, M., Cvetkovikj Karanfilova, I., Trajkovska, N., Petreska Ivanovska, T., Kadifkova Panovska, T.	Evaluation of Tanacetum vulgare L. and Juniperus communis L. biocompatibility limitations in eukaryotic cells	Mac Pharm Bull, 2022, 68 (Suppl 1), 349-350.

	4.	Zhivikj, Z., Petrushevska-Tozi, L., Geskovski, N., Shutevska, K., Kadifkova Panovska, T., Karapandzova, M., Hiljadnikova Bajro M., Petreska Ivanovska, T.	Toxicity assessment of weight loss supplements and possible interaction risk with lipid- lowering and antihypertensive drugs in HepG2 cell line	Mac Pharm Bull, 2022, 68 (Suppl 1), 321-322
	5.	Djokoski, F., Kadifkova Panovska, T., Hiljadnikova-Bajro, M.	Proteomic markers in breast cancer diagnosis and treatment	Mac pharm bull, 2022, 68 (Suppl 1), 355-356
	6.	Spasovska, M., Kadifkova Panovska, T.	Correlation between adiponectin level and obesity as a risk factor for allergy disease	Ukr Biochem J, 2022, 94(3), 39- 46
12	Evidence of at least two printed/published research articles in international impact-			
.2.	factor scientific journals in the specified field, within the past five years			
	No	Authors	Title	Publisher / Year
	1.	Darinka Gjorgieva Ackova, Tatjana Kadifkova Panovska	Silver nanoparticles: Toxicity and inhibitory effects against Aflatoxins	Plant Sci. Today, Vol. 12 No. 1 (2025), DOI: https://doi.org/10.14719/pst.4422 5 year Impact Factor: 0.9 NAAS score (2025): 6.7
	2.	Zhivikj, Z., Petreska Ivanovska, T., Petrushevska-Tozi, L., Kadifkova Panovska, T.	Toxicity of food supplements as an adjuvant for COVID-19 treatment or prevention	Brawijaya University/2022, Journal of Tropical Life Science 12(1):37-51 (IF 0.61)
12	Evidence of at Least Three Participations in International Conferences in the Last Five			
.3.	Years			
	No	Authors	Title	Publisher / Year
				Authors

		1.	Zhivikj, Z., Bajatovska, AM., Karapandzova , M., Shutevska, K., Kadifkova Panovska, T., Karapandzova , M., Petrushevska- Tozi, L., Petreska Ivanovska, T.	Nopal-based dietary supplement against rifampicin- induced hepatotoxicity	7 th International Congress of the Croatian Society of Toxicology, Rab, Croatia, 5-8 th October	2025
		2.	Zhivikj, Z., Petreska Ivanovska, T., Bajatovska, AM., Shutevska, K., Zhivikj, D., Karapandzova , M., Kadifkova Panovska, T., Karapandzova , M., Petrushevska- Tozi, L.	Effect of weight loss dietary supplements on intracellular glutathione levels in HepG2 cells	7 th International Congress of the Croatian Society of Toxicology, Rab, Croatia, 5-8 th October 2025	2025
		3.	Zhivikj, Z., Petrushevska- Tozi, L., Geskovski, N., Shutevska, K., Bajatovska AM., Karapandzova, M., Kadifkova Panovska, T., Petreska Ivanovska, T.	Evaluation of weight loss supplements toxicity in rifampicin pretreated HepG2 cells	14 th Central European Symposium on Pharmaceutical Technology (Ohrid, Macedonia 28-30 September)	2023

		4.	Jovanova Blagica, Kulevanova Svetlana and Kadifkova Panovska Tatjana	ROS Scavenging and Reducing Capacity of Aromatic Herbs	Book of Abstracts – 5 th MESMAP, Cappadocia, Turkey; 146	2019

No. 22	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Marija Hiljadnikova-Bajro		
2.	Date of Birth	12.08.1974		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Full Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Master of Pharmacy	1998	University SS Cyril and Methodius in Skopje, Faculty of Pharmacy
		Master of Sciences	2003	University SS Cyril and Methodius in Skopje, Interdisciplinary postgraduate studies in Molecular Biology and Genetic Engineering
		PhD	2012	University SS Cyril and Methodius in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical sciences and health	Molecular biology and genetic engineering	Molecular pharmacy
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical sciences and health	Pharmacy	Applied Biochemistry

8.	If employed, the institution where the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Institution	Academic Title	Scientific Field
		University SS Cyril and Methodius in Skopje, Faculty of Pharmacy	Full professor	Applied Biochemistry
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Biochemistry	Master of Pharmacy / University SS Cyril and Methodius in Skopje, Faculty of Pharmacy	
	2.	Clinical Biochemical analyses	Laboratory Bioengineering / University SS Cyril and Methodius in Skopje, Faculty of Pharmacy	
	3.	Fundamentals of Biochemistry	Laboratory Bioengineering / University SS Cyril and Methodius in Skopje, Faculty of Pharmacy	
	4.	Clinical Biochemistry	Master of Pharmacy / University SS Cyril and Methodius in Skopje, Faculty of Pharmacy	
	5.	General and food biochemistry	Dietetics and Diet Therapy/ University SS Cyril and Methodius in Skopje, Faculty of Pharmacy	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	

		1.	Nutritional biochemistry and metabolism	Master's studies in laboratory analysis and pharmaceutical engineering University SS Cyril and Methodius in Skopje, Faculty of Pharmacy	
		2.	Genetic aspects of food metabolism	Master’s Studies in Dietetics and Diet Therapy University SS Cyril and Methodius in Skopje, Faculty of Pharmacy	
	9.	List of courses taught by the instructor in the third cycle of studies			
	3.	No.	Course Title	Study Program / Institution	
		1.	Research ethics with examples and applications in pharmaceutical sciences	PhD studies in Pharmaceutical Sciences University SS Cyril and Methodius in Skopje, Faculty of Pharmacy	
2.		Principles, methods and diagnostics in Clinical Biochemistry	PhD studies in Pharmaceutical Sciences University SS Cyril and Methodius in Skopje, Faculty of Pharmacy		
		3.	Principles and applications of proteomics and metabolomics	PhD studies in Pharmaceutical Sciences University SS Cyril and Methodius in Skopje, Faculty of Pharmacy	
10.	Selected Results in the Last Five Years				
	10	Relevant Published Scientific Papers (up to five)			
	.1.	No.	Authors	Title	Publisher / Year
		1.	Marija Hiljadnikova-Bajro, Filip Djokoski	The Emerging Power of miRNAs in Management of Acute Coronary Syndrome	Balkan Journal of Clinical Laboratory, 2023, Vol. XXX (1): 132-133
		2.	Duvlis S, Dabeski D, Hiljadnikova-Bajro M, Osmani D, Memeti S.	HPV E6/E7mRNA association with interleukin 10 (rs1800872) polymorphism in a group of Macedonian women	J Med Virol. 2022 Sep;94(9):4485-4489. doi: 10.1002/jmv.27858. Epub 2022 May 31.
		3.	Marija Hiljadnikova-Bajro, Angela Simovska	The potential of salivary proteome in laboratory analysis of Sjogren’s syndrome	J Med Biochem 2022; 41 (3): 408-409
	10	Participation in National and International Research Projects (up to five)			
.2.	No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project	

		1.	Participant	EUropean network to tackle METAbolic alterations in HEART failure (EU-METAHEART)	European Comission COST Action CA22169 2024-2027
		3.	Participant	Evaluation of Toxic Effects and Drug Interactions of Weight-Loss Dietary Supplements	Ss. Cyril and Methodius University, Skopje, 2021
	10	Printed Books in the Last Five Years (up to five)			
	.3.	No.	Authors	Title	Publisher / Year
		1.	Marija Hiljadnikova-Bajro	Questions in Biochemistry: learning aid for the subjects Biochemistry, Fundamentals of Biochemistry, General Biochemistry and Food Biochemistry	Faculty of Pharmacy, University SS Cyril and Methodius, Skopje, 2022
	10	Published Professional Papers in the Last Five Years (up to five)			
	.4.	No.	Authors	Title	Publisher / Year
11.	Mentorships				
	11	Diploma Theses		15	
	.1.				
	11	Master's Theses		/	
	.2.				
	11	Doctoral Dissertations		/	
	.3.				
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
	.1.	No	Authors	Title	Publisher / Year
		1.	Filip Djokoski, Marija Hiljadnikova-Bajro	The Impact of the Human Microbiome on Cancer Immunotherapy	Macedonian pharmaceutical bulletin, 2023, 69 (S1) 271 - 272
		2.	Gegovska M., Hiljadnikova-Bajro M.	Novel laboratory biomarkers in colorectal cancer management.	Macedonian pharmaceutical bulletin, 2022, 68 (S1) 333 - 334
		3.	Filip Djokoski, Marija Hiliadnikova-Bajro	Novel insights in pharmacomicrobio mics	Macedonian pharmaceutical bulletin, 2022, 68 (S1), 353-354

		4.	Elena Pacheshkoska, Marija Hiljadnikova-Bajro	Potential of liquid biopsy in diagnosis and monitoring of malignant invasion	Macedonian Pharmaceutical Bulletin, 2022, 68(S1): 387-388
		5.	Filip Djokoski, Tatjana Kadifkova Panovska, Marija Hiljadnikova-Bajro	Proteomic markers in breast cancer diagnosis and treatment	Macedonian pharmaceutical bulletin, 2022, 68 (S1): 355 – 356
		6.	Teodora Jovanova, Ivana Vichentijevikj, Debora Petrevska, Elena Ilievska, Marija Hiljadnikova-Bajro	Current and future perspectives in laboratory analysis of pituitary neuroendocrine tumors	Macedonian pharmaceutical bulletin 68 (S1), 595 – 596;
	12 .2.	Evidence of at least two printed/published research articles in international impact-factor scientific journals in the specified field, within the past five years			
		No	Author	Title	Publisher / Year
		1.	Duvlis S, Dabeski D, Hiljadnikova-Bajro M, Osmani D, Memeti S.	HPV E6/E7mRNA association with interleukin 10 (rs1800872) polymorphism in a group of Macedonian women	J Med Virol. 2022 Sep;94(9):4485-4489.
		2.	Marija Hiljadnikova-Bajro, Angela Simovska	The potential of salivary proteome in laboratory analysis of Sjogren's syndrome	J Med Biochem 2022; 41 (3): 408-409
	12 .3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
		No	Authors	Title	International Conference
					Year

		1.	Marija Hiljadnikova-Bajro, Filip Djokoski	The Emerging Power of miRNAs in Management of Acute Coronary Syndrome	30 th Meeting of the Balkan Clinical Laboratory Federation and 2nd Montenegrin Conference of Clinical Chemistry and Laboratory Medicine Herceg Novi, Montenegro 27 – 30 September 2023	2023
		2.	Hiljadnikova-Bajro M. Djokoski, F.	Integrative omics approach in breast cancer management	Laboratory Medicine for Mobile Societies in Our Area, 2nd AFCB-EFLM Conference co-organized with the 20th GSCC-CB annual Congress and XXIX BCLF annual meeting, October 2-5, 2022, Heraklion, Greece	2022
		3.	Anel Lila, Marija Hiljadnikova Bajro.	Biochemical markers for diagnosing and monitoring of acute pancreatitis.	„7 th Congress of Pharmacy in North Macedonia with international participation“, Ohrid, 5-9 th October, 2022.	2022
		4.	Marija Hiljadnikov a-Bajro	Ethical issues in (Pharmaco)genetics	XXVII Meeting of the Balkan Clinical Laboratory Federation and XXX National Congress of the Turkish Biochemical Society, October 27-31, 2019, Belek, Antalya, Turkey	2019

No. 23	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Tanja Petreska Ivanovska		
2.	Date of Birth	26.07.1979		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		University Degree	2005	UKIM, Faculty of Pharmacy - Skopje
		Master's degree	2011	UKIM, Faculty of Pharmacy - Skopje
		PhD	2015	UKIM, Faculty of Pharmacy - Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical sciences and health	Pharmacy	Food and nutrition
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical sciences and health	Pharmacy	Food and nutrition
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	UKIM, Faculty of Pharmacy - Skopje	Full Professor	Food and nutrition Pharmaceutical toxicology
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Food and Nutrition	Master of Pharmacy / UKIM, Faculty of Pharmacy - Skopje	
	2.	Toxicology	Master of Pharmacy / UKIM, Faculty of Pharmacy - Skopje	
	3.	Food Product Analysis	Laboratory Bioengineering / UKIM, Faculty of Pharmacy - Skopje	
	4.	Food Chemistry I	Dietetics and Diet Therapy/ UKIM, Faculty of Pharmacy - Skopje	
	5.	Food Products	Dietetics and Diet Therapy/ UKIM, Faculty of Pharmacy - Skopje	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	Advanced Food Product Analysis	Master's studies in laboratory analysis and pharmaceutical engineering UKIM, Faculty of Pharmacy - Skopje	
	2.	Food Science	Master's Studies in Dietetics and Diet Therapy UKIM, Faculty of Pharmacy - Skopje	

		3	Food–Drug Interaction	Master’s Studies in Dietetics and Diet Therapy UKIM, Faculty of Pharmacy - Skopje		
	9.	List of courses taught by the instructor in the third cycle of studies				
	3.	No.	Course Title	Study Program / Institution		
		1.	Functional Foods	PhD studies in Pharmaceutical Sciences UKIM, Faculty of Pharmacy - Skopje		
		2.	Clinical Nutrition	PhD studies in Pharmaceutical Sciences UKIM, Faculty of Pharmacy - Skopje		
		3.	Clinical and Forensic Toxicology	PhD studies in Pharmaceutical Sciences UKIM, Faculty of Pharmacy - Skopje		
10.	Selected Results in the Last Five Years					
	10	Relevant Published Scientific Papers (up to five)				
	.1.	No.	Authors	Title	Publisher / Year	
		1.	Zhivikj, Z., Petreska Ivanovska, T., Karapandzova, M., Kulevanova, S., Kadifkova Panovska, T., Petrushevska-Tozi, L.	Safety issues of herbal weight loss dietary supplements: Hepatotoxicity and adulteration	Pharmaceutical Association of Serbia/2024, Archives of Pharmacy 74:316-334	
		2.	Zhivikj, Z., Petreska Ivanovska , T., Petrushevska-Tozi, L., Kadifkova Panovska, T.	Toxicity of food supplements as an adjuvant for COVID-19 treatment or prevention	Brawijaya University/2022, Journal of Tropical Life Science 12(1):37-51	
		3.	Anastasova, L., Petreska Ivanovska, T., Ancevska, A., Petkovska, R., Petrushevska-Tozi, L.	Application of experimental design approach in optimization of quality parameters of calcium and magnesium enriched milk	Meral Publisher/2022, International Journal of Pharmaceutical and Phytopharmacological Research / 12(1):7-16	
		4.	Zhivikj, Z., Petreska Ivanovska , T., Petrushevska-Tozi, L.	The relevance of nutrition as a step forward to combat COVID-19	Macedonian Pharmaceutical Association/2021, Macedonian Pharmaceutical Bulletin66(2):53-66	
	10	Participation in National and International Research Projects (up to five)				
	.2.	No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project	

		1.	Participant	Design, Development, and Characterization of Combined Solid Dosage Forms Using 3D Printing and Electrospinning, with the Application of Machine Learning Models	Ministry of Education and Science, 2025–2027
		2.	Participant	Development of Methods Using Vibrational Spectroscopic Techniques Coupled with Multivariate Analysis in Various Areas of Pharmaceutical Interest	Faculty of Pharmacy, Skopje, 2021-2024
		3.	Principal Investigator	Evaluation of Toxic Effects and Drug Interactions of Weight-Loss Dietary Supplements	Ss. Cyril and Methodius University, Skopje, 2021
	10	Printed Books in the Last Five Years (up to five)			
	.3.	No.	Authors	Title	Publisher / Year
		1.	Petrushevska-Tozi, L., Zhivikj, Z., Petreska Ivanovska, T.	Basic Diet Therapy	UKIM, Faculty of Pharmacy, Skopje/2023
		2.	Zhivikj, Z., Spiroski, I., Petreska Ivanovska, T., Petrushevska-Tozi, L.	Types of food intolerance, symptom recognition, and distinction from food allergies	Consumer Organization of Macedonia in cooperation with the Food and Veterinary Agency, Skopje / 2023
		3.	Petrushevska-Tozi, L., Petreska Ivanovska, T., Zhivikj, Z., Lonchar Velkova, M.	A Consumer Guide for Safe Online Food Purchasing	Consumer Organization of Macedonia in cooperation with the Food and Veterinary Agency, Skopje / 2022
	10	Published Professional Papers in the Last Five Years (up to five)			
	.4.	No.	Authors	Title	Publisher / Year

		1.	Ali, R., Majstorov, O., Petreska Ivanovska, T., Zhivikj, Z., Petkovska, R., Petrushevska-Tozi, L., Anastasova, L.	Analytical methods for determination of sugar content in fruit juices: from classical methods to modern analytical techniques	Macedonian Pharmaceutical Association/2025, Macedonian Pharmaceutical Bulletin 71(2):3-11
		2.	Skenderoska Adjija, S., Petreska Ivanovska, T., Dimitrovska, M., Zhivikj, Z., Petrushevska-Tozi, L., Chuleva, B.	Impact of oil selection and cooking methods on acrylamide levels in different potato products	Macedonian Pharmaceutical Association/2025, Macedonian Pharmaceutical Bulletin 71(1):31-41
		3.	Mishevski, P., Petreska Ivanovska, T., Zhivikj, Z., Petrushevska-Tozi, L., Najdenkoska, A., Mincheva, M.	LC-MS/MS method for detecting trace levels of aflatoxin B1 in cultivated cannabis from Republic of North Macedonia	Macedonian Pharmaceutical Association/2024, Macedonian Pharmaceutical Bulletin 70(2):33-39
		4.	Bozhinoska, Z., Ivcheva, A., Jakovski, Z., Bujaroska Perkovikj, M., Zhivikj, Z., Petreska Ivanovska, T., Stankov, A.	Sudden death after ethyl alcohol intoxication in chronic alcoholics: two case reports	Macedonian Pharmaceutical Association/2024, Macedonian Pharmaceutical Bulletin 70(2):57-60
		5.	Atanasovikj, S., Kuzmanovska, AM., Petreska Ivanovska, T., Sterjev, Z., Anchevska Netkovska, K.	Nutritional information and labels in relation to food advertising: a survey of Macedonian consumers	Macedonian Pharmaceutical Association/2024, Macedonian Pharmaceutical Bulletin 70(1):25-30
11.	Mentorships				
	11 .1.	Diploma Theses		57	
	11 .2.	Master’s Theses		8 (2 ongoing)	
	11 .3.	Doctoral Dissertations		1 (1 ongoing)	
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year

	1.	Bozhinoska, Z., Zhivikj, Z., Ubavkova, S., Bujaroska Perkovikj, M., Poposka, V., Stankov, A., Petreska Ivanovska, T.	Analyzing food supplements to enhance erectile system function for the presence of undeclared sildenafil and tadalafil using HPLC-DAD	Serbian Chemical Society/2025, Journal of the Serbian Chemical Society, 90(6):781–787
	2.	Zhivikj, Z., Petreska Ivanovska, T., Karapandzova, M., Kulevanova, S., Kadifkova Panovska, T., Petrushevska-Tozi, L.	Safety issues of herbal weight loss dietary supplements: Hepatotoxicity and adulteration	Pharmaceutical Association of Serbia/2024, Archives of Pharmacy 74:316-334
	3.	Shutevska K, Bajatovska AM, Anastasova L, Zhivikj Z, Zafirova Gjorgievska M, Spasikj S, Petreska Ivanovska T, Makreski P, Geskovski N.	Rapid quantification models for assessing melamine adulteration in sport nutrition supplements via benchtop and portable NIRS instruments	Elsevier/2024, Spectrochimica Acta. Part A, Molecular and Biomolecular Spectroscopy, 317:124370
	4.	Dimovska, E., Zhivikj, Z., Gavazova, E., Petreska Ivanovska, T., Petrushevska-Tozi, L.	Analysis of total aflatoxins in commercially available cereal products in the Republic of North Macedonia	Macedonian Pharmaceutical Association/2024, Macedonian Pharmaceutical Bulletin 68(1):3-19
	5.	Bujaroska, M., Bozhinoska, Z., Vujovic, M., Milosavljevic, B., Stankov, A., Petreska Ivanovska T., Poposka, V., Petrushevska-Tozi, L.	Development and validation of a quantitative HS-GC/FID method for alcohol analysis in biological samples: stability assessment	Romanian Legal Medicine Society/ 2022, Romanian Journal of Legal Medicine 30:53-59

	6.	Anastasova, L., Petreska Ivanovska, T., Ancevska, A., Petkovska, R., Petrushevsk-Tozi, L.	Application of experimental design approach in optimization of quality parameters of calcium and magnesium enriched milk	Meral Publisher/2022, International Journal of Pharmaceutical and Phytopharmacological Research 12(1):7-16
12	Evidence of at least two printed/published research articles in international impact-factor scientific journals in the specified field, within the past five years			
.2.	No	Authors	Title	Publisher / Year
	1.	Spasikj, S., Zafirova-Gjorgjievska, M., Shutevska, K., Bajatovska, AM., Zhivikj, Z., Geskovski, N., Anastasova, L., Petreska Ivanovska, T.	A user-friendly RP-HPLC method for determination of melamine adulteration in dietary supplements for sport nutrition	North University of Baia Mare/2025, Carpathian Journal of Food Science and Technology, <i>in press</i> (IF 0.7)
	2.	Bozhinoska, Z., Zhivikj, Z., Ubavkova, S., Bujaroska Perkovikj, M., Poposka, V., Stankov, A., Petreska Ivanovska, T.	Analyzing food supplements to enhance erectile system function for the presence of undeclared sildenafil and tadalafil using HPLC-DAD	Serbian Chemical Society/2025, Journal of the Serbian Chemical Society, 90(6):781–787 (IF 1.1)
	3.	Shutevska K, Bajatovska AM, Anastasova L, Zhivikj Z, Zafirova Gjorgievska M, Spasikj S, Petreska Ivanovska T, Makreski P, Geskovski N.	Rapid quantification models for assessing melamine adulteration in sport nutrition supplements via benchtop and portable NIRS instruments	Elsevier/2024, Spectrochimica Acta. Part A, Molecular and Biomolecular Spectroscopy, 317:124370. doi: 10.1016/j.saa.2024.124370 (IF 4.3)
	4.	Zhivikj, Z., Petreska Ivanovska, T., Petrushevsk-Tozi, L., Kadifkova Panovska, T.	Toxicity of food supplements as an adjuvant for COVID-19 treatment or prevention	Brawijaya University/2022, Journal of Tropical Life Science 12(1):37-51 (IF 0.61)
12	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
.3.				

No	Authors	Title	International Conference	Year
1.	Zhivikj, Z., Bajatovska, AM., Karapandzova, M., Shutevska, K., Kadifkova Panovska, T., Karapandzova, M., Petrushevsk Tozi, L., Petreska Ivanovska, T.	Nopal-based dietary supplement against rifampicin-induced hepatotoxicity	7 th International Congress of the Croatian Society of Toxicology, Rab, Croatia, 5-8 th October	2025
2.	Zhivikj, Z., Petreska Ivanovska, T., Bajatovska, AM., Shutevska, K., Zhivikj, D., Karapandzova, M., Kadifkova Panovska, T., Karapandzova, M., Petrushevsk Tozi, L.	Effect of weight loss dietary supplements on intracellular glutathione levels in HepG2 cells	7 th International Congress of the Croatian Society of Toxicology, Rab, Croatia, 5-8 th October 2025	2025
3.	Zhivikj, Z., Petreska Ivanovska, T., Karapandzova, M., Kadifkova Panovska, T., Petrushevsk a-Tozi, L.	Current safety challenges of food supplements	Pharmacy Practice in Motion and Interprofessional Collaboration – How much faster could we grow?”, Struga, Republic of North Macedonia, 8-10 th November	2024

		4.	Zhivikj, Z., Stefanovski , D., Dimzova, J., Petrushevsk a-Tozi, L., Kadifkova Panovska, T., Karapandzo va, M., Petreska Ivanovska, T.	Rapid GC- MS/MS analysis of multiple pesticide residues in cereal-based products	26th Congress of Chemists and Technologists of Macedonia, Ohrid, Republic of North Macedonia, 20-23 September	2023

No. 24	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Zoran Zhivikj		
2.	Date of Birth	19.05.1990		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Assistant professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		University Degree (Integrated First- and Second-Cycle Studies)	2014	UKIM, Faculty of Pharmacy - Skopje
		PhD	2023	UKIM, Faculty of Pharmacy - Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		/	/	/
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical sciences and health	Pharmacy	Food and nutrition Pharmaceutical toxicology
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	UKIM, Faculty of Pharmacy - Skopje	Assistant professor	Food and nutrition Pharmaceutical toxicology
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Food and Nutrition	Master of Pharmacy / UKIM, Faculty of Pharmacy - Skopje	
	2.	Toxicological and Forensic Analysis	Laboratory Bioengineering / UKIM, Faculty of Pharmacy - Skopje	
	3.	Food Product Analysis	Laboratory Bioengineering / UKIM, Faculty of Pharmacy - Skopje	
	4.	Introduction to Nutrition	Dietetics and Diet Therapy/ UKIM, Faculty of Pharmacy - Skopje	
	5.	Basic Diet Therapy	Dietetics and Diet Therapy/ UKIM, Faculty of Pharmacy - Skopje	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	Advanced Food Product Analysis	Master's studies in laboratory analysis and pharmaceutical engineering UKIM, Faculty of Pharmacy - Skopje	
	2.	Food Science	Master's Studies in Dietetics and Diet Therapy UKIM, Faculty of Pharmacy - Skopje	

		3	Nutrition Care Process	Master's Studies in Dietetics and Diet Therapy UKIM, Faculty of Pharmacy - Skopje
	9.	List of courses taught by the instructor in the third cycle of studies		
	3.	No.	Course Title	Study Program / Institution
		1.	Quality Control and Safety of Food Products	PhD studies in Pharmaceutical Sciences UKIM, Faculty of Pharmacy - Skopje
		2.	Pharmaceutical toxicology	PhD studies in Pharmaceutical Sciences UKIM, Faculty of Pharmacy - Skopje
		3.	Clinical and Forensic Toxicology	PhD studies in Pharmaceutical Sciences UKIM, Faculty of Pharmacy - Skopje
10.	Selected Results in the Last Five Years			
	10	Relevant Published Scientific Papers (up to five)		
	.1.	No.	Authors	Title Publisher / Year
		1.	Zhivikj, Z., Petreska Ivanovska, T., Karapandzova, M., Kulevanova, S., Kadifkova Panovska, T., Petrushevska-Tozi, L.	Safety issues of herbal weight loss dietary supplements: Hepatotoxicity and adulteration Pharmaceutical Association of Serbia/2024, Archives of Pharmacy 74:316-334
		2.	Zhivikj, Z., Petreska Ivanovska , T., Petrushevska-Tozi, L., Kadifkova Panovska, T.	Toxicity of food supplements as an adjuvant for COVID-19 treatment or prevention Brawijaya University/2022, Journal of Tropical Life Science 12(1):37-51
		3.	Bujaroska Perkovic, M., Anastasova, L., Stankov, A., Zhivikj, Z., Poposka, V., Petrushevska-Tozi, L.	The role of alcohol and patterns of alcohol-related deaths in Republic of North Macedonia within the period 2007–2020 Springer/2023, Forensic Science Medicine and Pathology 20(3):933-940
		4.	Zhivikj, Z., Petreska Ivanovska , T., Petrushevska-Tozi, L.	The relevance of nutrition as a step forward to combat COVID-19 Macedonian Pharmaceutical Association/2021, Macedonian Pharmaceutical Bulletin 66(2):53-66
	10	Participation in National and International Research Projects (up to five)		
	.2.	No.	Role (Principal Investigator or Participant)	Title Duration Institution Organizing, Funding, or Implementing the Project

		1.	Participant	Design, Development, and Characterization of Combined Solid Dosage Forms Using 3D Printing and Electrospinning, with the Application of Machine Learning Models	Ministry of Education and Science, 2025–2027
		2.	Participant	Development of Methods Using Vibrational Spectroscopic Techniques Coupled with Multivariate Analysis in Various Areas of Pharmaceutical Interest	Faculty of Pharmacy, Skopje, 2021-2024
		3.	Participant	Evaluation of Toxic Effects and Drug Interactions of Weight-Loss Dietary Supplements	Ss. Cyril and Methodius University, Skopje, 2021
	10	Printed Books in the Last Five Years (up to five)			
	.3.	No.	Authors	Title	Publisher / Year
		1.	Zhivikj, Z., Spiroski, I., Petreska Ivanovska, T., Petrushevska-Tozi, L.	Trans Fatty Acids	UKIM, Faculty of Pharmacy, Skopje/2023
		2.	Petrushevska-Tozi, L., Zhivikj, Z., Petreska Ivanovska, T.	Basic Diet Therapy	UKIM, Faculty of Pharmacy, Skopje/2023
		3.	Zhivikj, Z., Spiroski, I., Petreska Ivanovska, T., Petrushevska-Tozi, L.	Types of food intolerance, symptom recognition, and distinction from food allergies	Consumer Organization of Macedonia in cooperation with the Food and Veterinary Agency, Skopje / 2023
		4.	Petrushevska-Tozi, L., Petreska Ivanovska, T., Zhivikj, Z., Lonchar Velkova, M.	A Consumer Guide for Safe Online Food Purchasing	Consumer Organization of Macedonia in cooperation with the Food and Veterinary Agency, Skopje / 2022

		5.	Ristovska, G., Zhivikj, Z., Petreska Ivanovska, T., Petrushevska-Tozi, L.	Guidelines for Food Service Operators in School Settings	Consumer Organization of Macedonia in cooperation with the Food and Veterinary Agency, Skopje / 2020
10	Published Professional Papers in the Last Five Years (up to five)				
.4.	No.	Authors	Title	Publisher / Year	
	1.	Ali, R., Majstorov, O., Petreska Ivanovska, T., Zhivikj, Z., Petkovska, R., Petrushevska-Tozi, L., Anastasova, L.	Analytical methods for determination of sugar content in fruit juices: from classical methods to modern analytical techniques	Macedonian Pharmaceutical Association/2025, Macedonian Pharmaceutical Bulletin 71(2):3-11	
	2.	Skenderoska Adjija, S., Petreska Ivanovska, T., Dimitrovska, M., Zhivikj, Z., Petrushevska-Tozi, L., Chuleva, B.	Impact of oil selection and cooking methods on acrylamide levels in different potato products	Macedonian Pharmaceutical Association/2025, Macedonian Pharmaceutical Bulletin 71(1):31-41	
	3.	Mishevski, P., Petreska Ivanovska, T., Zhivikj, Z., Petrushevska-Tozi, L., Najdenkoska, A., Mincheva, M.	LC-MS/MS method for detecting trace levels of aflatoxin B1 in cultivated cannabis from Republic of North Macedonia	Macedonian Pharmaceutical Association/2024, Macedonian Pharmaceutical Bulletin 70(2):33-39	
	4.	Bozhinoska, Z., Ivcheva, A., Jakovski, Z., Bujaroska Perkovikj, M., Zhivikj, Z., Petreska Ivanovska, T., Stankov, A.	Sudden death after ethyl alcohol intoxication in chronic alcoholics: two case reports	Macedonian Pharmaceutical Association/2024, Macedonian Pharmaceutical Bulletin 70(2):57-60	
	5.	Davkova, I., Zhivikj, Z., Cvetkovikj Karanfilova, I., Trajkovska, A., Stoilkovska Gjorgievska, V., Stefkov, G., Kadifkova Panovska, T., Karapandzova, M.	Determination of chemical composition and cytotoxic activity of selected essential oils from Macedonian origin	WJPSR, 2024, World Journal of Pharmaceutical Science and Research 3(2):257-266	
11.	Mentorships				

	11 .1.	Diploma Theses	15		
	11 .2.	Master’s Theses	1 (3 ongoing)		
	11 .3.	Doctoral Dissertations	/		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years				
	No	Authors	Title	Publisher / Year	
	1.	Bozhinoska, Z., Zhivikj, Z., Ubavkova, S., Bujaroska Perkovicj, M., Poposka, V., Stankov, A., Petreska Ivanovska, T.	Analyzing food supplements to enhance erectile system function for the presence of undeclared sildenafil and tadalafil using HPLC-DAD	Serbian Chemical Society/2025, Journal of the Serbian Chemical Society, 90(6):781–787	
	2.	Zhivikj, Z., Petreska Ivanovska, T., Karapandzova, M., Kulevanova, S., Kadifkova Panovska, T., Petrushevska-Tozi, L.	Safety issues of herbal weight loss dietary supplements: Hepatotoxicity and adulteration	Pharmaceutical Association of Serbia/2024, Archives of Pharmacy 74:316-334	
	3.	Davkova, I., Zhivikj, Z., Kukic, J., Cvetkovikj Karanfilova, I., Stefkov, G., Kulevanova, S., Karapandzova, M.,	Natural products in the management of obesity	Pharmaceutical Association of Serbia/2024, Archives of Pharmacy 74:298-315	
	4.	Shutevska K, Bajatovska AM, Anastasova L, Zhivikj Z, Zafirova Gjorgievska M, Spasikj S, Petreska Ivanovska T, Makreski P, Geskovski N.	Rapid quantification models for assessing melamine adulteration in sport nutrition supplements via benchtop and portable NIRS instruments	Elsevier/2024, Spectrochimica Acta. Part A, Molecular and Biomolecular Spectroscopy, 317:124370	

		5.	Dimovska, E., Zhivikj, Z., Gavazova, E., Petreska Ivanovska, T., Petrushevska-Tozi, L.	Analysis of total aflatoxins in commercially available cereal products in the Republic of North Macedonia	Macedonian Pharmaceutical Association/2024, Macedonian Pharmaceutical Bulletin 68(1):3-19
12	Evidence of at least two printed/published research articles in international impact-factor scientific journals in the specified field, within the past five years				
.2.	No	Author	Title	Publisher / Year	
	1.	Spasikj, S., Zafirova-Gjorgjievska, M., Sutevska, K., Bajatovska, AM., Zhivikj, Z., Geskovski, N., Anastasova, L., Petreska Ivanovska, T.	A user-friendly RP-HPLC method for determination of melamine adulteration in dietary supplements for sport nutrition	North University of Baia Mare/2025, Carpathian Journal of Food Science and Technology, <i>in press</i> (IF 0.7)	
	2.	Bozhinoska, Z., Zhivikj, Z., Ubavkova, S., Bujaroska Perkovic, M., Poposka, V., Stankov, A., Petreska Ivanovska, T.	Analyzing food supplements to enhance erectile system function for the presence of undeclared sildenafil and tadalafil using HPLC-DAD	Serbian Chemical Society/2025, Journal of the Serbian Chemical Society, 90(6):781–787 (IF 1.1)	
	3.	Shutevska, K., Bajatovska, AM., Anastasova, L., Zhivikj, Z., Zafirova Gjorgjievska, M., Spasikj, S., Petreska Ivanovska, T., Makreski P, Geskovski, N.	Rapid quantification models for assessing melamine adulteration in sport nutrition supplements via benchtop and portable NIRS instruments	Elsevier/2024, Spectrochimica Acta. Part A, Molecular and Biomolecular Spectroscopy, 317:124370. doi: 10.1016/j.saa.2024.124370 (IF 4.3)	
	4.	Bujaroska Perkovic, M., Anastasova, L., Stankov, A., Zhivikj, Z., Poposka, V., Petrushevska-Tozi, L.	The role of alcohol and patterns of alcohol-related deaths in Republic of North Macedonia within the period 2007–2020	Springer/2023, Forensic Science Medicine and Pathology 20(3):933-940 (IF 1.7)	

	5.	Zhivikj, Z., Petreska Ivanovska, T., Petrushevska-Tozi, L., Kadifkova Panovska, T.	Toxicity of food supplements as an adjuvant for COVID-19 treatment or prevention	Brawijaya University/2022, Journal of Tropical Life Science 12(1):37-51 (IF 0.61)	
12 .3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
	No	Authors	Title	International Conference	Year
	1.	Zhivikj, Z., Bajatovska, AM., Karapandzova , M., Shutevska, K., Kadifkova Panovska, T., Karapandzova , M., Petrushevska-Tozi, L., Petreska Ivanovska, T.	Nopal-based dietary supplement against rifampicin-induced hepatotoxicity	7 th International Congress of the Croatian Society of Toxicology, Rab, Croatia, 5-8 th October	2025
	2.	Zhivikj, Z., Petreska Ivanovska, T., Bajatovska, AM., Shutevska, K., Zhivikj, D., Karapandzova , M., Kadifkova Panovska, T., Karapandzova , M., Petrushevska-Tozi, L.	Effect of weight loss dietary supplements on intracellular glutathione levels in HepG2 cells	7 th International Congress of the Croatian Society of Toxicology, Rab, Croatia, 5-8 th October 2025	2025
	3.	Zhivikj, Z., Petreska Ivanovska, T., Karapandzova , M., Kadifkova Panovska, T., Petrushevska-Tozi, L.	The current challenges of food supplements	6 th Congress with international participation of doctors of general practice/family medicine, Skopje, Republic of North Macedonia, 15-18 th May 2025	2025

		4.	Zhivikj, Z., Petreska Ivanovska, T., Karapandzo va, M., Kadifkova Panovska, T., Petrushevsk a-Tozi, L.	Current safety challenges of food supplements	Pharmacy Practice in Motion and Interprofessional Collaboration – How much faster could we grow?”, Struga, Republic of North Macedonia, 8-10 th November	2024
		5.	Shutevska, K., Zhivikj, Z., Bajatovska, AM., Anastasova , L., Petreska Ivanovska, T., Geskovski, N.	A rapid quantification NIR model to detect melamine adulteration in sport nutrition supplements	21 st International Conference of Near Infrared Spectroscopy, Innsbruck, Austria 20- 24 th August 2023	2023
		6.	Zhivikj, Z., Stefanovski , D., Dimzova, J., Petrushevsk a-Tozi, L., Kadifkova Panovska, T., Karapandzo va, M., Petreska Ivanovska, T.	Rapid GC- MS/MS analysis of multiple pesticide residues in cereal-based products	26th Congress of Chemists and Technologists of Macedonia, Ohrid, Republic of North Macedonia, 20-23 September	2023

No. 25	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Kristina Shutevska Achevska		
2.	Date of Birth	17.2.1996		
3.	Educational Qualification	VIII (PhD)		
4.	Academic and Professional Titles	Assistant professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		University Degree (Integrated First- and Second-Cycle Studies)	2019	UKIM, Faculty of Pharmacy - Skopje
		PhD	2025	UKIM, Faculty of Pharmacy - Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		/	/	/
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical sciences and health	Pharmacy	Applied biochemistry
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	UKIM, Faculty of Pharmacy - Skopje	Docent	Applied biochemistry
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Biochemistry	Master of Pharmacy / UKIM, Faculty of Pharmacy - Skopje	
	2.	Fundamentals of biochemistry	Laboratory Bioengineering / UKIM, Faculty of Pharmacy - Skopje	
	3.	Clinical biochemistry	Master of Pharmacy / UKIM, Faculty of Pharmacy - Skopje	
	4.	Clinical biochemical analyses	Laboratory Bioengineering / UKIM, Faculty of Pharmacy - Skopje	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	/	/	
9.	List of courses taught by the instructor in the third cycle of studies			
3.	No.	Course Title	Study Program / Institution	
	1.	Principles, methods, and diagnostics in clinical biochemistry	PhD studies in Pharmaceutical Sciences UKIM, Faculty of Pharmacy - Skopje	
	2.	Biochemical toxicology	PhD studies in Pharmaceutical Sciences UKIM, Faculty of Pharmacy - Skopje	
10.	Selected Results in the Last Five Years			

10	10 .1.	Relevant Published Scientific Papers (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Shutevska, K., Kadifkova, P.T., Zhivikj, Z., Kapedanovska, N.A.	In Vitro Analysis of AKR1D1 Interactions with Clopidogrel: Effects on Enzyme Activity and Gene Expression.	Macedonian Academy of Sciences and Arts/ Balkan Journal of Medical Genetics, 2025
		2.	Shutevska, K. & Nestorovska, A.K.	Cloning, expression, and purification of recombinant AKR1D1 for therapeutic applications.	Croatian Pharmaceutical Society/ Acta Pharmaceutica, 2025
		3.	Shutevska, K., Bajatovska, A.M., Anastasova, L., Zhivikj, Z., Zafirova Gjorgievska, M., Spasikj, S., Petreska Ivanovska, T., Makreski, P., Geskovski, N.	Rapid quantification models for assessing melamine adulteration in sport nutrition supplements via benchtop and portable NIRS instruments.	Elsevier/Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 2024
	10 .2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	Development of 3D Cell Bioreactor Systems and the Application of Fluorescence Microscopy in Various Areas of Pharmaceutical Research	Faculty of Pharmacy, Skopje, 2025-2027

	2.	Participant	PharmDataBorg: A Platform for Integration, Aggregation, and Knowledge Storage in Pharmaceutical Sciences	Faculty of Pharmacy, Skopje, 2022-2024
	3.	Participant	Development of Methods Using Vibrational Spectroscopic Techniques Coupled with Multivariate Analysis in Various Areas of Pharmaceutical Interest	Faculty of Pharmacy, Skopje, 2021-2024
	4.	Participant	Evaluation of Toxic Effects and Drug Interactions of Weight-Loss Dietary Supplements	Ss. Cyril and Methodius University, Skopje, 2021
10	Printed Books in the Last Five Years (up to five)			
.3.	No.	Authors	Title	Publisher / Year
	1.	/	/	/
10	Published Professional Papers in the Last Five Years (up to five)			
.4.	No.	Authors	Title	Publisher / Year
	1.	Bajatovska AM, Zhivikj Z, Shutevska K, Karapandzova M, Petreska Ivanovska T, Petrushevska-Tozi L, Kadifkova Panovska T.	Toxicity screening of weight loss tea products by Brine Shrimp Lethality Assay	Macedonian Pharmaceutical Association Macedonian Pharmaceutical Bulletin, 2023
	2.	Shutevska K, Bajatovska AM, Zhivikj Z, Anastasova L, Petreska Ivanovska T, Geskovski N.	PCA based screening for melamine adulteration in supplements for sport nutrition using vibrational spectroscopy tools.	Macedonian Pharmaceutical Association Macedonian Pharmaceutical Bulletin, 2023

		3.	Zhivikj Z, Petrushevska-Tozi L, Geskovski N, Shutevska K, Bajatovska AM, Karapandzova M, Kadifkova Panovska T, Petreska Ivanovska T.	Evaluation of weight loss supplements toxicity in rifampicin pre-treated HepG2 cells.	Macedonian Pharmaceutical Association Macedonian Pharmaceutical Bulletin, 2023
		4.	Shutevska K, Zhivikj Z, Sofronievska S, Bajatovska AM, Karapandzova M, Cvetkovikj Karanfilova I, Trajkovska N, Petreska Ivanovska T, Kadifkova Panovska T.	Evaluation of <i>Tanacetum vulgare</i> L. and <i>Juniperus communis</i> L. biocompatibility limitations in eukaryotic cells	Macedonian Pharmaceutical Association Macedonian Pharmaceutical Bulletin, 2022
		5.	Zhivikj, Z., Petrushevska-Tozi, L., Geskovski, N., Shutevska, K., Kadifkova Panovska, T., Karapandjova, M., Hiljadnikova Bajro M., Petreska Ivanovska, T.	Toxicity assessment of weight loss supplements and possible interaction risk with lipid-lowering and antihypertensive drugs in HepG2 cell line.	Macedonian Pharmaceutical Association Macedonian Pharmaceutical Bulletin, 2022
11.	Mentorships				
	11 .1.	Diploma Theses	/		
	11 .2.	Master’s Theses	/		
	11 .3.	Doctoral Dissertations	/		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				

12	.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	/	/	/
	.2.	Evidence of at least two printed/published research articles in international impact-factor scientific journals in the specified field, within the past five years			
		No	Authors	Title	Publisher / Year
			Shutevska, K., Kadifkova, P.T., Zhivikj, Z., Kapedanovska, N.A.	In Vitro Analysis of AKR1D1 Interactions with Clopidogrel: Effects on Enzyme Activity and Gene Expression.	Macedonian Academy of Sciences and Arts/ Balkan Journal of Medical Genetics, 2025
			Shutevska, K. and Nestorovska, A.K.	Cloning, expression, and purification of recombinant AKR1D1 for therapeutic applications.	Croatian Pharmaceutical Society/ Acta Pharmaceutica 2025
			Shutevska, K., Bajatovska, A.M., Anastasova, L., Zhivikj, Z., Zafirova Gjorgievska, M., Spasikj, S., Petreska Ivanovska, T., Makreski, P., Geskovski, N.	Rapid quantification models for assessing melamine adulteration in sport nutrition supplements via benchtop and portable NIRS instruments.	Elsevier/Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 2024
	.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
		No	Authors	Title	International Conference Year

		1.	Zhivikj, Z., Bajatovska, AM., Karapandzo va, M., Shutevska, K., Kadifkova Panovska, T., Karapandzo va, M., Petrushevska -Tozi, L., Petreska Ivanovska, T.	Nopal-based dietary supplement against rifampicin- induced hepatotoxicit y	7th International Congress of the Croatian Society of Toxicology, Rab, Croatia, 5-8th October	2025
		2.	Shutevska, K., Bajatovska , AM., Zhivikj, Z., Anastasov a, L., Petreska Ivanovska, T., Geskovski , N.,	A rapid quantificatio n NIR model to detect melamine adulteration in sport nutrition supplements.	International Conference on Near Infrared Spectroscopy, Innsbruck, Austria, 20-24 August.	2023

		3.	Shutevska K, Zhivikj Z, Dimkovski A, Geshkovsk i N, Petreska Ivanovska T, Kadifkova Panovska T, Kapedano vska Nestorovs ka A.	The importance of AKR1D1 enzyme in drug metabolism.	7th Congress of Pharmacy in North Macedonia, Ohrid, 5- 9th October	2022

No. 26	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Aneta Dimitrovska		
2.	Date of Birth	02.07.1960		
3.	Educational Qualification	VIII (Doctor of Sciences)		
4.	Academic and Professional Titles	Full Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate Studies in Pharmacy	1983	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master's Studies	1992	University of Belgrade, Faculty of Pharmacy
		Doctoral Studies (PhD)	1996	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical chemistry
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical analysis
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Full professor	Quality control of medicines; Applied chemistry and instrumental pharmaceutical analysis and
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.1.	List of courses taught by the instructor in the first cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Quality control of medicines and Legislation	Master of Pharmacy, Ss. Cyril and Methodius University in Skopje,	
	2.	Instrumental Pharmaceutical Analyses	Master of Pharmacy, Ss. Cyril and Methodius University in Skopje,	
	3.	Laboratory Techniques and Instrumental Methods 1	Laboratory Bioengineering, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	4.	Laboratory Techniques and Instrumental Methods 2	Laboratory Bioengineering, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
9.2.	List of courses taught by the instructor in the second cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Quality Management of Testing in Analytical Laboratory	Master's Studies in Laboratory Analysis and Engineering in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	

		2.	Pharmaceutical Legislation	Specialist Studies in Pharmaceutical Regulation, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		3.	Innovative and Generic Medicines	Specialist Studies in Pharmaceutical Regulation, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	9.3.	List of courses taught by the instructor in the third cycle of studies			
		No.	Course Title	Study Program / Institution	
		1.	Advanced Instrumental Techniques in Pharmaceutical Research	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		2.	Contemporary Trends and Research Approaches in Pharmaceutical Regulation	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		3.	Scientific Concepts and Approaches in Pharmaceutical Analysis	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
10.	Selected Results in the Last Five Years				
	10.1.	Relevant Published Scientific Papers (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Trifunovska BV, Atanasova A, Antovska P, Lazova J, Brezovska K, Dimitrovska A , Nakov N	Transformation model to green HPLC methods for lipophilic acidic compounds based on isoelutropic series of elution solvents	Microchemical Journal. 2025:113853 (IF 5.1) https://doi.org/10.1016/j.microc.2025.113853
		2.	Nakov N, Acevska J, Brezovska K, Kavrakovski Z, Dimitrovska A	Green Strategies toward Eco-Friendly HPLC Methods in Pharma Analysis. High Performance Liquid Chromatography - Recent Advances and Applications	IntechOpen; London, UK, 2023 Book chapter
		3.	N.Nakov, L.Anastasova, M. Zafirova Gjorgievska, J. Acevska, K.Brezovska, R.Petkovska, A.Dimitrovska	Green RP-HPLC methods for assay and related substances in rivaroxaban tablets	Acta Chromatographica, 2023 (IF 2.01) https://doi.org/10.1556/1326.2023.01178

		4.	N. Nakov, K. Brezovska, V. Karchev, J. Acevska, A. Dimitrovska	Chromatographic and surfactant based potentiometric determination of aqueous dissociation constant of mupirocin	Current Analytical Chemistry 2020, 16, 158-165 Impact factor: 1.242
	10.2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	Approaches for the Development of Environmentally Friendly Chromatographic Methods in Pharmaceutical Analysis	Ss. Cyril and Methodius University in Skopje/ 2022-2023
		2.	Participant	Method Development Using Vibrational Spectroscopic Techniques Combined with Multivariate Analysis in Diverse Pharmaceutical Applications	2020-2023, UKIM, Faculty of Pharmacy
		3.	Participant	Strengthening laboratory capacities for the detection of falsified medicines as part of the Republic of North Macedonia's strategy to combat medicine falsification	Ministry of Education and Science of the Republic of North Macedonia / 2020 - 2022
		4.	Participant	Analysis of Nitrosamine Impurities in Active Substances and Finished Pharmaceutical Products	Ss. Cyril and Methodius University in Skopje/ 2020-2022
	10.3.	Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year

		1.	Nakov N, Acevska J, Brezovska K, Kavrovski Z, Dimitrovska A	Green Strategies toward Eco-Friendly HPLC Methods in Pharma Analysis. High Performance Liquid Chromatography - Recent Advances and Applications	IntechOpen; London, UK, 2023
		2.	N. Nakov, A. Dimitrovska	Scientific approach for development of LC- MS/MS bioanalytic method	Eliva Press SRL, Chisinau, Moldova, Europe, 2022 ISBN: 978-99949-8-197-7
		3.	Natalija Nakov, Jelena Acevska, Katerina Brezovska, Zoran Kavrovski, Aneta Dimitrovska.	Chromatographic Approaches for Physicochemical Characterisation of Compounds in CHROMATOGRAPHY: AT A GLANCE. 2021. Open Access eBooks, Las Vegas, USA.	Open Access eBooks, Las Vegas, USA / 2021, Chromatography At a Glance, Vol. 1, Chapter 1: 1-22
		4.	A. Dimitrovska , S. Trajkovic- Jolevska, K. Brezovska, J. Acevska	Evaluation of Chemical Substances for Pharmaceutical Use According to the European Pharmacopoeia	Fourth Edition, Ss. Cyril and Methodius University in Skopje , Faculty of Pharmacy, May 2021(Review published in UKIM Bulletin No. 1237, 01.05.2021)
		5.	A. Dimitrovska , Z. Kavrovski, K. Brezovska, J. Acevska, N. Nakov	Instrumental Pharmaceutical Analyses	Ss. Cyril and Methodius University in Skopje , Skopje , October 2020 (CIP: 615.074:543(075.8))
	10.4.	Published Professional Papers in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year

		1.	M. Miloshevska, I. Slaveska Spirevska, N. Nakov, Gj.Stefkov, A. Dimitrovska , J. Acevska	Water content determination in different varieties of Cannabis flowers	Macedonian pharmaceutical bulletin, 69 (1) 67 - 75 (2023)
		2.	E. Trajkovska Bojadjiska, H. Godzo, J. Acevska, N. Nakov, A. Dimitrovska , K. Brezovska	Evaluation of measurement uncertainty after optimization of the method for potentiometric titration of glycine	Macedonian pharmaceutical bulletin, 68 (1) 43 - 52 (2022)
		3.	Katerina Aleksievska Beldedovska, Jelena Acevska, Aneta Dimitrovska , Miroslava Ilievska	Challenges of manufacturing site in batch certification and release in European Union	Macedonian Pharmaceutical Bulletin, 65 (2), 2019
		4.	Tanturovski Zharko, Zorica Arsova-Sarafinovska, Aneta Dimitrovska	RP-HPLC method with indirect UV detection for determination of sodium ibandronate in pharmaceuticals	Macedonian Pharmaceutical Bulletin, 64 (2), 2019
		5.	Maja Hadzieva Gigovska, Ana Petkovska, Blagica Manchevska, Jelena Acevska, Natalija Nakov, Packa Antovska, Sonja Ugarkovic, Aneta Dimitrovska	Chemometrically assisted optimization, development and validation of UPLC method for the analysis of simvastatin	Macedonian Pharmaceutical Bulletin, 64 (1), 2019
11.	Mentorships				
	11.1.	Diploma Theses		35	
	11.2.	Master's Theses		5	

	11.3.	Doctoral Dissertations	5		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	Trifunovska BV, Atanasova A, Antovska P, Lazova J, Brezovska K, Dimitrovska A , Nakov N	Transformation model to green HPLC methods for lipophilic acidic compounds based on isoelutropic series of elution solvents	Microchemical Journal. 2025:113853 (IF 5.1) https://doi.org/10.1016/j.microc.2025.113853
		2.	Jelena Acevska, Michel Ulmschneider, Katerina Brezovska, Aneta Dimitrovska , Bruno Spieldenner	Data analysis – quality aspects	Macedonian pharmaceutical bulletin, 69 (Suppl 1) 215 - 216 (2023) Online ISSN 1857 - 8969 DOI: 10.33320/maced.pharm.bull.2023.69.03.105
		3.	Angela Arsovska, Jelena Acevska, Katerina Brezovska, Hrisanta Godzo, Aneta Dimitrovska	Risk-based assessment of the possibility for falsification during post-marketing surveillance of medicines	Macedonian pharmaceutical bulletin, 69 (Suppl 1) 229 - 230 (2023) Online ISSN 1857 - 8969 DOI: 10.33320/maced.pharm.bull.2023.69.03.112
		4.	Gentiana Mehmeti, Nikola Geshkovski, Katerina Brezovska, Aneta Dimitrovska , Suzana Trajkovic Jolevska, Rumenka Petkovska, Jelena Acevska	Analytical strategy for discrimination between different origins of Metformin film-coated tablets	Macedonian pharmaceutical bulletin, 69 (1) 255 - 256 (2023) Online ISSN 1857 - 8969 DOI: 10.33320/maced.pharm.bull.2023.69.03.125
		5.	Maja Hadzieva Gigovska, Natalija Nakov, Jelena Acevska, Katerina Brezovska, Aneta Dimitrovska , Jelena Lazova	Scientific approach and implementation of a measurement uncertainty in mass balance determination	Macedonian pharmaceutical bulletin, 68 (Suppl 1) 39 -40 (2022) Online ISSN 1857 - 8969 DOI:10.33320/maced.pharm.bul.2022.68.03.015

12.2.	Evidence of at least two published research papers in international peer-reviewed journals with an impact factor in the relevant field within the past five years				
	1.	Trifunovska BV, Atanasova A, Antovska P, Lazova J, Brezovska K, Dimitrovska A , Nakov N	Transformation model to green HPLC methods for lipophilic acidic compounds based on isoelutropic series of elution solvents	Microchemical Journal. 2025:113853 (IF 5.1) https://doi.org/10.1016/j.microc.2025.113853	
	2.	N. Nakov, K. Brezovska, V. Karchev, J. Acevska, A. Dimitrovska	Chromatographic and surfactant based potentiometric determination of aqueous dissociation constant of mupirocin	Current Analytical Chemistry (2020) 16: 158-165	
12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
	No	Authors	Title	Publisher / Year	Authors
	1.	M. Miloshevska, I. Slaveska Spirevska, N. Nakov, A. Dimitrovska , J. Acevska	Semi-micro determination of water content in different varieties of Cannabis flower	8th Congress of Pharmacy with International Participation (Borovets, Bulgaria, 27-30 April)	2023
	2.	N. Nakov, J. Acevska, K. Brezovska, R. Petkovska, Z. Kavrovski, A. Dimitrovska	Possibilities and challenges of "green" chromatographic solutions	7 th Congress of Pharmacy in Macedonia with international participation (Ohrid, Macedonia 5-9 October)	2022
	3.	M. H. Gigovska, N. Nakov, J. Acevska, K. Brezovska, A. Dimitrovska , J. Lazova	Scientific approach and implementation of a measurement uncertainty in mass balance determination	7 th Congress of Pharmacy in Macedonia with international participation (Ohrid, Macedonia 5-9 October)	2022

No. 27	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Rumenka Petkovska		
2.	Date of Birth	24.09.1966		
3.	Educational Qualification	VIII (Doctor of Philosophy)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate studies in Pharmacy	1990	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master's degree studies	2004	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Ph.D. studies	2008	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical and health sciences	Pharmacy	Pharmaceutical chemistry
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical and health sciences	Pharmacy	Applied chemistry and pharmaceutical analysis
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Faculty of pharmacy, University of Ss. Cyril and Methodius, Skopje	Full professor	Applied Chemistry and instrumental pharmaceutical analysis
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Inorganic chemistry applied in pharmacy	Master of pharmacy, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	2.	Physical chemistry for pharmacists	Master of pharmacy, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	3.	General and inorganic chemistry	Bachelor in laboratory biomedical engineering, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	4.	Fundamentals of physical chemistry	Bachelor in laboratory biomedical engineering, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	Biostatistics (Advanced level)	Master's degree studies in laboratory biomedical engineering Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	2.	<u>Design of chemical Experiments</u>	Master's degree studies in laboratory biomedical engineering Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	

		3	Food science	Master's degree studies in dietetics/dietotherapy Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	9.	List of courses taught by the instructor in the third cycle of studies			
	3.	No.	Course Title	Study Program / Institution	
		1.	Biostatistics	Ph.D. studies in Pharmacy, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
		2.	Stability studies in the pharmaceutical drug development	Ph.D. studies in pharmacy, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
		3.	Regulation on the registration of medicinal products for human use, part quality	Ph.D. studies in pharmacy, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
10.	Selected Results in the Last Five Years				
	10	Relevant Published Scientific Papers (up to five)			
	.1.	No.	Authors	Title	Publisher / Year
		1.	N. Geskovski, S. Dimcevska Sazd ova, S. Gjoseva, R. Petkovska, M. Popovska, L. Anastasova, K. Mladenovska, K. Goracinova	Rational development of nanomedicines for molecular targeting in periodontal disease	Archives of Oral Biology, 93, 31-46, 2018. <a href="https://doi.org/10.1016/j.archora
lbio.2018.05.009">https://doi.org/10.1016/j.archora lbio.2018.05.009
		2.	B. Pajaziti, R.Petkovska, M. Andrasi, D. Nebija	Application of the capi llary zone electrophore sis (CZE) and capillary electrophoresis for the separation of human i nsulin, insulin lispro a nd their degradation pr oducts	Pharmazie 75: 167-171, 2020 doi:10.1691/ph.2020.9188
		3.	B. Pajaziti, M. Andrasi, D. Nebija, B. A. Pajaziti, L. Anastasova, R. Petkovska	Chemometrics approach for optimization of capillary electrophoretic conditions for the separation of insulin analogues	Pharmazie 76, 528-531, 2021. <a href="https://doi.org/10.1691/ph.2021.
1758">https://doi.org/10.1691/ph.2021. 1758

		4.	M. Tomikj, M. Bozinovska, N. Anevsk-Stojanovska, J. Lazova, R. Petkovska, L. Anastasova, N. Nakov.	Eco-friendly RP-HPLC method for determination of diazepam in coated tablet	The Macedonian Journal of Chemistry and Chemical Engineering, 42(2): 153-163, 2023 https://doi.org/10.20450/mjce.2023.2683
		5.	Natalija Nakov, Liljana Anastasova, Marija Zafirova Gjorgievska, Jelena Acevska, Katerina Brezovska, Rumenka Petkovska and Aneta Dimitrovska	Green RP-HPLC methods for assay and related substances in rivaroxaban tablets	Acta Chromatographica, 36(4): 371-382, 2024. https://doi.org/10.1556/1326.2023.01178
	10	Participation in National and International Research Projects (up to five)			
	.2.	No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	Approaches for the Development of Environmentally Friendly Chromatographic Methods in Pharmaceutical Analysis	University of Ss. Cyril and Methodius in Skopje 2022-2023
		2.	Participant	Strengthening the laboratory capacities for detection of falsified medicines as part of the strategy of Republic of North Macedonia against falsified medicines	Ministry of Science and Education of Republic of North Macedonia 2020 - 2022
		3.	Participant	Nitrosamine impurity analysis in pharmaceutical active substances and in pharmaceutical products	University of Ss. Cyril and Methodius in Skopje 2020 - 2022
	10	Printed Books in the Last Five Years (up to five)			
	.3.	No.	Authors	Title	Publisher / Year

		1.	Anastasova L., Petkovska R.	A Chemometrics-driven strategy for assessment of treatment efficacy: contemporary approach towards effective and individualized treatments.	BP International India, United Kingdom, 2023 https://doi.org/10.9734/bpi/cpmr/v5/6057C
		2.	Rumenka Petkovska, Liljana Bogdanovska	Study guide for laboratory exercises and calculations in general and inorganic chemistry	Faculty of Pharmacy, UKIM, Skopje, 2023 ISBN 978-9989-9564-9-2
		3.	Rumenka Petkovska, Liljana Bogdanovska	Study guide for calculations in inorganic chemistry applied in pharmacy	Faculty of Pharmacy, UKIM, Skopje, 2023 ISBN 978-608-5037-00-1
		4.	Natalija Nakov, Rumenka Petkovska, Zoran Kavrovski	A textbook for Physical chemistry for pharmacists	Faculty of Pharmacy, UKIM, Skopje, 2024 ISBN 978-608-5037-05-6
		5.	Liljana Anastasova, Rumenka Petkovska	Inorganic chemistry applied in pharmacy – study guide, 2 nd Ed.	Faculty of Pharmacy, UKIM, Skopje, 2025 ISBN 978-608-5037-11-7
10	Published Professional Papers in the Last Five Years (up to five)				
.4.	No.	Authors	Title	Publisher / Year	
	1.	M. Mandzukovska Micevska, G. Petrusevski, R. Petkovska	Risk based approach of data integrity aspects of configuring computerized system in GMP laboratory	Macedonian Pharmaceutical Bulletin Vol 68(2), 77-96, 2022 DOI: 10.33320/maced.pharm.bull.2022.68.02.009	
	2.	K. Grncharoska, E. Lazarevska Todevska, I. Slavevska Spirevska, T. Bakovska Stoimenova, B. Achevski, L. Anastasova, R. Petkovska	A stability-indicating HPLC method for determination of folic acid and its related substances in tablets	Macedonian Pharmaceutical Bulletin, Vol 68(1), 27-36, 2022. DOI:10.33320/maced.pharm.bull.2022.68.01.003	

	3.	T. Achkoska, M. Bozhinovska, A. Arnaudova, P. Antovska, L. Anastasova, R. Petkovska	Bootstrap analysis for dissolution similarity f actor f_2 – bringing conf idence for borderline r esults – a case study	Macedonian Pharmaceutical Bul letin, Vol 68(2), 97-102, 2022. DOI:10.33320/maced.pharm.bul 1.2022.68.02.010
	4.	Marija Grozdanoska Kostadinovska, Sacha Manuel, Nena Velevska, Packa Antovska, Jelena Lazova, Jasmina Tonic Ribarska, Rumenka Petkovska, Suzana Trajkovic Jolevska	Development and validation of an in vitro release test and use of Strat-M synthetic membrane as a predictor for the in vitro permeation test of topical gel formulations	Macedonian pharmaceutical bulletin, 69 (1) 51 – 66, 2023. DOI: 10.33320/maced.pharm.bull.202 3.69.01.005
	5.	Keti Nonevska- Vaneva1, Liljana Anastasova, Rumenka Petkovska	Medical oxygen: quality assurance and quality control practices for safe and effective application	Macedonian pharmaceutical bulletin, 70 (2), 47 – 55, 2024. DOI: 10.33320/maced.pharm.bull.202 4.70.02.007
11.	Mentorships			
	11 .1.	Diploma Theses	28	
	11 .2.	Master’s Theses	1	
	11 .3.	Doctoral Dissertations	3	
12.	For PhD Mentors: Selected Results in the Last Four/Five Years			
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years		
	No	Authors	Title	Publisher / Year
	1.	Anastasova L., Petkovska R.	A Chemometrics- driven strategy for assessment of treat ment efficacy: cont emporary approach towards effective a nd individualized tr eatments.	BP International India, United Kingdom, 2023 https://doi.org/10.9734/bpi/cpmr/v5/6057C

	2.	M. Tomikj, M. Bozinovska, N. Anevsk-Stojanovska, J. Lazova, R. Petkovska, L. Anastasova, N. Nakov	Eco-friendly RP-HPLC method for determination of diazepam in coated tablet	The Macedonian Journal of Chemistry and Chemical Engineering, 42(2): 153-163, 2023 https://doi.org/10.20450/mjcce.2023.2683
	3.	T. Achkoska, M. Bozhinovska, A. Arnaudova, P. Antovska, L. Anastasova, R. Petkovska	Bootstrap analysis for dissolution similarity factor f_2 – bringing confidence for borderline results – a case study	Macedonian Pharmaceutical Bulletin Vol 68(2), 97-102, 2022. DOI: 10.33320/maced.pharm.bull.2022.68.02.010
	4.	B. Pajaziti, M. Andradi, D. Nebija, B. A. Pajaziti, L. Anastasova, R. Petkovska	Chemometrics approach for optimization of capillary electrophoretic conditions for the separation of insulin analogues	Pharmazie 76, 528-531, 2021 doi: 10.1691/ph.2021.1758
	5.	B. Pajaziti, R. Petkovska, M. Andradi, D. Nebija	Application of the capillary zone electrophoresis (CZE) and capillary electrophoresis for the separation of human insulin, insulin lispro and their degradation products	Pharmazie 75: 167-171, 2020 doi: 10.1691/ph.2020.9188
	6.	Natalija Nakov, Liljana Anastasova, Marija Zafirova Gjorgievska, Jelena Acevska, Katerina Brezovska, Rumenka Petkovska and Aneta Dimitrovska	Green RP-HPLC methods for assay and related substances in rivaroxaban tablets	Acta Chromatographica, 36(4):371-382, 2024 https://doi.org/10.1556/1326.2023.01178
	12. 2.	Evidence of at least two Published Scientific Research Papers in Peer Reviewed Journals in the Given Field in the Last Five Years		

	1.	B. Pajaziti, R.Petkovska, M. Andrasi, D. Nebija	Application of the capillary zone electrophoresis (CZE) and capillary electrophoresis for the separation of human insulin, insulin lispro and their degradation products	Pharmazie 75: 167-171, 2020 doi: 10.1691/ph.2020.9188	
	2.	B. Pajaziti, M. Andrasi, D. Nebija, B. A. Pajaziti, L. Anastasova, R. Petkovska	Chemometrics approach for optimization of capillary electrophoretic conditions for the separation of insulin analogues	Pharmazie 76, 528-531, 2021. doi: 10.1691/ph.2021.1758	
	3.	M. Tomikj, M. Bozinovska, N. Anevsk-Stojanovska, J. Lazova, R. Petkovska, L. Anastasova, N. Nakov	Eco-friendly RP-HPLC method for determination of diazepam in coated tablet	The Macedonian Journal of Chemistry and Chemical Engineering, 42(2): 153-163, 2023 https://doi.org/10.20450/mjcce.2023.2683	
	4.	Natalija Nakov, Liljana Anastasova, Marija Zafirova Gjorgievska, Jelena Acevska, Katerina Brezovska, Rumenka Petkovska, Aneta Dimitrovska	Green RP-HPLC methods for assay and related substances in rivaroxaban tablets	Acta Chromatographica, 36(4):371-382, 2024 https://doi.org/10.1556/1326.2023.01178	
12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
	No	Authors	Title	International Conference	Year
	1.	G. Mehmeti, N. Geshkovski, K. Brezovska, A. Dimitrovska, S. Trajkovic Jolevska, R. Petkovska, J. Acevska	Analytical strategy for discrimination between different origins of Metformin film-coated tablets	14th Central European Symposium on Pharmaceutical Technology (Ohrid, Macedonia 28-30 September)	2023

		2.	B. Pajaziti, M. András, L. Anastasova, D. Nebija, B. Pajaziti, R. Petkovska	Application of experime ntal design f or determina tion of insu lin analogs	7 th Congress of Pharmacy in Macedonia with international participation (Ohrid, Macedonia, 5-9 October)	2022
		3.	M. Bujaroska, I. Papoutsis, L. Anastasova, R. Petkovska, T. Petreska Ivanovska, C. Spiliopoulou, A. Stankov, L. Petrushevska- Tozi	Estimation o f the relationship between diazepam use and risk of violent death using post mortem data	7 th Congress of Pharmacy in Macedonia with international participation (Ohrid, Macedonia, 5-9 October)	2022

No. 28	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname:	Ana Poceva Panovska		
2.	Date of Birth:	28.04.1975		
3.	Educational Qualification	VIII (Doctor of Sciences)		
4.	Academic and Professional Titles	Full Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate Studies in Pharmacy	2000	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master's Studies	2004	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral Studies (PhD)	2012	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Pharmaceutical Chemistry
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Applied chemistry and pharmaceutical analysis
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Full professor	Applied chemistry and instrumental pharmaceutical analysis
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Organic Chemistry Applied in Pharmacy	Master of Pharmacy, Ss. Cyril and Methodius University in Skopje,	
	2.	Bioorganic Chemistry	Master of Pharmacy, Ss. Cyril and Methodius University in Skopje,	
	3.	Fundamentals of Organic Chemistry	Laboratory Bioengineering, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	Quality Management of Testing in an Analytical Laboratory	Master's Studies in Laboratory Analysis and Engineering in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	2.	Biological Medicines	Specialist Studies in Pharmaceutical Regulation, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	

		3	Ecopharmacovigilance	Specialist Studies in Pharmacovigilance, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	9.	List of courses taught by the instructor in the third cycle of studies			
	3.	No.	Course Title	Study Program / Institution	
		1.	Molecular Foundations of therapeutics	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		2.	Advanced Instrumental Techniques in Pharmaceutical Research	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		3.	Modern Strategies in the Synthesis, Structural Analysis, and Characterization of New Pharmacologically Active Molecules	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
10.	Selected Results in the Last Five Years				
	10	Relevant Published Scientific Papers (up to five)			
	.1.	No.	Authors	Title	Publisher / Year
		1.	Dimkovski A, Dobričić V, Simić MR, Jurhar Pavlova M, Mihajloska E, Sterjev Z, Poceva Panovska A.	Synthesis, Biological Evaluation, and Molecular Docking Studies of Novel Coumarin–Triazole–Isatin Hybrids as Selective Butyrylcholinesterase Inhibitors.	Molecules. 2025; 30(10):2121 https://doi.org/10.3390/molecules30102121
		2.	A. Dimkovski, E. Mihajloska, A. Poceva Panovska	Recent advances in isatin-derived hybrids: promising multifunctional agents for drug development	Macedonian pharmaceutical bulletin, 71 (2) 13 - 25 (2025) DOI: 10.33320/maced.pharm.bul 1.2025.71.02.002
		3.	Dimkovski A., Mihajloska E., Poceva Panovska A.	Recent advances in isatin-derived hybrids: promising multifunctional agents for drug development.	Macedonian Pharmaceutical Bulletin, 2025; 71(2) pg 13-25

		4.	Gigopulu O, Godzo H, Atanasovska B, Gjorgievska MZ, Panovska AP, Tonic-Ribarska J, Acevska J, Brezovska K, Nakov N	Green RP-HPLC method for impurity profile of amlodipine in tablets	Archives of Pharmacy. (2024);74 2):216-34.
		5.	Olga Gigopulu, Nikola Geskovski, Gjoshe Stefkov, Ana Poceva Panovska, Marjan Piponski, Irena Slaveska Spirevska, Petre Makreski	Real-time monitoring of CBDA decarboxylation in solid state and cannabis flowers using mid infrared spectroscopy coupled with multivariate analysis	Vibrational Spectroscopy 134:103728, (2024) DOI: 10.1016/j.vibspec.2024.103 728
	10	Participation in National and International Research Projects (up to five)			
	.2.	No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	Harmonized and sustainable pharmacy education for open Europe	2024-2026 Erasmus + (KA220-HED)
		2.	Participant	Development of vibrational spectroscopy methods for rapid screening of phytocannabinoids in hemp and its preparations	2022-2023, Bilateral project with the Republic of Austria, Ministry of Education and Science of the Republic of North Macedonia
		3.	Participant	Approaches for the Development of Environmentally Friendly Chromatographic Methods in Pharmaceutical Analysis	Ss. Cyril and Methodius University in Skopje/ 2022- 2023

	4.	Participant	Method Development Using Vibrational Spectroscopic Techniques Combined with Multivariate Analysis in Diverse Pharmaceutical Applications	2020-2023, UKIM, Faculty of Pharmacy
	5.	Participant	Strengthening laboratory capacities for the detection of falsified medicines as part of the Republic of North Macedonia's strategy to combat medicine falsification	Ministry of Education and Science of the Republic of North Macedonia / 2020 - 2022
10	Printed Books in the Last Five Years (up to five)			
.3.	No.	Authors	Title	Publisher / Year
	1.	Katerina Ancevska-Netkovska, Aleksandra Grozdanova, Zoran Sterjev, Ana Poceva-Panovska, Jasmina Tonic-Ribarska, Katerina Brezovska	Intellectual Property Rights in Pharmacy	UKIM, Faculty of Pharmacy e/2021
		Ana Poceva-Panovska, Emil Popovski, Olga Gigopulu	Experimental Techniques and Syntheses in Organic Chemistry: Laboratory Manual	UKIM, Faculty of Pharmacy, /2022
10	Published Professional Papers in the Last Five Years (up to five)			
.4.	No.	Authors	Title	Publisher / Year
	1.	Dimkovski A, Dobričić V, Simić MR, Jurhar Pavlova M, Mihajloska E, Sterjev Z, Poceva Panovska A.	Synthesis, Biological Evaluation, and Molecular Docking Studies of Novel Coumarin–Triazole–Isatin Hybrids as Selective Butyrylcholinesterase Inhibitors.	<i>Molecules</i> . 2025; 30(10):2121 https://doi.org/10.3390/molecules30102121

		2.	Ljqi Berisha, N.; PocevaPanovska, A.; Hajrulai-Musliu, Z.	Antibiotic Resistance and AquaticSystems: Importance in Public Health	Water, 16(17), 2362; (2024) https://doi.org/10.3390/w16172362
		3.	Gigopulu O, Godzo H, Atanasovska B, Gjorgievska MZ, Panovska AP, Tonic-Ribarska J, Acevska J, Brezovska K, Nakov N	Green RP-HPLC method for impurity profile of amlodipine in tablets	Archives of Pharmacy 74(2):216-234 (2024) DOI: 10.5937/arhfarm74-49799
		4.	Hrisanta Godzo, Olga Gigopulu1, Nikola Geskovski2,Jelena Acevska1, Natalija Nakov1, Jasmina Tonic-Ribarska1,Ana Poceva Panovska1, Katerina Brezovska	PLS based quantitative determination of insulinaspert in solution using Raman spectroscopy	Archives of Pharmacy. 74: 206 – 215, (2024);
		5.	A. Dimkovski, E. Mihajloska, O. Gigopulu, Z. Naumovska, L. Suturkova, A. Poceva Panovska	Design and synthetic approach of novel hybrid molecules for treatment of Alzheimer’s disease	Maced. Pharm. Bull. 68 Suppl 1, (2022) 401– 402. https://doi.org/10.33320/maced.pharm.bull.2022.68.03.19
11.	Mentorships				
	11 .1.	Diploma Theses		15	
	11 .2.	Master’s Theses		1	
	11 .3.	Doctoral Dissertations		1	
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		Ред. број	Автори	Наслов	Издавач / година

	1.	Dimkovski A., Mihajloska E., Poceva Panovska A.	Recent advances in isatin-derived hybrids: promising multifunctional agents for drug development.	Macedonian Pharmaceutical Bulletin, 2025; 71(2) pg 13-25 DOI: 10.33320/maced.pharm.bul.2025.71.02.002
	2.	Gigopulu O., Hrisanta Godzo, Biljana Atanasovska, Marija Zafirova Gjorgievska, Ana Poceva Panovska, Jasmina Tonic-Ribarska, Jelena Acevska, Katerina Brezovska, Natalija Nakov	Green RP-HPLC method for impurity profile of amlodipine in tablets	Archives of Pharmacy 74(2): pp. 216-234 (2024) https://doi.org/10.5937/arhfarm74-49799
	3.	Godzo, H., Gigopulu, O., Brezovska, K., Geshkovski, N., Nakov, N., Acevska, J., Panovska, A.P. and Tonic-Ribarska, J.,	PLS based quantitative determination of insulin aspart in solution using Raman spectroscopy.	Archives of Pharmacy, 74(2), pp. 206-215. (2024) https://doi.org/10.5937/arhfarm74-49901
	4.	A. Dimkovski, E. Mihajloska, O. Gigopulu, Z. Naumovska, L. Suturkova, A. Poceva Panovska	Design and synthetic approach of novel hybrid molecules for treatment of Alzheimer's disease	Maced. Pharm. Bull. 68 Suppl 1, (2022) 401– 402. https://doi.org/10.33320/maced.pharm.bull.2022.68.03.19
	5.	Ana Poceva Panovska, Jelena Acevska, Gabriela Petrovska Dimitrievska, Katerina Brezovska, Natalija Nakov, Zoran Kavrakovski,	Quantification using GC/ECD: challenges and pitfalls,	Macedonian Pharmaceutical Bulletin, 66 (Suppl 1), 181 - 182 (2020)
	12 .2	Evidence of at least two published research papers in international peer-reviewed journals with an impact factor in the relevant field within the past five years		

		1.	Dimkovski A, Dobričić V, Simić MR, Jurhar Pavlova M, Mihajloska E, Sterjev Z, Poceva Panovska A.	Synthesis, Biological Evaluation, and Molecular Docking Studies of Novel Coumarin–Triazole–Isatin Hybrids as Selective Butyrylcholinesterase Inhibitors.	<i>Molecules</i> . 2025; 30(10):2121 https://doi.org/10.3390/molecules30102121
		2.	Gigopulu O, Geskovski N, Stefkov G, Poceva Panovska A, Piponski M, Slaveska Spirevska I, Makreski P.	Real-time monitoring of CBDA decarboxylation in solid state and cannabis flowers using mid infrared spectroscopy coupled with multivariate analysis	<i>Vibrational Spectroscopy</i> . 2024;134:103728. https://doi.org/10.1016/j.vibspec.2024.103728 2024
		3.	Ljqi Berisha, N.; PocevaPanovska, A.; Hajrulai-Musliu, Z.	Antibiotic Resistance and AquaticSystems: Importance in Public Health	<i>Water</i> , 16(17), 2362; (2024) https://doi.org/10.3390/w16172362
	12 .3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
	No	Authors	Title	Publisher / Year	Authors
	1.	Dimkovski A; Dobričić V; Mihajloska E; Poceva Panovska A.	Molecular docking analysis of novel coumarin triazole-isatin hybrid with cholinesterase inhibitory activity.	33rd Annual GP2A Medicinal Chemistry Conference, XIVth Paul Ehrlich MedChem Euro PhD Network Meeting & COST Action OneHealthdrugs,	2025

		2.	Olga Gigopulu, Gjoshe Stefkov, Nikola Geskovski, Ana Poceva Panovska, Petre Makreski	Real-time monitoring of CBDA decarboxylation in cannabis flowers by coupling temperature-controlled infrared spectroscopy and statistical analysis	5th International Conference on Natural Products Utilization: from Plants to Pharmacy ShelfAt: Varna, Bulgaria	2023
		3.	A. Dimkovski, E. Mihajloska, O. Gigopulu, Z. Naumovska, L. Suturkova, A. Poceva Panovska,	Design and synthetic approach of novel hybrid molecules for treatment of Alzheimer's disease	7 th Congress of Pharmacy in Macedonia with international participation (Ohrid, Macedonia 5-9 October)	2022

No. 29	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Jasmina Tonikj Ribarska		
2.	Date of Birth	31.01.1975		
3.	Educational Qualification	VIII (Doctor of Sciences)		
4.	Academic and Professional Titles	Full Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate Studies in Pharmacy	2000	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master's Studies	2008	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral Studies (PhD)	2012	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Drug Analyses
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Applied chemistry and pharmaceutical analysis
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Full Professor	Applied chemistry and pharmaceutical analysis
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Analytical Chemistry applied in Pharmacy	Master of Pharmacy / Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	2.	Bioanalytical Chemistry	Master of Pharmacy / Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	3.	Bioorganic Chemistry	Master of Pharmacy / Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	Medical Devices	Specialist Studies in Pharmaceutical Regulation, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	2.	Safety Monitoring of Medical Devices	Specialist Studies in Pharmacovigilance, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	3.	Regulation of Orphan Medicinal Products	Specialist Studies in Pharmaceutical Regulation, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	

		4.	Quality Management of Testing in Analytical Laboratory	Master's Studies in Laboratory Analysis and Engineering in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		5.	Development and Validation of Analytical Methods	Master's Studies in Laboratory Analysis and Engineering in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		6.	Application of Modern Bioanalytical Methods	Master's Studies in Laboratory Analysis and Engineering in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	9.	List of courses taught by the instructor in the third cycle of studies			
	3.	No.	Course Title	Study Program / Institution	
		1.	Ethics in Scientific Research	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		2.	Modern Approaches in Bioanalytical Analyses	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		3.	Stability of Pharmaceutical Products	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		4.	Application of Green Chemistry Principles in Pharmaceutical Analyses	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	10.	Selected Results in the Last Five Years			
10 .1.	Relevant Published Scientific Papers (up to five)				
	No.	Authors	Title	Publisher / Year	
	1.	Serafimovska T., Stefanovski S., Erler J., Keckovski Z., Stefkov G., Mitevaska M., Darkovska Serafimovska M., Balkanov T., Tonic Ribarska J.	Does Cannabis Extract Obtained from Cannabis Flowers with Maximum Allowed Residual Level of Aflatoxins and Ochratoxin A have an Impact on Human Safety and Health?	<i>Front. Med.</i> , 2021, 8:759856. doi: 10.3389/fmed.2021.759856 IF 5,091	

		2.	Aleksandra Chakarjanevska, Marika Bogoevska Nikolovska, Mirsada Dervisevic Andonov, Irena Slaveska Spirevska, Marija Karapandzova, Suzana Trajkovic Jolevska, Jasmina Tonic Ribarska	Stability study of Fluconazole capsules with Bracketing Design	<i>Macedonian pharmaceutical bulletin</i> , 69 (1), 2023
		3.	Veronika Popovska Jakimovska, Ana Atanasova, Filip Gogu, Maja Stevanoska, Emilija Arsovska Popovska, Packa Antovska, Suzana Trajkovic Jolevska, Jasmina Tonic Ribarska	Analytical Quality by Design approach in development and optimization of HPLC method for assay of 5 mg angiotensin – converting enzyme inhibitor in tablets	<i>Macedonian pharmaceutical bulletin</i> , 69 (1), 2023
		4.	Marija Tomich, Marijana Božinovska, Aleksandra Petrovska, Natasha Anevsk-Stojanovska, Jelena Lazova, Jelena Acevska, Katerina Brezovska, Jasmina Tonic Ribarska, Natalija Nakov	Sustainable and white HPLC method for simultaneous determination of amlodipine and atorvastatin in film-coated tablet	<i>Green Analytical Chemistry</i> . 2024 Feb 17:100103. IF 6,2
		5.	Godzo H, Gigopulu O, Brezovska K, Geshkovski N, Nakov N, Acevska J, Panovska AP, Tonic-Ribarska J.	PLS based quantitative determination of insulin aspart in solution using Raman spectroscopy	<i>Arh. farm.</i> 2024; 74: 206 – 215
10 .2.	Participation in National and International Research Projects (up to five)				
	No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project	

	1.	Participant	VI-SEEM, Project reference: 675121, VRE (Virtual Research Environment) for regional Interdisciplinary communities in Southeast Europe and the Eastern Mediterranean)	Type of project: International (Cyprus, Bulgaria, Serbia, Hungary, Romania, Albania, Bosnia and Herzegovina, Macedonia, Montenegro, Moldova, Armenia, Georgia, Egypt, Israel, Jordan) Financed by: EU programme Horizon 2020 Project length: 2015-2018
	2.	Principal Investigator	Impact of new EU regulatory requirements on quality assurance and safety monitoring of medical devices	Type of project: national Engagement: head of project Financed by: external subjects Project length: 2019-2021
	3.	Participant	Strengthening laboratory capacities for the detection of falsified medicines as part of the Republic of North Macedonia's strategy to combat medicine falsification	Ministry of Education and Science of the Republic of North Macedonia / 2020 - 2022
	4.	Participant	Approaches for the Development of Environmentally Friendly Chromatographic Methods in Pharmaceutical Analysis	Ss. Cyril and Methodius University in Skopje/ 2022-2023
	5.	Participant	Implementation of an Electrochemical Method with a Potentiostat for Simulation and Analysis of the Metabolism of Drugs Acting on the CNS	Ministry of Education and Science of the Republic of North Macedonia / 2024 - 2026
	10	Printed Books in the Last Five Years (up to five)		
3.	No.	Authors	Title	Publisher / Year

		1.	Katerina Ančevska-Netkovska, Aleksandra Grozdanova, Zoran Sterjev, Ana Poceva-Panovska, Jasmina Tonic-Ribarska, Katerina Brezovska	Intellectual Property Rights in Pharmacy	UKIM, Faculty of Pharmacy, 2021
	10	Published Professional Papers in the Last Five Years (up to five)			
	.4.	No.	Authors	Title	Publisher / Year
		1.	Aleksandra Ackovska, Aleksandra Grozdanova, Zoran Sterjev, Jasmina Tonic Ribarska , Katerina Ancevska Netkovska	The role of branding in the healthcare system with special review to healthcare institutions	<i>Knowledge International Journal- Medical sciences and health</i> , 2020, 41(3), 489-501.
		2.	Serafimovska T., Tonic Ribarska J., Trajkov D., Darkovska Serafimovska M., Stefkov Gj.	Approved indications for cannabis-based preparations	<i>IOSR Journal of Pharmacy</i> , 2021; 11(9):36-40.
11.	Mentorships				
	11	Diploma Theses		40	
	.1.				
	11	Master’s Theses		6	
	.2.				
	11	Doctoral Dissertations		4	
	.3.				
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
	.1.	No	Authors	Title	Publisher / Year

	1.	Katerina Ančevska Netkovska, Katerina Brezovska, Nikola Geškovski, Jasmina Tonić Ribarska, Biljana Petrovska Jakimovska, Blagoj Achevski, Katerina Goračinova	The role of intellectual property rights and package safety features in the prevention of counterfeit medicines	<i>Arh. farm.</i> , 2020, 70, 332–343
	2.	Serafimovska T., Stefanovski S., Erler J., Keckovski Z., Stefkov G., Mitevaska M., Darkovska Serafimovska M., Balkanov T., Tonic Ribarska J.	Does Cannabis Extract Obtained from Cannabis Flowers with Maximum Allowed Residual Level of Aflatoxins and Ochratoxin A have an Impact on Human Safety and Health?	<i>Front. Med.</i> , 2021, 8:759856. doi: 10.3389/fmed.2021.759856 IF 5,091
	3.	Mereme Idrizi, Blagoj Achevski, Hrisanta Godzo, Kristina Mitic, Ljupcho Pejov, Jasmina Tonic- Ribarska	Physico-Chemical Aspects of the Processes During the Combustion and Heating of Tobacco under Different Conditions: A Review	<i>Asian J. Chem.</i> , 2023, 35(6), 1296-1302
	4.	Olga Gigopulu, Hrisanta Godzo, Biljana Atanasovska, Marija Zafirova Gjorgievska, Ana Poceva Panovska, Jasmina Tonic- Ribarska, Jelena Acevska, Katerina Brezovska, Natalija Nakov	Green RP-HPLC method for impurity profile of amlodipine in tablets	<i>Arh. farm.</i> 2024; 74: 216 – 234

		5.	Marija Tomich, Marijana Božinovska, Aleksandra Petrovska, Natasha Anevsk-Stojanovska, Jelena Lazova, Jelena Acevska, Katerina Brezovska, Jasmina Tonic Ribarska, Natalija Nakov	Sustainable and white HPLC method for simultaneous determination of amlodipine and atorvastatin in film-coated tablet	<i>Green Analytical Chemistry</i> . 2024 Feb 17:100103. IF 6,2
		6.	Godzo H, Gigopulu O, Brezovska K, Geshkovski N, Nakov N, Acevska J, Panovska AP, Tonic-Ribarska J	PLS based quantitative determination of insulin aspart in solution using Raman spectroscopy	<i>Arh. farm.</i> 2024; 74: 206 – 215
	12 .2.	Evidence of at least two published research papers in international peer-reviewed journals with an impact factor in the relevant field within the past five years			
		1.	Serafimovska T., Stefanovski S., Erler J., Keckovski Z., Stefkov G., Mitevsk M., Darkovska Serafimovska M., Balkanov T., Tonic Ribarska J.	Does Cannabis Extract Obtained from Cannabis Flowers with Maximum Allowed Residual Level of Aflatoxins and Ochratoxin A have an Impact on Human Safety and Health?	<i>Front. Med.</i> , 2021, 8:759856. doi: 10.3389/fmed.2021.759856 IF 5,091
		2.	Marija Tomich, Marijana Božinovska, Aleksandra Petrovska, Natasha Anevsk-Stojanovska, Jelena Lazova, Jelena Acevska, Katerina Brezovska, Jasmina Tonic Ribarska, Natalija Nakov	Sustainable and white HPLC method for simultaneous determination of amlodipine and atorvastatin in film-coated tablet	<i>Green Analytical Chemistry</i> . 2024 Feb 17:100103. IF 6,2
	12 .3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
		No	Authors	Title	Publisher / Year
					Authors

		1.	N. Nakov, L. Anastasova, M. Zafirova, G. Petrovska-Dimitrievska, J. Tonic-Ribarska, J. Acevska, K. Brezovska	Experience-based insights for switching to greener chromatographic methods	14th Central European Symposium on Pharmaceutical Technology (Ohrid, Macedonia 28-30 September)	2023
		2.	M. Tomik, M. Bozinovska, A. Petrovska, N. Anevska-Stojanovska, J. Lazova, J. Acevska, K. Brezovska, J. Tonic-Ribarska, N. Nakov	Robust, eco-friendly HPLC method for simultaneous determination of amlodipine and atorvastatin in pharmaceutical formulation	7th Green and sustainable chemistry conference (22 – 24 May, Dresden, Germany)	2023
		3.	A. Damjanoska, S. Radevski, C. Dolikjoska Trajkova, K. Brezovska, J. Tonikj-Ribarska, N. Nakov	Green silica-based HPLC method for quantification of cefalexin in capsules using dimethylisobutyl alcohol as a bio-renewable solvent	15th CESPT Conference, 25-27.09.2025, Bled, Slovenia	2025

No. 30	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Katerina Brezovska		
2.	Date of Birth	14.03.1976		
3.	Educational Qualification	VIII (Doctor of Sciences)		
4.	Academic and Professional Titles	Full Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate Studies in Pharmacy	2000	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master's Studies	2004	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral Studies (PhD)	2012	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Quality control of medicines
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Immunochemistry
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Full professor	Applied chemistry and instrumental pharmaceutical analysis and Quality control of medicines
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.1.	List of courses taught by the instructor in the first cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Quality control of medicines and Legislation	Master of Pharmacy, Ss. Cyril and Methodius University in Skopje,	
	2.	Bioorganic Chemistry	Master of Pharmacy, Ss. Cyril and Methodius University in Skopje,	
	3.	Instrumental Pharmaceutical Analyses	Master of Pharmacy, Ss. Cyril and Methodius University in Skopje,	
	4.	Laboratory Techniques and Instrumental Methods 2	Laboratory Bioengineering, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	5.	Legislation and Laboratory Management	Laboratory Bioengineering, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
9.2.	List of courses taught by the instructor in the second cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Quality Management of Testing in Analytical Laboratory	Master's Studies in Laboratory Analysis and Engineering in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	

		2.	Analysis of Pharmaceutical Substances and Products	Master's Studies in Laboratory Analysis and Engineering in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		3.	Pharmaceutical Legislation	Specialist Studies in Pharmaceutical Regulation, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		4.	Innovative and Generic Medicines	Specialist Studies in Pharmaceutical Regulation, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	9.3.	List of courses taught by the instructor in the third cycle of studies			
		No.	Course Title	Study Program / Institution	
		1.	Advanced Instrumental Techniques in Pharmaceutical Research	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		2.	Contemporary Trends and Research Approaches in Pharmaceutical Regulation	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		3.	Scientific Concepts and Approaches in Pharmaceutical Analysis	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		4.	Application of Principles of Green Chemistry in Pharmaceutical Analysis	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
10.	Selected Results in the Last Five Years				
	10.1.	Relevant Published Scientific Papers (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	B. Vulovska. Trifunovska, A. Atanasova, P. Antovska, J. Lazova, K. Brezovska, A. Dimitrovska, N. Nakov	Transformation model to green HPLC methods for lipophilic acidic compounds based on isoelutotropic series of elution solvents,	Microchemical Journal, (2025) Volume 213, 113853, ISSN 0026-265X, https://doi.org/10.1016/j.microc.2025.113853 .

	2.	Nakov, N., Anastasova, L., Gjorgievska, M. Z., Acevska, J., Brezovska, K., Petkovska, R., & Dimitrovska, A.	Green RP-HPLC methods for assay and related substances in rivaroxaban tablets.	Acta Chromatographica, (2024) 36(4), 371-382. https://doi.org/10.1556/1326.2023.01178 .
	3.	Tomikj, M., Božinovska, M., Anevska- Stojanovska, N., Lazova, J., Acevska, J., Brezovska, K., Tonich- Ribarska, J. and Nakov, N.	Sustainable and white HPLC method for simultaneous determination of amlodipine and atorvastatin in film- coated tablet.	Green Analytical Chemistry, (2024) 8, p.100103. https://doi.org/10.1016/j.greeac.2024.100103
	4.	E. Deconinck, P. Courselle, M. Raimondo, Y. Grange, H. Rebiere, A. Mihailova, O. Bøyum, J.K. Maurin, K. Piorunska- Sędlak, L. Stengelshøj Olsen, J. Acevska, K. Brezovska, T. Rundlof, M.J. Portela, M. Bertrand	GEONs API fingerprint project: Selection of analytical techniques for clustering of sildenafil citrate API samples	Talanta 239 (2022) 123123 https://doi.org/10.1016/j.talanta.2021.123123
	5.	H. Rebiere, Y. Grange, E. Deconinck, P. Courselle, J.Acevska, K. Brezovska, J. Maurin, T. Rundlöfb, M.J. Portela, L.S. Olsen, C. Offerlé, M. Bertrand	European fingerprint study on omeprazole drug substances using a multi analytical approach and chemometrics as a tool for the discrimination of manufacturing sources	Journal of Pharmaceutical and Biomedical Analysis 208 (2021) 114444 https://doi.org/10.1016/j.jpba.2021.114444
	10.2.	Participation in National and International Research Projects (up to five)		

		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	Approaches for the Development of Environmentally Friendly Chromatographic Methods in Pharmaceutical Analysis	Ss. Cyril and Methodius University in Skopje/ 2022-2023
		2.	Participant	Method Development Using Vibrational Spectroscopic Techniques Combined with Multivariate Analysis in Diverse Pharmaceutical Applications	2020-2023, UKIM, Faculty of Pharmacy
		3.	Principal Investigator	Strengthening laboratory capacities for the detection of falsified medicines as part of the Republic of North Macedonia's strategy to combat medicine falsification	Ministry of Education and Science of the Republic of North Macedonia / 2020 - 2022
		4.	Participant	Analysis of Nitrosamine Impurities in Active Substances and Finished Pharmaceutical Products	Ss. Cyril and Methodius University in Skopje/ 2020-2022
		5.	Principal Investigator	Building a national strategy for combating falsified medicines	National project 2016–2023
	10.3.	Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year

	1.	Nakov N, Acevska J, Brezovska K, Kavrovski Z, Dimitrovska A	Green Strategies toward Eco-Friendly HPLC Methods in Pharma Analysis. High Performance Liquid Chromatography - Recent Advances and Applications	IntechOpen; London, UK, 2023
	2.	Natalija Nakov, Jelena Acevska, Katerina Brezovska, Zoran Kavrovski, Aneta Dimitrovska.	Chromatographic Approaches for Physicochemical Characterisation of Compounds in CHROMATOGRAPHY: AT A GLANCE. 2021. Open Access eBooks, Las Vegas, USA.	Open Access eBooks, Las Vegas, USA / 2021, Chromatography At a Glance, Vol. 1, Chapter 1: 1-22
	3.	A. Dimitrovska, S. Trajkovic- Jolevska, K. Brezovska, J. Acevska	Evaluation of Chemical Substances for Pharmaceutical Use According to the European Pharmacopoeia	Fourth Edition, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, May 2021(Review published in UKIM Bulletin No. 1237, 01.05.2021)
	4.	A. Dimitrovska, Z. Kavrovski, K. Brezovska, J. Acevska, N. Nakov	Instrumental Pharmaceutical Analyses	Ss. Cyril and Methodius University in Skopje, Skopje, October 2020 (CIP: 615.074:543(075.8))
	5.	K. Ančevska Netkovska, A. Grozdanova, Z. Sterjev, A. Poceva Panovska, J. Tonić-Ribarska, K. Brezovska	Intellectual Property Rights in Pharmacy	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, (2021)
10.4.	Published Professional Papers in the Last Five Years (up to five)			
	No.	Authors	Title	Publisher / Year

	1.	Zulfikjari, S., Nakov, N., Godzo, H., Acevska, J., Arsova- Sarafinovska, Z. and Brezovska, K.,	Development of Green RP-HPLC method for determination of sorafenib in film- coated tablets.	Macedonian pharmaceutical bulletin, 70(2), pp.17-24. (2024)
	2.	E. Trajkovska Bojadjiska, H. Godzo, J. Acevska, N. Nakov, A. Dimitrovska, K. Brezovska	Evaluation of measurement uncertainty after optimization of the method for potentiometric titration of glycine	Macedonian pharmaceutical bulletin, 68 (1) 43 - 52 (2022)
	3.	G. Petrovska- Dimitrievska, J. Acevska, N. Nakov, M. Zafirova Gjorgievska, K. Brezovska	Impact of mobile phase on reverse-phase separation of polar basic compounds	Macedonian Pharmaceutical Bulletin, 68(1), 68 (1) 69 - 74 (2022)
	4.	I. Mitrevska, K. Brezovska, A.Dimitrovska, S. Memed- Sejfulah, S. Ugarkovic,	Optimization and statistical evaluation of discriminative dissolution method for bisoprolol immediate- release film coated tablets,	Macedonian Pharmaceutical Association Mac. Pharm. Bull. Vol. 66(1), 2020;
	5.	N. Nakov, J. Acevska, K. Brezovska, Z. Kavrovski, R. Petkovska, A. Dimitrovska	Characterization of physicochemical properties of substances using chromatographic separation methods	Macedonian Pharmaceutical Association / 2020, Macedonian Pharmaceutical Bulletin, Vol. 66 (Suppl. 1)
11.	Mentorships			
	11.1.	Diploma Theses	20	
	11.2.	Master's Theses	2	
	11.3.	Doctoral Dissertations	3 ongoing	
12.	For PhD Mentors: Selected Results in the Last Four/Five Years			
	12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years		

No	Authors	Title	Publisher / Year
1.	N.Velevska, E. Deconinck, H. Rebiere, N. Nakov, K. Brezovska, A. Atanasova, P. Antovska, J. Lazova, J. Acevska,	Simultaneous quantification of Ibuprofen and Paracetamol in combined tablet formulations by UV–VIS spectrophotometry and chemometric modelling	Next Research, Volume 2, Issue 3, (2025), 100559, ISSN 3050-4759, https://doi.org/10.1016/j.nexres.2025.100559 .
2.	Godzo, H., Gigopulu, O., Brezovska, K., Geshkovski, N., Nakov, N., Acevska, J., Panovska, A.P. and Tonic-Ribarska, J.,	PLS based quantitative determination of insulin aspart in solution using Raman spectroscopy.	Archives of Pharmacy, 74(Notebook 2), pp.206-215. (2024)
3.	Jelena Acevska, Michel Ulmschneider, Katerina Brezovska, Aneta Dimitrovska, Bruno Spieldenner	Data analysis – quality aspects	Macedonian pharmaceutical bulletin, 69 (Suppl 1) 215 - 216 (2023) Online ISSN 1857 - 8969 DOI: 10.33320/maced.pharm.bull.2023.69.03.105
4.	Angela Arsovska, Jelena Acevska, Katerina Brezovska, Hrisanta Godzo, Aneta Dimitrovska	Risk-based assessment of the possibility for falsification during post-marketing surveillance of medicines	Macedonian pharmaceutical bulletin, 69 (Suppl 1) 229 - 230 (2023) Online ISSN 1857 - 8969 DOI: 10.33320/maced.pharm.bull.2023.69.03.112
5.	Maja Hadzieva Gigovska, Natalija Nakov, Jelena Acevska, Katerina Brezovska, Aneta Dimitrovska, Jelena Lazova	Scientific approach and implementation of a measurement uncertainty in mass balance determination	Macedonian pharmaceutical bulletin, 68 (Suppl 1) 39 -40 (2022) Online ISSN 1857 - 8969 DOI:10.33320/maced.pharm.bull.2022.68.03.015
12.2.	Evidence of at least two published research papers in international peer-reviewed journals with an impact factor in the relevant field within the past five years		

	1.	Damjanoska A, Mitreska K, Petrova M, Acevska J, Brezovska K, Nakov N.	Dimethyl Isosorbide: An Innovative Bio-Renewable Solvent for Sustainable Chromatographic Applications	Molecules. 2025 24;30(13):2713. (IF 4.6) https://doi.org/10.3390/molecules30132713
	2.	Todorovski A, Geskovski N, Petreska M, Deconinck E, Rebière H, Nakov N, Brezovska K, Acevska J	Screening the capability of vibrational spectroscopic techniques for simultaneous quantification of vitamins B1, B6, and B12 in a powder blend	Vibrational Spectroscopy. 2024;133:103711. (IF 3.1) https://doi.org/10.1016/j.vibspec.2024.103711
	3.	M. Topkoska, M. Miloshevska, M. Piponski, I. Slaveska Spirevska, N. Nakov, K. Brezovska, J. Acevska	Greenness Assessment and Validation of HPLC Method for Simultaneous Determination of Resveratrol and Vitamin E in Dietary Supplements	Journal of AOAC INTERNATIONAL, 2024, 1–6 (IF 1.9) https://doi.org/10.1093/jaoacint/qsad131
	4.	N.Nakov, L.Anastasova, M. Zafirova Gjorgievska, J. Acevska, K.Brezovska, R.Petkovska, A.Dimitrovska	Green RP-HPLC methods for assay and related substances in rivaroxaban tablets	Acta Chromatographica, 2023 (IF 2.01) https://doi.org/10.1556/1326.2023.01178

	5.	E. Deconinck, P. Courselle, M. Raimondo, Y. Grange, H. Rebiere, A. Mihailova, O. Bøyum, J.K. Maurin, K. Piorunska-Sędlak, L. Stengelshøj Olsen, J. Acevska, K. Brezovska, T. Rundlof, M.J. Portela, M. Bertrand	GEONs API fingerprint project: Selection of analytical techniques for clustering of sildenafil citrate API samples	Talanta 239 (2022) 123123 https://doi.org/10.1016/j.talanta.2021.123123	
12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
	No	Authors	Title	Publisher / Year	Authors
	1.	A. Damjanoska, S. Radevski, C. Dolikjoska Trajkova, K. Brezovska, J. Tonikj-Ribarska, N. Nakov	Green silica-based HPLC method for quantification of cefalexin in capsules using dimethylisobutyl alcohol as a bio-renewable solvent	15th CESPT Conference, 25-27.09.2025, Bled, Slovenia	2025
	2.	B. V. Trifunovskaa, A. Atanasova, P. Antovska, J. Lazova, J. Acevska, K. Brezovska, J. Tonic-Ribarska, N. Nakov	Study of Elution Strength of Ethanol as “Green” Eluent in LC Analysis of Non-polar Acidic Compounds	27th Congress of the Society of Chemists and Technologists of Macedonia (SCTM), 25-28.09.2024 Ohrid, R. North Macedonia.	2024
	3.	N. Nakov, L. Anastasova, M. Zafirova, G. Petrovska-Dimitrievska, J. Tonic-Ribarska, J. Acevska, K. Brezovska	Experience-based insights for switching to greener chromatographic methods	14th Central European Symposium on Pharmaceutical Technology (Ohrid, Macedonia 28-30 September)	2023

		4.	M. Tomik, M. Bozinovska, A. Petrovska, N. Anevska-Stojanovska, J. Lazova, J. Acevska, K. Brezovska, J. Tonic-Ribarska, N. Nakov	Robust, eco-friendly HPLC method for simultaneous determination of amlodipine and atorvastatin in pharmaceutical formulation	7th Green and sustainable chemistry conference (22 – 24 May, Dresden, Germany)	2023
		5.	N. Nakov, J. Acevska, K. Brezovska, R. Petkovska, Z. Kavrakovski, A. Dimitrovska	Possibilities and challenges of "green" chromatographic solutions	7 th Congress of Pharmacy in Macedonia with international participation (Ohrid, Macedonia 5-9 October)	2022

No. 31	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Jelena Acevska		
2.	Date of Birth	15.06.1980		
3.	Educational Qualification	VIII (Doctor of Sciences)		
4.	Academic and Professional Titles	Full Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate Studies in Pharmacy	2004	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master's Studies	2011	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral Studies (PhD)	2015	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Quality control of medicines
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Quality control of medicines/ Pharmaceutical analysis
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Full professor	Applied chemistry and instrumental pharmaceutical analysis and Quality control of medicines
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.1.	List of courses taught by the instructor in the first cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Quality control of medicines and Legislation	Master of Pharmacy, Ss. Cyril and Methodius University in Skopje,	
	2.	Organic Chemistry applied to Pharmacy	Master of Pharmacy, Ss. Cyril and Methodius University in Skopje,	
	3.	Instrumental Pharmaceutical Analyses	Master of Pharmacy, Ss. Cyril and Methodius University in Skopje,	
	4.	Laboratory Techniques and Instrumental Methods 1 and 2	Laboratory Bioengineering, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	5.	Legislation and Laboratory Management	Laboratory Bioengineering, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
9.2.	List of courses taught by the instructor in the second cycle of studies			
	No.	Course Title	Study Program / Institution	
	1.	Quality Management of Testing in Analytical Laboratory	Master's Studies in Laboratory Analysis and Engineering in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	

		2.	Analysis of Pharmaceutical Substances and Products	Master's Studies in Laboratory Analysis and Engineering in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		3.	Pharmaceutical Legislation	Specialist Studies in Pharmaceutical Regulation, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		4.	Innovative and Generic Medicines	Specialist Studies in Pharmaceutical Regulation, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	9.3.	List of courses taught by the instructor in the third cycle of studies			
		No.	Course Title	Study Program / Institution	
		1.	Advanced Instrumental Techniques in Pharmaceutical Research	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		2.	Contemporary Trends and Research Approaches in Pharmaceutical Regulation	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
			Chemometric design and experimental data analysis	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		3.	Scientific Concepts and Approaches in Pharmaceutical Analysis	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
		4.	Application of Principles of Green Chemistry in Pharmaceutical Analysis	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
10.	Selected Results in the Last Five Years				
	10.1.	Relevant Published Scientific Papers (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Nakov, N., Anastasova, L., Gjorgievska, M. Z., Acevska, J., Brezovska, K., Petkovska, R., & Dimitrovska, A.	Green RP-HPLC methods for assay and related substances in rivaroxaban tablets.	Acta Chromatographica, (2024) 36(4), 371-382. https://doi.org/10.1556/1326.2023.01178 .

		2.	Tomikj, M., Božinovska, M., Anevska- Stojanovska, N., Lazova, J., Acevska, J., Brezovska, K., Tonich- Ribarska, J. and Nakov, N.	Sustainable and white HPLC method for simultaneous determination of amlodipine and atorvastatin in film- coated tablet.	Green Analytical Chemistry, (2024) 8, p.100103. https://doi.org/10.1016/j.greeac.2024.100103
		3.	E. Deconinck, P. Courselle, M. Raimondo, Y. Grange, H. Rebiere, A. Mihailova, O. Bøyum, J.K. Maurin, K. Piorunska- Sędłak, L. Stengelshøj Olsen, J. Acevska, K. Brezovska, T. Rundlof, M.J. Portela, M. Bertrand	GEONs API fingerprint project: Selection of analytical techniques for clustering of sildenafil citrate API samples	Talanta 239 (2022) 123123 https://doi.org/10.1016/j.talanta.2021.123123
		4.	H. Rebiere, Y. Grange, E. Deconinck, P. Courselle, J.Acevska, K. Brezovska, J. Maurin, T. Rundlöfb, M.J. Portela, L.S. Olsen, C. Offerlé, M. Bertrand	European fingerprint study on omeprazole drug substances using a multi analytical approach and chemometrics as a tool for the discrimination of manufacturing sources	Journal of Pharmaceutical and Biomedical Analysis 208 (2021) 114444 https://doi.org/10.1016/j.jpba.2021.114444
		5.	V.Cucuz, J.Cvejic, L.Torovic, Lj.Gojkovic- Bukarica, J.Acevska, A.Dimitrovska, T.M. S. Aldawoud, C.M.Galanaki	Design of experiments (DoE) to model phenolic compounds recovery from grape pomace using ultrasounds	J Food Sci Technol (2022) 59(7): 2913–2924 https://doi.org/10.1007/s13197-021-05317-9

	10.2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	Approaches for the Development of Environmentally Friendly Chromatographic Methods in Pharmaceutical Analysis	Ss. Cyril and Methodius University in Skopje/ 2022-2023
		2.	Participant/ Work package coordinator	Development of vibrational spectroscopy methods for rapid screening of phytocannabinoids in hemp and its preparations	Ss. Cyril and Methodius University in Skopje / Faculty of Pharmacy 2022-2023
		3.	Participant	Strengthening laboratory capacities for the detection of falsified medicines as part of the Republic of North Macedonia's strategy to combat medicine falsification	Ministry of Education and Science of the Republic of North Macedonia / 2020 - 2022
		4.	Participant	Analysis of Nitrosamine Impurities in Active Substances and Finished Pharmaceutical Products	Ss. Cyril and Methodius University in Skopje/ 2020-2022
		5.	Participant	Building a national strategy for combating falsified medicines	National project 2016–
	10.3.	Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year

		1.	Nakov N, Acevska J, Brezovska K, Kavrovski Z, Dimitrovska A	Green Strategies toward Eco-Friendly HPLC Methods in Pharma Analysis. High Performance Liquid Chromatography - Recent Advances and Applications	IntechOpen; London, UK, 2023
		2.	Natalija Nakov, Jelena Acevska, Katerina Brezovska, Zoran Kavrovski, Aneta Dimitrovska.	Chromatographic Approaches for Physicochemical Characterisation of Compounds in CHROMATOGRAPHY: AT A GLANCE. 2021. Open Access eBooks, Las Vegas, USA.	Open Access eBooks, Las Vegas, USA / 2021, Chromatography At a Glance, Vol. 1, Chapter 1: 1-22
		3.	A. Dimitrovska, S. Trajkovic- Jolevska, K. Brezovska, J. Acevska	Evaluation of Chemical Substances for Pharmaceutical Use According to the European Pharmacopoeia	Fourth Edition, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, May 2021(Review published in UKIM Bulletin No. 1237, 01.05.2021)
		4.	A. Dimitrovska, Z. Kavrovski, K. Brezovska, J. Acevska, N. Nakov	Instrumental Pharmaceutical Analyses	Ss. Cyril and Methodius University in Skopje, Skopje, October 2020 (CIP: 615.074:543(075.8))
	10.4.	Published Professional Papers in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	E. Trajkova Kovachovska, J.Acevska, K.Brezovska, S.Trajkovic, I.Mitrevska, S.Ugarkovic, A.Dimitrovska	Development of a stability-indicating method for evaluation of impurity profile of Atorvastatin film- coated tablets using cyano column based on core-shell technology	Macedonian Journal of Chemistry and Chemical Engineering, (2022) 41(1). 65- 76, DOI: https://doi.org/10.20450/mjcce.2022.2478

		2.	E. Trajkovska Bojadjiska, H. Godzo, J. Acevska, N. Nakov, A. Dimitrovska, K. Brezovska	Evaluation of measurement uncertainty after optimization of the method for potentiometric titration of glycine	Macedonian pharmaceutical bulletin, 68 (1) 43 - 52 (2022)
		3.	G. Petrovska- Dimitrievska, J. Acevska, N. Nakov, M. Zafirova Gjorgievska, K. Brezovska	Impact of mobile phase on reverse-phase separation of polar basic compounds	Macedonian Pharmaceutical Bulletin, 68(1), 68 (1) 69 - 74 (2022)
		4.	N. Nakov, J. Acevska, K. Brezovska, Z. Kavrovski, R. Petkovska, A. Dimitrovska	Characterization of physicochemical properties of substances using chromatographic separation methods	Macedonian Pharmaceutical Association / 2020, Macedonian Pharmaceutical Bulletin, Vol. 66 (Suppl. 1)
		5.	N.Vukicevic, A.Dimitovska, J.Acevska.	Pharmaceuticals in the Environment	Journal of GXP Compliance (2020) 24 (1)
		11.	Mentorships		
	11.1.	Diploma Theses	7		
	11.2.	Master's Theses	2		
	11.3.	Doctoral Dissertations	3 ongoing		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12.1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
	1.		N.Velevska, E. Deconinck, H. Rebiere, N. Nakov, K. Brezovska, A. Atanasova, P. Antovska, J. Lazova, J. Acevska,	Simultaneous quantification of Ibuprofen and Paracetamol in combined tablet formulations by UV-VIS spectrophotometry and chemometric modelling	Next Research, Volume 2, Issue 3, (2025), 100559, ISSN 3050-4759, https://doi.org/10.1016/j.nexres.2025.100559 .

		2.	Godzo, H., Gigopulu, O., Brezovska, K., Geshkovski, N., Nakov, N., Acevska, J., Panovska, A.P. and Tonic-Ribarska, J.,	PLS based quantitative determination of insulin aspart in solution using Raman spectroscopy.	Archives of Pharmacy, 74(Notebook 2), pp.206-215. (2024)
		3.	Jelena Acevska, Michel Ulmschneider, Katerina Brezovska, Aneta Dimitrovska, Bruno Spieldenner	Data analysis – quality aspects	Macedonian pharmaceutical bulletin, 69 (Suppl 1) 215 - 216 (2023) Online ISSN 1857 - 8969 DOI: 10.33320/maced.pharm.bull.202 3.69.03.105
		4.	Angela Arsovska, Jelena Acevska, Katerina Brezovska, Hrisanta Godzo, Aneta Dimitrovska	Risk-based assessment of the possibility for falsification during post-marketing surveillance of medicines	Macedonian pharmaceutical bulletin, 69 (Suppl 1) 229 - 230 (2023) Online ISSN 1857 - 8969 DOI: 10.33320/maced.pharm.bull.202 3.69.03.112
		5.	Gentiana Mehmeti, Nikola Geshkovski, Katerina Brezovska, Aneta Dimitrovska, Suzana Trajkovic Jolevska, Rumenka Petkovska, Jelena Acevska	Analytical strategy for discrimination between different origins of Metformin film- coated tablets	Macedonian pharmaceutical bulletin, 69 (1) 255 - 256 (2023) Online ISSN 1857 - 8969 DOI: 10.33320/maced.pharm.bull.202 3.69.03.125
	12.2.	Evidence of at least two published research papers in international peer-reviewed journals with an impact factor in the relevant field within the past five years			
		1.	Damjanoska A, Mitreska K, Petrova M, Acevska J, Brezovska K, Nakov N.	Dimethyl Isosorbide: An Innovative Bio- Renewable Solvent for Sustainable Chromatographic Applications	Molecules. 2025 24;30(13):2713. (IF 4.6) https://doi.org/10.3390/molecules30132713

		2.	Todorovski A, Geskovski N, Petreska M, Deconinck E, Rebière H, Nakov N, Brezovska K, Acevska J	Screening the capability of vibrational spectroscopic techniques for simultaneous quantification of vitamins B1, B6, and B12 in a powder blend	Vibrational Spectroscopy. 2024;133:103711. (IF 3.1) https://doi.org/10.1016/j.vibspec.2024.103711
		3.	M. Topkoska, M. Miloshevska, M. Piponski, I. Slaveska Spirevska, N. Nakov, K. Brezovska, J. Acevska	Greenness Assessment and Validation of HPLC Method for Simultaneous Determination of Resveratrol and Vitamin E in Dietary Supplements	Journal of AOAC INTERNATIONAL, 2024, 1–6 (IF 1.9) https://doi.org/10.1093/jaoacint/qsad131
		4.	N. Nakov, L. Anastasova, M. Zafirova Gjorgievska, J. Acevska, K. Brezovska, R. Petkovska, A. Dimitrovska	Green RP-HPLC methods for assay and related substances in rivaroxaban tablets	Acta Chromatographica, 2023 (IF 2.01) https://doi.org/10.1556/1326.2023.01178
		5.	E. Deconinck, P. Courselle, M. Raimondo, Y. Grange, H. Rebiere, A. Mihailova, O. Bøyum, J.K. Maurin, K. Piorunska-Sędkak, L. Stengelshøj Olsen, J. Acevska, K. Brezovska, T. Rundlof, M.J. Portela, M. Bertrand	GEONs API fingerprint project: Selection of analytical techniques for clustering of sildenafil citrate API samples	Talanta 239 (2022) 123123 https://doi.org/10.1016/j.talanta.2021.123123
		12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years		
	No	Authors	Title	Publisher / Year	Authors

		1.	B. V. Trifunovskaa, A. Atanasova, P. Antovska, J. Lazova, J. Acevska, K. Brezovska, J. Tonic-Ribarska, N. Nakov	Study of Elution Strength of Ethanol as "Green" Eluent in LC Analysis of Non-polar Acidic Compounds	27th Congress of the Society of Chemists and Technologists of Macedonia (SCTM), 25-28.09.2024 Ohrid, R. North Macedonia.	2024
		2.	N. Nakov, L. Anastasova, M. Zafirova, G. Petrovska-Dimitrievska, J. Tonic-Ribarska, J. Acevska, K. Brezovska	Experience-based insights for switching to greener chromatographic methods	14th Central European Symposium on Pharmaceutical Technology (Ohrid, Macedonia 28-30 September)	2023
		3.	M. Tomik, M. Bozinovska, A. Petrovska, N. Anevska-Stojanovska, J. Lazova, J. Acevska, K. Brezovska, J. Tonic-Ribarska, N. Nakov	Robust, eco-friendly HPLC method for simultaneous determination of amlodipine and atorvastatin in pharmaceutical formulation	7th Green and sustainable chemistry conference (22 – 24 May, Dresden, Germany)	2023
		4.	M. Miloshevska, I. Slaveska Spirevska, N. Nakov, A. Dimitrovska, J. Acevska	Semi-micro determination of water content in different varieties of Cannabis flower	8th Congress of Pharmacy with International Participation (Borovets, Bulgaria, 27-30 April)	2023
		5.	N. Nakov, J. Acevska, K. Brezovska, R. Petkovska, Z. Kavrovski, A. Dimitrovska	Possibilities and challenges of "green" chromatographic solutions	7 th Congress of Pharmacy in Macedonia with international participation (Ohrid, Macedonia 5-9 October)	2022

No. 32	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Natalija Nakov		
2.	Date of Birth	07.12.1982		
3.	Educational Qualification	VIII (Doctor of Sciences)		
4.	Academic and Professional Titles	Full Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate Studies in Pharmacy	2006	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master's Studies	2011	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral Studies (PhD)	2015	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Drug Analyses
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Applied chemistry and pharmaceutical analysis
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Full Professor	Applied chemistry and pharmaceutical analysis
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Physical chemistry for pharmacists	Master of Pharmacy / Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	2.	Instrumental pharmaceutical analysis	Master of Pharmacy / Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	3.	Green chemistry in pharmaceutical analysis	Master of Pharmacy / Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	4	Fundamentals and Safety in Laboratory Work	Laboratory Bioengineering, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	Quality Management of Testing in an Analytical Laboratory	Master's Studies in Laboratory Analysis and Engineering in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	
	2.	Green Analytical Methods (Advanced Level)	Master's Studies in Laboratory Analysis and Engineering in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	

		3.	Development and Validation of Analytical Methods	Master's Studies in Laboratory Analysis and Engineering in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
	9.	List of courses taught by the instructor in the third cycle of studies		
	3.	No.	Course Title	Study Program / Institution
		1.	Advanced Instrumental Techniques in Pharmaceutical Research	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		2.	Application of Green Chemistry Principles in Pharmaceutical Analyses	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		3.	Modern Approaches in Bioanalytical Analyses	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		4.	Scientific Concepts and Approaches in Pharmaceutical Analysis	Doctoral Studies in Pharmacy, Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
10.	Selected Results in the Last Five Years			
10	Relevant Published Scientific Papers (up to five)			
.1.	No.	Authors	Title	Publisher / Year
	1.	Trifunovska BV, Atanasova A, Antovska P, Lazova J, Brezovska K, Dimitrovska A, Nakov N	Transformation model to green HPLC methods for lipophilic acidic compounds based on isoelutropic series of elution solvents	Microchemical Journal. 2025;113853 (IF 5.1) https://doi.org/10.1016/j.micr.2025.113853
	2.	Damjanoska A, Mitreska K, Petrova M, Acevska J, Brezovska K, Nakov N.	Dimethyl Isosorbide: An Innovative Bio-Renewable Solvent for Sustainable Chromatographic Applications	Molecules. 2025 24;30(13):2713. (IF 4.6) https://doi.org/10.3390/molecules30132713
	3.	M. Tomikj, M.Bozinovska, N. Anevskaa-Stojanovska, J. Lazova,J. Acevska, K. Brezovska, J. Tonich-Ribarska, N. Nakov	Sustainable and white HPLC method for simultaneous determination of amlodipine and atorvastatin in film-coated tablet	Elsevier, Green Analytical Chemistry 8 (2024) 100103 (IF 6.2) https://doi.org/10.1016/j.greeac.2024.100103

		4.	Nakov N , Acevska J, Brezovska K, Kavrakovski Z, Dimitrovska A	Green Strategies toward Eco-Friendly HPLC Methods in Pharma Analysis. High Performance Liquid Chromatography - Recent Advances and Applications	IntechOpen; London, UK, 2023 Book chapter
		5.	N.Nakov , L.Anastasova, M. Zafirova Gjorgievska, J. Acevska, K.Brezovska, R.Petkovska, A.Dimitrovska	Green RP-HPLC methods for assay and related substances in rivaroxaban tablets	Acta Chromatographica, 2023 (IF 2.01) https://doi.org/10.1556/1326.2023.01178
	10	Participation in National and International Research Projects (up to five)			
	.2.	No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	Implementation of an Electrochemical Method with a Potentiostat for Simulation and Analysis of the Metabolism of Drugs Acting on the CNS	Ministry of Education and Science of the Republic of North Macedonia / 2024 - 2026
		2.	Principal Investigator	Approaches for the Development of Environmentally Friendly Chromatographic Methods in Pharmaceutical Analysis	Ss. Cyril and Methodius University in Skopje/ 2022-2023
		3.	Participant	Strengthening laboratory capacities for the detection of falsified medicines as part of the Republic of North Macedonia's strategy to combat medicine falsification	Ministry of Education and Science of the Republic of North Macedonia / 2020 - 2022

		4.	Participant	Method Development Using Vibrational Spectroscopic Techniques Combined with Multivariate Analysis in Diverse Pharmaceutical Applications	Ss. Cyril and Methodius University in Skopje/ 2020-2023
		5.	Participant	Analysis of Nitrosamine Impurities in Active Substances and Finished Pharmaceutical Products	Ss. Cyril and Methodius University in Skopje/ 2020-2022
	10	Printed Books in the Last Five Years (up to five)			
	3.	No.	Authors	Title	Publisher / Year
		1.	Natalija Nakov , Rumenka Petkovska, Zoran Kavrakovski	Textbook for Physical Chemistry for Pharmacists	Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje, 2024 ISBN 978-608-5037-05-6
		2.	Natalija Nakov , Rumenka Petkovska, Zoran Kavrakovski	Laboratory manual in fundamentals of physical chemistry	Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje, 2024 ISBN 978-608-5037-03-2
		3.	Nakov N , Acevska J, Brezovska K, Kavrakovski Z, Dimitrovska A	Green Strategies toward Eco-Friendly HPLC Methods in Pharma Analysis. High Performance Liquid Chromatography - Recent Advances and Applications	IntechOpen; London, UK, 2023
		4.	N. Nakov , J. Acevska, K. Brezovska, Z. Kavrakovski, A. Dimitrovska.	Chromatographic Approaches for Physicochemical Characterization of Compounds in CHROMATOGRAPHY: AT A GLANCE.	2021. Open Access eBooks, Las Vegas, USA
		5.	N. Nakov , A. Dimitrovska	Scientific approach for development of LC-MS/MS bioanalytic method	Eliva Press SRL, Chisinau, Moldova, Europe, 2022 ISBN: 978-99949-8-197-7
		6.	A. Dimitrovska, Z. Kavrakovski, K. Brezovska, J. Acevska, N. Nakov	Book Instrumental Pharmaceutical Analysis	Ss. Cyril and Methodius University in Skopje, 2020 CIP: 615.074:543(075.8)
	10	Published Professional Papers in the Last Five Years (up to five)			
	4.	No.	Authors	Title	Publisher / Year

		1.	M. Miloshevska, I. Slaveska Spirevska, N. Nakov , Gj.Stefkov, A. Dimitrovska, J. Acevska	Water content determination in different varieties of Cannabis flowers	Macedonian pharmaceutical bulletin, 69 (1) 67 - 75 (2023)
		2.	E. Trajkovska Bojadjiska, H. Godzo, J. Acevska, N. Nakov, A. Dimitrovska, K. Brezovska	Evaluation of measurement uncertainty after optimization of the method for potentiometric titration of glycine	Macedonian pharmaceutical bulletin, 68 (1) 43 - 52 (2022)
		3.	G. Petrovska-Dimitrievska, J. Acevska, N. Nakov , M. Zafirova Gjorgievska, K. Brezovska	Impact of mobile phase on reverse-phase separation of polar basic compounds	Macedonian Pharmaceutical Bulletin, 68(1), 68 (1) 69 - 74 (2022)
		4.	I. Maksimoska, H. Godzo, N. Nakov , I. Slavevska Spirevska, K. Brezovska, J. Acevska, J. Tonic Ribarska	Green potentiometric method for determination of sildenafil citrate in pharmaceutical dosage forms	IOSR Journal Of Pharmacy 2023, 13 (10):12-16
		5.	N. Nakov , J. Acevska, K. Brezovska, Z. Kavrovski, R. Petkovska, A. Dimitrovska	Characterization of physicochemical properties of substances using chromatographic separation methods	Macedonian Pharmaceutical Bulletin, Vol. 66 (1) 149 - 150 (2020)
		11.	Mentorships		
	11 .1.	Diploma Theses		11	
	11 .2.	Master’s Theses		3	
	11 .3.	Doctoral Dissertations		3 (ongoing)	
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
	No	Authors	Title	Publisher / Year	

		1.	Trifunovska BV, Atanasova A, Antovska P, Lazova J, Brezovska K, Dimitrovska A, Nakov N	Transformation model to green HPLC methods for lipophilic acidic compounds based on isoelutropic series of elution solvents	Microchemical Journal. 2025;113853 (IF 5.1) https://doi.org/10.1016/j.microc.2025.113853
		2.	Damjanoska A, Mitreska K, Petrova M, Acevska J, Brezovska K, Nakov N.	Dimethyl Isosorbide: An Innovative Bio-Renewable Solvent for Sustainable Chromatographic Applications	Molecules. 2025 24;30(13):2713. (IF 4.6) https://doi.org/10.3390/molecules30132713
		3.	M. Tomikj, M.Bozinovska, N. Anevskaa-Stojanovska, J. Lazova, J. Acevska, K. Brezovska, J. Tonich-Ribarska, N. Nakov	Sustainable and white HPLC method for simultaneous determination of amlodipine and atorvastatin in film-coated tablet	Elsevier, Green Analytical Chemistry 8 (2024) 100103 (IF 6.2) https://doi.org/10.1016/j.greac.2024.100103
		4.	Gigopulu O, Godzo H, Atanasovska B, Gjorgievska MZ, Panovska AP, Tonic-Ribarska J, Acevska J, Brezovska K, Nakov N	Green RP-HPLC method for impurity profile of amlodipine in tablets	Archives of Pharmacy. 2024;74(Notebook 2):216-34.
		5.	Godzo H, Gigopulu O, Brezovska K, Geshkovski N, Nakov N , Acevska J, Panovska AP, Tonic-Ribarska J.	PLS based quantitative determination of insulin aspart in solution using Raman spectroscopy	Archives of Pharmacy. 2024;74(Notebook 2):206-15.
	12	Evidence of at least two published research papers in international peer-reviewed journals with an impact factor in the relevant field within the past five years			
	.2.	1.	Trifunovska BV, Atanasova A, Antovska P, Lazova J, Brezovska K, Dimitrovska A, Nakov N	Transformation model to green HPLC methods for lipophilic acidic compounds based on isoelutropic series of elution solvents	Microchemical Journal. 2025;113853 (IF 5.1) https://doi.org/10.1016/j.microc.2025.113853

		2.	Damjanoska A, Mitreska K, Petrova M, Acevska J, Brezovska K, Nakov N.	Dimethyl Isosorbide: An Innovative Bio-Renewable Solvent for Sustainable Chromatographic Applications	Molecules. 2025 24;30(13):2713. (IF 4.6) https://doi.org/10.3390/molecules30132713
		3.	M. Tomikj, M. Bozinovska, N. Anevsk-Stojanovska, J. Lazova, J. Acevska, K. Brezovska, J. Tonich-Ribarska, N. Nakov	Sustainable and white HPLC method for simultaneous determination of amlodipine and atorvastatin in film-coated tablet	Elsevier, Green Analytical Chemistry 8 (2024) 100103 (IF 6.2) https://doi.org/10.1016/j.greeac.2024.100103
		4.	Todorovski A, Geskovski N, Petreska M, Deconinck E, Rebière H, Nakov N , Brezovska K, Acevska J	Screening the capability of vibrational spectroscopic techniques for simultaneous quantification of vitamins B1, B6, and B12 in a powder blend	Vibrational Spectroscopy. 2024;133:103711. (IF 3.1) https://doi.org/10.1016/j.vibspec.2024.103711
		5.	M. Topkoska, M. Miloshevska, M. Piponski, I. Slaveska Spirevska, N. Nakov , K. Brezovska, J. Acevska	Greenness Assessment and Validation of HPLC Method for Simultaneous Determination of Resveratrol and Vitamin E in Dietary Supplements	Journal of AOAC INTERNATIONAL, 2024, 1–6 (IF 1.9) https://doi.org/10.1093/jaoacint/qsad131
		6.	N. Nakov , L. Anastasova, M. Zafirova Gjorgievska, J. Acevska, K. Brezovska, R. Petkovska, A. Dimitrovska	Green RP-HPLC methods for assay and related substances in rivaroxaban tablets	Acta Chromatographica, 2023 (IF 2.01) https://doi.org/10.1556/1326.2023.01178

		7.	M. Tomikj, M. Bozinovska, N. Anevsk-Stojanovska, J. Lazova, R. Petkovska, L. Anastasova, N. Nakov	Eco-friendly RP-HPLC method for determination of diazepam in coated tablet	The Macedonian Journal of Chemistry and Chemical Engineering, 42(2), 2023 (IF 1.0) https://doi.org/10.20450/mjcce.2023.2683
		8.	N. Nakov , K. Brezovska, V. Karchev, J. Acevska, A. Dimitrovska	Chromatographic and surfactant based potentiometric determination of aqueous dissociation constant of mupirocin	Current Analytical Chemistry (2020) 16:158-165 (IF 1.5) https://doi.org/10.2174/1573411014666180704125016
12 .3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
	No	Authors	Title	Publisher	Year
	1.	A. Damjanoska, S. Radevski, C. Dolikjoska Trajkova, K. Brezovska, J. Tonikj-Ribarska, N. Nakov	Green silica-based HPLC method for quantification of cefalexin in capsules using dimethylisosorbide as a bio-renewable solvent	15th CESPT Conference, 25-27.09.2025, Bled, Slovenia	2025
	2.	B. V. Trifunovskaa, A. Atanasova, P. Antovska, J. Lazova, J. Acevska, K. Brezovska, J. Tonic-Ribarska, N. Nakov	Study of Elution Strength of Ethanol as “Green” Eluent in LC Analysis of Non-polar Acidic Compounds	27th Congress of the Society of Chemists and Technologists of Macedonia (SCTM), 25-28.09.2024 Ohrid, R. North Macedonia.	2024
	3.	N. Nakov , L. Anastasova, M. Zafirova, G. Petrovska-Dimitrievska, J. Tonic-Ribarska, J. Acevska, K. Brezovska	Experience-based insights for switching to greener chromatographic methods	14th Central European Symposium on Pharmaceutical Technology (Ohrid, Macedonia, 28-30 September)	2023

		4.	M. Tomik, M. Bozinovska, A. Petrovska, N. Anevsk-Stojanovska, J. Lazova, J. Acevska, K. Brezovska, J. Tonic-Ribarska, N. Nakov	Robust, eco-friendly HPLC method for simultaneous determination of amlodipine and atorvastatin in pharmaceutical formulation	7th Green and sustainable chemistry conference (22 – 24 May, Dresden, Germany)	2023
		5.	M. Miloshevska, I. Slaveska Spirevska, N. Nakov , A. Dimitrovska, J. Acevska	Semi-micro determination of water content in different varieties of Cannabis flower	8th Congress of Pharmacy with International Participation (Borovets, Bulgaria, 27-30 April)	2023
		6.	N. Nakov , J. Acevska, K. Brezovska, R. Petkovska, Z. Kavrovski, A. Dimitrovska	Possibilities and challenges of "green" chromatographic solutions	7 th Congress of Pharmacy in Macedonia with international participation (Ohrid, Macedonia 5-9 October)	2022

No. 33	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Liljana Anastasova		
2.	Date of Birth	20.12.1983		
3.	Educational Qualification	VIII (Doctor of Philosophy)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate studies in Pharmacy	2007	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master's degree studies	2011	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Ph.D. studies	2015	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical sciences and healthcare	Pharmacy	Pharmaceutical analysis
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical sciences and healthcare	Pharmacy	Applied chemistry and pharmaceutical analysis
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Faculty of pharmacy, University of Ss. Cyril and Methodius, Skopje	Full professor	Applied Chemistry and pharmaceutical analysis
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Inorganic chemistry applied in pharmacy	Master of pharmacy, Faculty of Pharmacy, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	2.	General and inorganic chemistry	Bachelor in laboratory biomedical engineering, Faculty of Pharmacy, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	3.	Chemistry of physiological macro and microelements	Bachelor in dietetics/dietotherapy, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	Application of modern instrumental techniques for analysis: AAS and AES	Master's degree studies in laboratory biomedical engineering Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	2.	Food science	Master's degree studies in dietetics/dietotherapy Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
9.	List of courses taught by the instructor in the third cycle of studies			
3.	No.	Course Title	Study Program / Institution	

		1.	Stability studies in the pharmaceutical drug development	Ph.D. studies in pharmacy, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje
		2.	Chemometrics for design of experiments and data analysis	Ph.D. studies in pharmacy, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje
10.	Selected Results in the Last Five Years			
10	Relevant Published Scientific Papers (up to five)			
.1.	No.	Authors	Title	Publisher / Year
	1.	B. Pajaziti, M. Andrasi, D. Nebija, B. A. Pajaziti, L. Anastasova, R. Petkovska	Chemometrics approach for optimization of capillary electrophoretic conditions for the separation of insulin analogues	Pharmazie 76, 528-531, 2021. https://doi.org/10.1691/ph.2021.1758
	2.	M. Tomikj, M. Bozinovska, N. Anevsk-Stojanovska, J. Lazova, R. Petkovska, L. Anastasova, N. Nakov.	Eco-friendly RP-HPLC method for determination of diazepam in coated tablet	The Macedonian Journal of Chemistry and Chemical Engineering, 42(2): 153-163, 2023 https://doi.org/10.20450/mjcce.2023.2683
	3.	Natalija Nakov, Liljana Anastasova, Marija Zafirova Gjorgievska, Jelena Acevska, Katerina Brezovska, Rumenska Petkovska and Aneta Dimitrovska	Green RP-HPLC methods for assay and related substances in rivaroxaban tablets	Acta Chromatographica, 36(4): 371-382, 2024. https://doi.org/10.1556/1326.2023.01178
	4.	Shutevska K, Bajatovska AM, Anastasova L, Zhivikj Z, Zafirova Gjorgievska M, Spasikj S, Petreska Ivanovska T, Makreski P, Geskovski N	Rapid quantification models for assessing melamine adulteration in sport nutrition supplements via benchtop and portable NIRS instruments	Spectrochim Acta A Mol Biomol Spectrosc. 2024 Sep 5;317:124370. doi: 10.1016/j.saa.2024.124370

	5.	M. Bujaroska Perkovikj, Liljana Anastasova, Aleksandar Stankov, Zoran Zhivikj, Verica Poposka, Lidija Petrushevska Tozi	The role of alcohol and patterns of alcohol-related deaths in Republic of North Macedonia within the period 2007–2020	Forensic Sci Med Pathol. 20, 933–940, 2024 https://doi.org/10.1007/s12024- 023-00748-6
10	Participation in National and International Research Projects (up to five)			
.2.	No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
	1.	Participant	Approaches for the Development of Environmentally Friendly Chromatographic Methods in Pharmaceutical Analysis	University of Ss. Cyril and Methodius in Skopje 2022-2023
	2.	Participant	Method Development Using Vibrational Spectroscopic Techniques coupled with Multivariate Analysis for different Pharmaceutical Applications	Ss. Cyril and Methodius University in Skopje, Faculty of pharmacy 2020-2023
	3.	Participant	Strengthening laboratory capacities for the detection of falsified medicines as part of the Republic of North Macedonia’s strategy to combat medicine falsification	Ministry of Science and Education of Republic of North Macedonia 2020 - 2022
	4.	Participant	Nitrosamine impurity analysis in pharmaceutical active substances and in pharmaceutical products	University of Ss. Cyril and Methodius in Skopje 2020 - 2022
10	Printed Books in the Last Five Years (up to five)			
.3.	No.	Authors	Title	Publisher / Year

		1.	Anastasova L., Petkovska R.	A Chemometrics-driven strategy for assessment of treatment efficacy: contemporary approach towards effective and individualized treatments	BP International India, United Kingdom, 2023 https://doi.org/10.9734/bpi/cpmr/v5/6057C
		2.	Rumenka Petkovska, Liljana Bogdanovska	Study guide for laboratory exercises and calculations in general and inorganic chemistry	Faculty of Pharmacy, UKIM, Skopje, 2023 ISBN 978-9989-9564-9-2
		3.	Rumenka Petkovska, Liljana Bogdanovska	Study guide for calculations in inorganic chemistry applied in pharmacy	Faculty of Pharmacy, UKIM, Skopje, 2023 ISBN 978-608-5037-00-1
		4.	Liljana Anastasova, Rumenka Petkovska	Inorganic chemistry applied in pharmacy – study guide, 2 nd Ed.	Faculty of Pharmacy, UKIM, Skopje, 2025 ISBN 978-608-5037-11-7
10	Published Professional Papers in the Last Five Years (up to five)				
4.	No.	Authors	Title	Publisher / Year	
	1.	K. Grncharoska, E. Lazarevska Todevska, I. Slavevska Spirevska, T. Bakovska Stoimenova, B. Achevski, L. Anastasova, R. Petkovska	A stability-indicating HPLC method for determination of folic acid and its related substances in tablets	Macedonian Pharmaceutical Bulletin, 68(1), 27-36, 2022 DOI:10.33320/maced.pharm.bull.2022.68.01.003	
	2.	T. Achkoska, M. Bozhinovska, A. Arnaudova, P. Antovska, L. Anastasova, R. Petkovska	Bootstrap analysis for dissolution similarity factor f_2 – bringing confidence for borderline results – a case study	Macedonian Pharmaceutical Bulletin, 68(2), 97-102, 2022 DOI:10.33320/maced.pharm.bull.2022.68.02.010	
	3.	Keti Nonevska-Vaneva, Liljana Anastasova, Rumenka Petkovska	Medical oxygen: quality assurance and quality control practices for safe and effective application	Macedonian pharmaceutical bulletin, 70 (2), 47 – 55, 2024 DOI: 10.33320/maced.pharm.bull.2024.70.02.007	

		4.	Dejan Stefanovski, Liljana Anastasova, Rumenka Petkovska, Lidija Petrushevska-Tozi, Zorica Arsova- Sarafinowska	Method performance verification and measurement uncertainty evaluation for determination of total active matter content in shampoos	Macedonian Pharmaceutical Bulletin, 71(1), 63-70, 2025 DOI: 10.33320/maced.pharm.bull.202 5.71.01.007
		5.	Laura Ajdari, Liljana Anastasova, Lidija Petrushevska Tozi, Rumenka Petkovska, Rejhan Muhamed Xhumkar, Biljana Manevska	Application of an ICP- MS method for determination of metal content in whey protein supplements	Macedonian Pharmaceutical Bulletin, 71(2), 87-94, 2025 DOI: 10.33320/maced.pharm.bull.202 5.71.02.009
11.	Mentorships				
	11 .1.	Diploma Theses		30	
	11 .2.	Master's Theses		1	
	11 .3.	Doctoral Dissertations		1 (ongoing)	
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	B. Pajaziti, M. Andrasi, D. Nebija, B. A. Pajaziti, L. Anastasova, R. Petkovska	Chemometrics approach for optimization of capillary electrophoretic conditions for the separation of insulin analogues	Pharmazie 76, 528-531, 2021 doi: 10.1691/ph.2021.1758
		2.	M. Tomikj, M. Bozinovska, N. Anevaska- Stojanovska, J. Lazova, R. Petkovska, L. Anastasova, N. Nakov.	Eco-friendly RP-HPLC method for determination of diazepam in coated tablet	The Macedonian Journal of Chemistry and Chemical Engineering, 42(2): 153-163, 2023 https://doi.org/10.20450/mjce.2023.2683

	3.	Anastasova L., Petkovska R.	A Chemometrics-driven strategy for assessment of treatment efficacy: contemporary approach towards effective and individualized treatments	BP International India United Kingdom, 2023
	4.	M. Bujaroska Perkovikj, Liljana Anastasova, Aleksandar Stankov, Zoran Zhivikj, Verica Poposka, Lidija Petrushevska Tozi	The role of alcohol and patterns of alcohol-related deaths in Republic of North Macedonia within the period 2007–2020	Forensic Sci Med Pathol. 20, 933–940, 2024 https://doi.org/10.1007/s12024-023-00748-6
	5.	Shutevska K, Bajatovska AM, Anastasova L, Zhivikj Z, Zafirova Gjorgievska M, Spasikj S, Petreska Ivanovska T, Makreski P, Geskovski N	Rapid quantification models for assessing melamine adulteration in sport nutrition supplements via benchtop and portable NIRS instruments	Spectrochim Acta A Mol Biomol Spectrosc. 2024 Sep 5;317:124370. doi: 10.1016/j.saa.2024.124370
	6.	Natalija Nakov, Liljana Anastasova, Marija Zafirova Gjorgievsk a, Jelena Acevska, Katerina Brezovska, Rumenka Petkovska, Aneta Dimitrovska	Green RP-HPLC methods for assay and related substances in rivaroxaban tablets	Acta Chromatographica, 36(4):3 71-382, 2024 IF=2,0 https://doi.org/10.1556/1326.2023.01178
12	Evidence of at least two Published Scientific Research Papers in Peer Reviewed			
.2.	Journals in the Given Field in the Last Five Years			
	1.	Shutevska K, Bajatovska AM, Anastasova L, Zhivikj Z, Zafirova Gjorgievska M, Spasikj S, Petreska Ivanovska T, Makreski P, Geskovski N	Rapid quantification models for assessing melamine adulteration in sport nutrition supplements via benchtop and portable NIRS instruments	Spectrochim Acta A Mol Biomol Spectrosc. 2024 Sep 5;317:124370. https://doi.org/10.1016/j.saa.2024.124370

		2.	B. Pajaziti, M. Andrasi, D. Nebija, B. A. Pajaziti, L. Anastasova, R. Petkovska	Chemometrics approach for optimization of capillary electrophoretic conditions for the separation of insulin analogues	Pharmazie 76, 528-531, 2021 doi: 10.1691/ph.2021.1758
		3.	M. Tomikj, M. Bozinovska, N. Anevsk-Stojanovska, J. Lazova, R. Petkovska, L. Anastasova, N. Nakov	Eco-friendly RP-HPLC method for determination of diazepam in coated tablet	The Macedonian Journal of Chemistry and Chemical Engineering, 42(2): 153-163, 2023 https://doi.org/10.20450/mjcce.2023.2683
		4.	Natalija Nakov, Liljana Anastasova, Marija Zafirova Gjorgievska, Jelena Acevska, Katerina Brezovska, Rumenka Petkovska, Aneta Dimitrovska	Green RP-HPLC methods for assay and related substances in rivaroxaban tablets	Acta Chromatographica, 36(4):371-382, 2024 https://doi.org/10.1556/1326.2023.01178
		5.	M. Bujaroska Perkovikj, Liljana Anastasova, Aleksandar Stankov, Zoran Zhivikj, Verica Poposka, Lidija Petrushevska Tozi	The role of alcohol and patterns of alcohol-related deaths in Republic of North Macedonia within the period 2007–2020	Forensic Sci Med Pathol. 20, 933–940, 2024 https://doi.org/10.1007/s12024-023-00748-6
	12.3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
	No	Authors	Title	International Conference	Year
	1.	N. Nakov, L. Anastasova, M. Zafirova, G. Petrovska-Dimitrievska, J. Tonic-Ribarska, J. Acevska, K. Brezovska	Experience-based insights for switching to greener chromatographic methods	14th Central European Symposium on Pharmaceutical Technology (Ohrid, Macedonia 28-30 September)	2023

		2.	M. Bujaroska, L. Anastasova, Z. Zhivikj, Z. Bozhinoska, G. Pavlovski, N. Bitoljanu, V. Belakaposka Srpanova, L. Petrushevska- Tozi	Alcohol involvement in fatal traffic accidents	7 th Congress of Pharmacy in Macedonia with international participation (Ohrid, Macedonia, 5-9 October)	2022
		3.	B. Pajaziti, M. András, L. Anastasova, D. Nebija, B. Pajaziti, R. Petkovska	Application of experimental design for determination of insulin analogs	7 th Congress of Pharmacy in Macedonia with international participation (Ohrid, Macedonia, 5-9 October)	2022

No. 34	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Olga Gigopulu		
2.	Date of Birth	01.09.1993		
3.	Educational Qualification	VIII (Doctor of Sciences)		
4.	Academic and Professional Titles	Assistant Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Higher Education	2017	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Master's Degree	2017	Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy
		Doctoral Studies (PhD)	2025	Ss. Cyril and Methodius University in Skopje, Faculty of Natural Sciences and Mathematics
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical Sciences and Health	Pharmacy	Applied chemistry and pharmaceutical analysis
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Natural and Mathematical Sciences	Chemical Sciences	Chemistry

8.	If employed, the institution where the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Institution	Academic Title	Scientific Field
		Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy	Assistant Professor	<i>Applied Chemistry and Instrumental Pharmaceutical Analyses</i>
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
	9.	List of courses taught by the instructor in the first cycle of studies		
	1.	No.	Course Title	Study Program / Institution
		1.	Organic Chemistry Applied in Pharmacy	Master of Pharmacy, UKIM – Faculty of Pharmacy, Skopje.
		2.	Bioorganic Chemistry	Master of Pharmacy, UKIM – Faculty of Pharmacy, Skopje.
		3.	Fundamentals of Organic Chemistry	Laboratory Bioengineer, UKIM – Faculty of Pharmacy, Skopje.
	9.	List of courses taught by the instructor in the second cycle of studies		
	2.	No.	Course Title	Study Program / Institution
		1.	/	/
	9.	List of courses taught by the instructor in the third cycle of studies		
	3.	No.	Course Title	Study Program / Institution
		1.	<i>Modern Strategies in the Synthesis, Structural Analysis, and Characterization of New Pharmacologically Active Molecules.</i>	Doctoral studies in the field of Pharmacy, UKIM – Faculty of Pharmacy, Skopje.
10.	Selected Results in the Last Five Years			

10	1.	Relevant Published Scientific Papers (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Rafailovska, E.; Xhemaili, E.; Naumovska, Z.; Gigopulu, O. ; Miova, B.; Suturkova, L.; Stefkov, G.	Unlocking the Antidiabetic Potential of CBD: In Vivo Preclinical Studies	Pharmaceuticals 2025, 18, 446. https://doi.org/10.3390/ph18040446 2025
		2.	Gigopulu O , Geskovski N, Stefkov G, Poceva Panovska A, Piponski M, Slaveska Spirevska I, Makreski P.	Real-time monitoring of CBDA decarboxylation in solid state and cannabis flowers using mid infrared spectroscopy coupled with multivariate analysis	Vibrational Spectroscopy. 2024;134:103728. https://doi.org/10.1016/j.vibspec.2024.103728 2024
		3.	Makreski P.; Ivanoska-Dacikj A.; Geskovski N.; Gigopulu O. ; Bogoeva-Gaceva G.	Rapid and in-situ determination of epoxy equivalent weight of bisphenol-based epoxides by microRaman spectroscopy	Journal of Polymer Research. 2023;30(2):92. https://doi.org/10.1007/s10965-023-03471-6 2023
		4.	Gigopulu O. ; Geskovski N.; Stefkov G.; Stoilkovska Gjorgievska V.; Slaveska Spirevska I.; Huck C.W.; Makreski P.	A unique approach for in-situ monitoring of the THCA decarboxylation reaction in solid state	Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy. 2022;267:120471. https://doi.org/10.1016/j.saa.2021.120471 2022
		5.	Geskovski N.; Stefkov G.; Gigopulu O. ; Stefov S.; Huck C.W.; Makreski P.	Mid-infrared spectroscopy as process analytical technology tool for estimation of THC and CBD content in Cannabis flowers and extracts	Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy. 2021;251:119422. https://doi.org/10.1016/j.saa.2020.119422 2021
	2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	<i>Development of vibrational spectroscopic methods</i>	Bilateral project with the Republic of Austria, Ministry of Education and Science of the

			<i>for rapid monitoring of phytocannabinoids in hemp and related products.</i>	Republic of North Macedonia, 2022–2023.
	2.	Participant	<i>Harmonized and Sustainable Pharmaceutical Education for an Open Europe.</i>	KA220-HED – Cooperation Partnerships in Higher Education, 2024–2026.
	3.	Participant	<i>Phytochemical screening of Macedonian and related Chinese medicinal plants.</i>	Bilateral project with China, Ministry of Education and Science of the Republic of North Macedonia, 2020–2021.
		Participant	<i>Platform for integration, aggregation and storage of knowledge related to pharmaceutical sciences (PharmDataBorg).</i>	Faculty of Pharmacy – UKIM, Skopje, Republic of North Macedonia, 2022–2025.
		Participant	<i>Development of methods using vibrational spectroscopic techniques coupled with multivariate analysis in various fields of pharmaceutical interest.</i>	Faculty of Pharmacy, 2022–2024.
10	Printed Books in the Last Five Years (up to five)			
.3.	No.	Authors	Title	Publisher / Year
	1.	Ana Poceva-Panovska, Emil Popovski, Olga Gigopulu.	<i>Experimental Techniques and Syntheses in Organic Chemistry: Laboratory Manual</i>	UKIM, Faculty of Pharmacy, Skopje, 2022
10	Published Professional Papers in the Last Five Years (up to five)			
.4.	No.	Authors	Title	Publisher / Year
	1.	M. Zafirova Gjorgievska, G. Petrovska-Dimitrovska, V. Karchev, H.	Re-validation during method transfer examples in Official	Maced. Pharm. Bull. 68, Suppl 1 (2022) 81–82. https://doi.org/10.33320/maced.pharm.bull.2022.68.03.036 .

			Godzo, O. Gigopulu , L. Ugrinova	medicines control laboratories	
		2.	D. Dimkovikj, O. Gigopulu , Z. Naumovska, Z. Sterjev	Antidepressant and anxiolytic consumption during COVID-19 pandemic	Maced. Pharm. Bull. 68, Suppl 1 (2022) 477–478. https://doi.org/10.33320/maced.pharm.bull.2022.68.03.229
		3.	A. Dimkovski, E. Mihajloska, O. Gigopulu , Z. Naumovska, L. Suturkova, A. Poceva Panovska	Design and synthetic approach of novel hybrid molecules for treatment of Alzheimer’s disease	Maced. Pharm. Bull. 68 Suppl 1, (2022) 401–402. https://doi.org/10.33320/maced.pharm.bull.2022.68.03.193
		4.	O. Gigopulu , N. Geskovski, G. Stefkov, P. Makreski	THCA → THC conversion and its importance for the stability and quality of the herbal material	Maced. Pharm. Bull. 68, Suppl 2 (2022) 111–112. https://doi.org/10.33320/maced.pharm.bull.2022.68.04.049
		5.	H. Godzo, O. Gigopulu , J. Acevska, N. Geskovski, A. Poceva Panovska, B. Acevski, F. Dimoska, M. Nuneva, K. Brezovska	Application of ATR-FTIR as a screening method for analysis of biopharmaceutical preparations containing trastuzumab	Maced. Pharm. Bull. 69, Suppl. 1 (2023) 253–254. https://doi.org/10.33320/maced.pharm.bull.2023.69.03.124
11.	Mentorships				
	11 .1.	Diploma Theses		/	
	11 .2.	Master’s Theses		/	
	11 .3.	Doctoral Dissertations		/	
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	Gigopulu O , Geskovski N, Stefkov G, Poceva Panovska A, Piponski M,	Real-time monitoring of CBDA decarboxylation in solid state and cannabis flowers	Vibrational Spectroscopy. 2024;134:103728. https://doi.org/10.1016/j.vibspec.2024.103728 2024

			Slaveska Spirevska I, Makreski P.	using mid infrared spectroscopy coupled with multivariate analysis	
	2.		Gigopulu O. ; Geskovski N.; Stefkov G.; Stoilkovska Gjorgievska V.; Slaveska Spirevska I.; Huck C.W.; Makreski P.	A unique approach for in-situ monitoring of the THCA decarboxylation reaction in solid state	Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy. 2022;267:120471. https://doi.org/10.1016/j.saa.2021.120471 2022
	3.		Geskovski N.; Stefkov G.; Gigopulu O. ; Stefov S.; Huck C.W.; Makreski P.	Mid-infrared spectroscopy as process analytical technology tool for estimation of THC and CBD content in Cannabis flowers and extracts	Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy. 2021;251:119422. https://doi.org/10.1016/j.saa.2020.119422 2021
	4.		Rafailovska, E.; Xhemali, E.; Naumovska, Z.; Gigopulu, O. ; Miova, B.; Suturkova, L.; Stefkov, G.	Unlocking the Antidiabetic Potential of CBD: In Vivo Preclinical Studies	Pharmaceuticals 2025, 18, 446. https://doi.org/10.3390/ph18040446 2025
	5.		Gigopulu O , Godzo H, Atanasovska B, Gjorgievska MZ, Panovska AP, Tonic-Ribarska J, Acevska J, Brezovska K, Nakov N	Green RP-HPLC method for impurity profile of amlodipine in tablets	Archives of Pharmacy. 2024;74(Notebook 2):216-34.
	6.		Godzo H, Gigopulu O , Brezovska K, Geskovski N, Nakov N, Acevska J, Panovska AP, Tonic-Ribarska J.	PLS based quantitative determination of insulin aspart in solution using Raman spectroscopy	Archives of Pharmacy. 2024;74(Notebook 2):206-15.
	12 .2.	Proof of at least two published scientific research papers in international scientific journals with an impact factor in the given field within the last five years.			
		No	Authors	Title	Publisher / Year

	1.	Rafailovska, E.; Xhemaili, E.; Naumovska, Z.; Gigopulu, O. ; Miova, B.; Suturkova, L.; Stefkov, G.	Unlocking the Antidiabetic Potential of CBD: In Vivo Preclinical Studies	Pharmaceuticals 2025, 18, 446. https://doi.org/10.3390/ph18040446 2025	
	2.	Gigopulu O , Geskovski N, Stefkov G, Poceva Panovska A, Piponski M, Slaveska Spirevska I, Makreski P.	Real-time monitoring of CBDA decarboxylation in solid state and cannabis flowers using mid infrared spectroscopy coupled with multivariate analysis	Vibrational Spectroscopy. 2024;134:103728. https://doi.org/10.1016/j.vibspec.2024.103728 2024	
	3.	Makreski P.; Ivanoska-Dacikj A.; Geskovski N.; Gigopulu O. ; Bogoeva-Gaceva G.	Rapid and in-situ determination of epoxy equivalent weight of bisphenol-based epoxides by microRaman spectroscopy	Journal of Polymer Research. 2023;30(2):92. https://doi.org/10.1007/s10965-023-03471-6 2023	
	4.	Gigopulu O. ; Geskovski N.; Stefkov G.; Stoilkovska Gjorgievska V.; Slaveska Spirevska I.; Huck C.W.; Makreski P.	A unique approach for in-situ monitoring of the THCA decarboxylation reaction in solid state	Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy. 2022;267:120471. https://doi.org/10.1016/j.saa.2021.120471 2022	
	5.	Geskovski N.; Stefkov G.; Gigopulu O. ; Stefov S.; Huck C.W.; Makreski P.	Mid-infrared spectroscopy as process analytical technology tool for estimation of THC and CBD content in Cannabis flowers and extracts	Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy. 2021;251:119422. DOI: 10.1016/j.saa.2020.119422 2021	
	12 .3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
	No	Authors	Title	Publisher / Year	Authors

	1.	Olga Gigopulu, Gjoshe Stefkov, Nikola Geshkovski, Petre Makreski.	Novel Approach for Assessment of Berries as Natural Resources in North Macedonia: Integrating Multispectral Drone-Based Mapping, GIS and Ground-Based Research	The 6th Annual Conference and Training Program of Pan-Balkan Alliance of Natural Products	27-28.10.2025, Shanghai, China. Oral presentation
	2.	Olga Gigopulu, Gjoshe Stefkov, Nikola Geshkovski, Petre Makreski.	Exploring vibrational spectroscopic approaches for quantifying main phytocannabinoids in medicinal Cannabis sativa inflorescence	International Congress on Natural Products Research	Krakow, Poland, 13-17 July 2024
		O.Gigopulu.	Laboratory work on monographs	OMCL Network, 20th Annual Meeting	13-19.05. 2024, Ohrid, R. North Macedonia
	3.	O. Gigopulu, N. Geskovski, G. Stefkov, C. W. Huck, K. B. Beć, J. Grabska, P. Makreski.	NIR spectroscopy for monitoring the decarboxylation pathway of the main phytocannabinoids in Cannabis sativa,	21st International Conference on Near Infrared Spectroscopy, Book of Abstracts, p. 172 - 173,	Innsbruck, Austria, 20-24.09.2023
	4.	Olga Gigopulu	Real time monitoring of decarboxylation of cannabinoids	The Fourth Annual Conference and Training Program of Pan-Balkan Alliance of Natural Products and Drug Discovery Associations and	29.11-2.12.2023, Shanghai, China.

				in Cannabis sativa L.	International Seminar of UNESCO Regional Network of Natural Products Chemistry for Safety and Well-being in Asia and the Pacific	
		5.	I. Cvetkovikj Karanfilova; J. Gjorgievska; O. Gigopulu ; M. Karapandzova; V. Stoilkovska Gjorgievska; A. Trajkovska; I. Davkova; S. Kulevanova; G. Stefkov.	Assessment of silymarin content in plant material and extracts using HPLC and Raman spectroscopy	26th Congress of SCTM	20-23.09.2023, Ohrid, R. North Macedonia
		6.	I. Slaveska Spirevska, M. Osman Nikolov, O. Gigopulu , G. Stefkov, N. Geskovski, P. Makreski, J. Acevska.	NIR spectroscopy as a tool for estimation of moisture content / water content / water activity in Cannabis flowers	21st International Conference on Near Infrared Spectroscopy	Book of Abstracts, p. 375, Innsbruck, Austria, 20-24.08.2023

No. 35	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Blagoj Achevski		
2.	Date of Birth	22 July 1993		
3.	Educational Qualification	VIII level (Doctor of Sciences)		
4.	Academic and Professional Titles	Assistant Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Undergraduate studies in pharmacy	2017	Faculty of Pharmacy, Skopje
		Master's degree studies	2017	Faculty of Pharmacy, Skopje
		Ph.D. studies	2025	Institute of Chemistry, Faculty of Natural Sciences and Mathematics, Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical sciences and Healthcare	Pharmacy	Pharmacy
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Mathematics and natural sciences	Chemistry	Physical Chemistry
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	Faculty of Pharmacy, UKIM, Skopje	Assistant Professor	Applied Chemistry and Pharmaceutical Analysis (3.05.02.08)
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Fundamentals of Physical Chemistry	Bachelor in laboratory biomedical engineering, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	2.	Analytical Chemistry	Bachelor in laboratory biomedical engineering, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	3.	Laboratory Techniques and Instrumental Methods I	Bachelor in laboratory biomedical engineering, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	4.	Laboratory Techniques and Instrumental Methods II	Bachelor in laboratory biomedical engineering, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
	5.	Food analysis methods	Bachelor in dietetics/dietotherapy, Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.			
	2.			
	3			
9.	List of courses taught by the instructor in the third cycle of studies			
3.	No.	Course Title	Study Program / Institution	

		1.		
		2.		
		3.		
10.	Selected Results in the Last Five Years			
10	Relevant Published Scientific Papers (up to five)			
.1.	No.	Authors	Title	Publisher / Year
		Achevski B., Pejov Lj.	Molecular hydrogen as a hydrogen-bond proton acceptor: From protonated betaine tagging to the weakest hydrogen bond	Journal of Physical Chemistry A, 128, 3968–3981 (2024). https://doi.org/10.1021/acs.jpca.4c01331 IF=2,7
		Achevski B., Pejov Lj.	Understanding IRMPD spectra of hydrogen-tagged protonated betaine: Vibrational confinement counteracting hydrogen-bond-induced O–H stretching downshift	ChemPhysChem, 2401089, 26 (14). (2025) https://doi.org/10.1002/cphc.202401089 IF=2.2
10	Participation in National and International Research Projects (up to five)			
.2.	No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
	1.	Participant	Spectroscopy and dynamics of water at interfaces: Development of hybrid classical–quantum approaches	Bilateral project between Republic of Austria and Ministry of Education and Science of the Republic of North Macedonia, 2022–2023.
	2.	Participant	Hybrid quantum and molecular dynamics approaches for IR spectra in condensed phases	Bilateral project between Republic of Austria and Ministry of Education and Science of the Republic of North Macedonia 01.2024-12.2024

	3.	Participant	Strengthening laboratory capacities for the detection of falsified medicines as part of the Republic of North Macedonia's strategy to combat medicine falsification	Ministry of Science and Education of Republic of North Macedonia, 2021–2024
10	Printed Books in the Last Five Years (up to five)			
.3.	No.	Authors	Title	Publisher / Year
	1.			
10	Published Professional Papers in the Last Five Years (up to five)			
.4.	No.	Authors	Title	Publisher / Year
	1.	Achevski B., Tonikj-Ribarska J., Petkovska R., Pejov Lj.	Static and dynamic quantum-mechanical methods for exact interpretation of infrared multiple-photon dissociation spectra: Current status and perspectives	Macedonian Pharmaceutical Bulletin, 68 (Suppl. 1), 33–34 (2022) DOI:10.33320/maced.pharm.bul 1.2022.68.03.012
	2.	Idrizi M., Achevski B., Godzo H., Mitic K., Pejov L., Tonik-Ribarska J.	Physico-chemical aspects of combustion and heating processes of tobacco under differing conditions	Asian Journal of Chemistry, 35(6), 1296–1302 (2023) https://doi.org/10.14233/ajchem.2023.27728
	3.	Achevski B., Arsova F., Acevska J., Tonikj-Ribarska J., Brezovska K., Nakov N.	Systematic approach to proper control-chart design for Karl-Fischer titrators	Macedonian Pharmaceutical Bulletin, 68 (Suppl. 1), 63–64 (2022) DOI:10.33320/maced.pharm.bul 1.2022.68.03.027
	4.	Grncharoska K., Lazarevska-Todevska E., Slavevska-Spirevska I., Bakovska-Stoimenova T., Achevski B., Anastasova L., Petkovska R.	Stability-indicating HPLC method for folic acid and related substances in tablets	Macedonian Pharmaceutical Bulletin, 68(1), 27–36 (2022)
	5.			
11.	Mentorships			
.1.	11	Diploma Theses		

	11 .2.	Master's Theses				
	11 .3.	Doctoral Dissertations				
12.	For PhD Mentors: Selected Results in the Last Four/Five Years					
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years				
		No	Authors	Title	Publisher / Year	
		1.				
		2.				
		3.				
	12 .2.	4.				
		5.				
	12 .3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
		No	Authors	Title	Publisher / Year	Authors
		1.				
		2.				
3.						

No. 36	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Gjoshe Stefkov		
2.	Date of Birth	11.12.1973		
3.	Educational Qualification	VIII (Doctor of science)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		BSc Pharm	1998	UKIM, Faculty of Pharmacy - Skopje
		MSc	2005	UKIM, Faculty of Pharmacy - Skopje
		PhD	2011	UKIM, Faculty of Pharmacy - Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical sciences and healthcare	Pharmacy	Pharmacognosy
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical sciences and healthcare	Pharmacy	Pharmacognosy
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	UKIM, Faculty of Pharmacy - Skopje	Full professor	Pharmacognosy and Pharmaceutical botany
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Pharmaceutical botany and biology	Master of Pharmacy, UKIM, Faculty of Pharmacy - Skopje	
	2.	Pharmacognosy	Master of Pharmacy, UKIM, Faculty of Pharmacy - Skopje	
	3.	Phytotherapy	Master of Pharmacy, UKIM, Faculty of Pharmacy - Skopje	
	4.	Rational use of herbal preparations	Master of Pharmacy, UKIM, Faculty of Pharmacy - Skopje	
	5.	Sustainability in pharmaceutical practice	Master of Pharmacy, UKIM, Faculty of Pharmacy - Skopje	
		Regulation of herbal products	Laboratory bioengineer, UKIM, Faculty of Pharmacy - Skopje	
		Chemistry of food 2	Dietetics and dietotherapy, UKIM, Faculty of Pharmacy - Skopje	
		Odors and aromas in food production	Dietetics and dietotherapy, UKIM, Faculty of Pharmacy – Skopje	

		6.	Testing for mycotoxins, pesticides, drug residues and heavy metals in food	Dietetics and dietotherapy, UKIM, Faculty of Pharmacy - Skopje	
	9.	List of courses taught by the instructor in the second cycle of studies			
	2.	No.	Course Title	Study Program / Institution	
		1.	Methodology and Ethics of Scientific Research	Master's studies in laboratory analysis and engineering in pharmacy, Faculty of Pharmacy/ UKIM, Skopje	
			Analysis of mycotoxins in herbal raw materials, herbal preparations and food supplements	Master's studies in laboratory analysis and engineering in pharmacy, Faculty of Pharmacy/ UKIM, Skopje	
			Analysis of pesticide residues in herbal raw materials, herbal preparations and food supplements	Master's studies in laboratory analysis and engineering in pharmacy, Faculty of Pharmacy/ UKIM, Skopje	
	9.	List of courses taught by the instructor in the third cycle of studies			
	3.	No.	Course Title	Study Program / Institution	
		1.	Natural medicinal and aromatic raw materials	Doctoral studies in the scientific research field of pharmacy, Faculty of Pharmacy, UKIM, Skopje	
		2.	Ethnopharmacology	Doctoral studies in the scientific research field of pharmacy, Faculty of Pharmacy, UKIM, Skopje	
	10.	Selected Results in the Last Five Years			
	10	Relevant Published Scientific Papers (up to five)			
	.1.	No.	Authors	Title	Publisher / Year
		1.	Basholli-Salihu M, Loshaj-Shala A, Çunaku A, Lupçi V, Bağcı U, Haloci E, Stefkov G, Kryeziu T, Zimmer A.	Assessment of cytotoxic impact of wild grown Lavandula angustifolia essential oil encapsulated in liposomes and nanoemulsions on DU145 cancer cell line	Marmara University/ 2024 Journal of research in pharmacy IF=0.9
		2.	Piponski, M., Beneta, A., Stefkov, G., Cvetkovikj Karanfilova, I., Horyn, M., Zarivna, N., Ivanets, L. and Logoyda, L.	Approaches to the Development of New Simple Rapid HPLC–Photodiode Array Method for the Simultaneous Determination of Levomenthol and Ibuprofen in Gel Pharmaceutical Formulation.	Wiley/2025, Separation Science Plus, 8(11), IF=1.6

		3.	Rafailovska E, Xhemali E, Naumovska Z, Gigopulu O, Miova B, Shuturkova Lj, Stefkov Gj.	Unlocking the Antidiabetic Potential of CBD: In Vivo Preclinical Studies	MDPI/2025, Pharmaceuticals, 18(4), 446. IF=4,3
		4.	Trajkovska A, Tusevski O, Stoilkovska Gjorgievska V, Cvetkovikj Karanfilova I, Davkova I, Karapandzova M., Stefkov Gj, Kulevanova S, Gadzovska Simic S.	Cannabinoid production in various <i>Cannabis sativa</i> L. in vitro cultures	Springer/2025, Plant Cell, Tissue and Organ Culture (PCTOC), 160, 1-10. IF=2,5
		5.	Mihailova Lj., Tchekalarova J, Shalabalija D, Geskovski N, Stoilkovska Gjorgievska V, Stefkov Gj, Krasteva P, Simonoska Crcarevska M, Glavas Dodov M.	Lipid nano-carriers loaded with Cannabis sativa extract for epilepsy treatment – in vitro characterization and in vivo efficacy studies	Journal of Pharmaceutical Sciences, 111, 12, 3384-3396. IF=3,7
	10 .2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	“Green” analytical approaches in the evaluation of the quality of preparations and herbal raw material from <i>Silybum marianum</i> L.	UKIM, Faculty of Pharmacy – Skopje, 2023–2024

		2.	Participant	Application of vibrational spectroscopic techniques for rapid in situ characterization of samples of pharmaceutical interest	UKIM, Faculty of Pharmacy – Skopje, 2022-2025
		3.	Principal investigator	Stability analysis of cannabis and its derivatives and preparations.	Ministry of Education and Science of N. Macedonia, Skopje, 2022–2023
		4.	Participant	Development of vibrational spectroscopy methods for rapid screening of phytocannabinoids in hemp and its preparations	ADSI/MON, 2022-2023
		5.	Principal investigator	Pharmacognostic, phytochemical, pharmacological-biological and molecular analysis of different types of hemp (Cannabis spp.) and their products	UKIM, Faculty of Pharmacy – Skopje, 2020-2023
		10 .3. Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	S. Kulevanova, Gj. Stefkov,	Chemistry of secondary metabolites in food	UKIM, Faculty of Pharmacy – Skopje, 2023
		2	S. Kulevanova, Gj. Stefkov, M. Karapandzova, I. Cvetkovikj Karanfilova	Pharmacognosy: Natural Medicinal and Aromatic Raw Materials, 3rd Edition	UKIM, Faculty of Pharmacy – Skopje, 2023
	10 .4.	Published Professional Papers in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year

	1.	Stefkov Gj, Todorov F, Gjorgievska J, Cvetkovikj Karanfilova I, Karapandzova M, Jovanovska D, Hristovski S.	Digital Agriculture Approaches for Resource Assessment of Blueberry Yield on Kozuf Mountain (R. of North Macedonia) Integrating Remote Sensing, GIS and Ground-Based Research Data	ACG Publications/ 2025, Records of Agricultural and Food Chemistry, 5:1; 21 - 33
	2.	Mladenovska E, Cvetkovikj Karanfilova I, Stefkov Gj, Sterjev Z, Naumovska Z.	Role of pharmacovigilance of herbal and traditional herbal medicines.	WJPSR/2025, World Journal of Pharmaceutical Science and Research, 3(6) 19-14.
	3.	Stefkov Gj, Todorov F, Jachovski A, Stoilkovska Gjorgievska V, Trajkovska A, Davkova I, Cvetkovikj Karanfilova I, Karapandzova M., Jovanovska M, Hristovski S.	Empetrum nigrum in national park - Shar mountain: ecological significance, phytochemical profile and medicinal applications,	University of Tetovo/2025 ECOTEC International Journal of Sciences, Environment and Technology, 4 (7- 8), 31-38
	4.	Davkova I, Zhivikj I, Cvetkovikj Karanfilova I, Trajkovska A, Stoilkovska Gjorgievska V, Stefkov Gj, Kadifkova Panovska T, Karapandzova M.	Determination of chemical composition and cytotoxic activity of selected essential oils from Macedonian origin	WJSPR/2024, World Journal of Pharmaceutical Science and Research, 3(2), 257-266. IF=5,11
	5.	Gigopulu O, Geskovski N, Stefkov Gj, Stoilkovska Gjorgievska V, Slaveska Spirevska I, Huck C.W, Makreski P.	A unique approach for in-situ monitoring of the THCA decarboxylation reaction in solid state.	ScienceDirect/2022, Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 267, 120471. IF=4,3.
11.	Mentorships			
	11 .1.	Diploma Theses	75	

	11 .2.	Master's Theses	7		
	11 .3.	Doctoral Dissertations	5		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	Stoilkovska Gjorgievska V, Cvetkovikj Karanfilova I, Trajkovska A, Karapandzova M, Bauer Petrovska B, Kulevanova K, Stefkov Gj.	Monitoring of Cannabis Cultivar Technological Maturity by Trichome Morphology Analysis and HPLC Phytocannabinoid Content	Medknow Publications/2023, Pharmacognosy Research, 2023; 15(1):94-100.
		2.	Stoilkovska Gjorgievska V, Cvetkovikj Karanfilova I, Karapandzova M, Trajkovska A, Kulevanova S, Stefkov Gj.	Terpene profile in fresh flowers of outdoor cultivated commercial strains and wildtype of Cannabis	Macedonian pharmaceutical Society/2022, Macedonian Pharmaceutical Bulletin, 68(2), 113-114.
	12 .2.	Evidence of at least two published scientific research papers in international scientific journals with an impact factor in the given field in the last five years			
No		Authors	Title	Publisher / Year	
1.		Stoilkovska Gjorgievska V, Geskovski N, Makreski P, Trajkovska A, Cvetkovikj Karanfilova I, Karapandzova M., Kulevanova S, Stefkov Gj.	Differentiation of Cannabis seeds employing digital morphological screening and infrared spectroscopy coupled with multivariate modeling	ScienceDirect/2024, Industrial Crops and Products, 211, 1-10. IF=5,6.	

		2.	Stefkov, G., Cvetkovikj Karanfilova, I., Stoilkovska Gjorgievska, V., Trajkovska, A., Geskovski, N., Karapandzova, M., Kulevanova, S.	Analytical Techniques for Phytocannabinoid Profiling of Cannabis and Cannabis-Based Products-A Comprehensive Review.	MDPI/ 2022, Molecules, 27(3):975. IF=4.6.
12	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
.3.	No	Authors	Title	International meeting/conference	year
	1.	Cvetkovikj Karanfilova I, Stoilkovska Gjorgievska V, Trajkovska A, Davkova I, Todorov F, Ibraliu A, Karapandzova M, Stefkov Gj,	Overview of Juniper Berries' Essential Oil from the Western Balkans	PSE meeting 2025, Phytochemicals as drugs, foods and biocommunicators, 22- 24 October 2025 Madeira Island, Portugal	2025
	2.	Stoilkovska Gjorgievska V, Matevska- Geshkovska N, Krstevska Bozinovikj E, Cvetkovikj Karanfilova I, Trajkovska A, Davkova I, . Geskovski N, Karapandzova M, Stefkov Gj	Exploring link between cannabinoid content and molecular markers in Cannabis sativa L. cultivated plants from wild and commercial origin	PSE meeting 2025, Phytochemicals as drugs, foods and biocommunicators, 22- 24 October 2025 Madeira Island, Portugal	2025

		3.	Stoilkovska Gjorgievska V, Matevska-Geskovska N, Krstevska Bozinovikj E, Cvetkovikj Karanfilova I, Trajkovska A, Karapandzova M, Kulevanova S, Dimovski A, Stefkov Gj.	Assessing intra- and inter-variability of Macedonian wild-types and commercial Cannabis strains using STR markers. International Congress on Natural Products Research, Krakow, Poland, 13-17 July 2024.	International Congress on Natural Products Research, Krakow, Poland, 13-17 July 2024.	2024

No. 37	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Biljana Bauer		
2.	Date of Birth	21.08.1966		
3.	Educational Qualification	VIII (Doctor of science)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		BSc Pharm	1988	UKIM, Faculty of Pharmacy - Skopje
		MSc	1992	UKIM, Faculty of Pharmacy - Skopje
		PhD	2000	UKIM, Faculty of Pharmacy - Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical sciences and healthcare	Pharmacy	Pharmaceutical analysis
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical sciences and healthcare	Pharmacy	Pharmaceutical analysis
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	UKIM, Faculty of Pharmacy - Skopje	Full professor	Pharmaceutical botany History of Pharmacy
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Basics of Pharmacy	Master of Pharmacy, UKIM, Faculty of Pharmacy - Skopje	
	2.	Basics of pharmaceutical biology	Master of Pharmacy, UKIM, Faculty of Pharmacy - Skopje	
	3.	Pharmaceutical botany	Master of Pharmacy, UKIM, Faculty of Pharmacy - Skopje	
	4.	Pharmaceutical botany and biology	Master of Pharmacy, UKIM, Faculty of Pharmacy - Skopje	
	5.	General and cell biology	Laboratory bioengineer, UKIM, Faculty of Pharmacy - Skopje	
	6.	Basics of safety in laboratory work	Laboratory bioengineer, UKIM, Faculty of Pharmacy - Skopje	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	

		1.	Analysis of mycotoxins in herbal raw materials, herbal processing and food additives	Master's degree in laboratory analysis and engineering in pharmacy
	9.	List of courses taught by the instructor in the third cycle of studies		
	3.	No.	Course Title	Study Program / Institution
		1.	Etnopharmacology	Doctor of Pharmaceutical sciences, UKIM, Faculty of Pharmacy - Skopje
		2.	Medical mushrooms	Doctor of Pharmaceutical sciences, UKIM, Faculty of Pharmacy - Skopje
		3.	Medical and aromatic plants (morphology and ecology)	Doctor of Pharmaceutical sciences, UKIM, Faculty of Pharmacy - Skopje
10.	Selected Results in the Last Five Years			
10	Relevant Published Scientific Papers (up to five)			
.1.	No.	Authors	Title	Publisher / Year
	1.	Biljana Bauer, 1.	Traditional approach in prevention and treatment of COVID-19 in Republic of North Macedonia,	Macedonian Pharmaceutical bulletin, 2022; 68(2): 179-180
	2.	Demush Bajraktari, Lulzim Zeneli, Biljana Bauer,	Salix alba phytoremediation potential of heavy metals,	2. Macedonian Pharmaceutical bulletin, 2022; 68(2): 89-90
	3.	Veronika Stoilkovska Georgievska, Ivana Cvetkovic Karanfilova, Ana Trajkovska, Marija Karapandzova, Biljana Bauer , Svetlana Kulevanova, Gjosh Stevko,	Monitoring of Cannabis Cultivar Technological Maturity by Trichome Morphology Analysis and HPLC Phytocannabinoid Content,	Pharmacognosy Research, 2023; 15(1):94-100 DOI: 10.5530/097484900306
	4.	Sanja Kostadonovic Velickovska, Daniela Todevska, Fidanka Ilieva, Maja Chochevska, Elizabeta Janchovska Seniceva, Biljana Bauer ,	Wild raspberries from Republic of North Macedonia as a valuable source for healing vinegars,	Etnobotany, 5, 2025; 109-133
	5.	Biljana Bauer , Sanja Kostadonovic Velickovska,	The usage of medicinal plants thought history	Etnobotany, 5, 2025; 185-207

10	.2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	Purification of plant species from the Macedonian flora in terms of antioxidant activity and possible hepatoprotective effects	Ministry of Education and Science of the Republic of Macedonia, 2004-2007
		2.	Participant	Restructuring of Pharmacist education in Republic of Macedonia, European Commission TEMPUS program, 2004-2007	Project No CD_JEP18016-2003 European Commission TEMPUS program, 2004-2007
	.3.	3.	Participant	"Green" analytical approaches in assessing the quality of preparations and herbal raw materials from <i>Silybum marianum</i> L.	UKIM, Faculty of Pharmacy – Skopje, 2023-2024
		Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	B. Bauer Petrovska	Botany with Systematics	Ministry of Education and Science of the Republic of Macedonia, 2013
	.4.		B. Bauer Petrovska, B. Gerasimovska	Protection of the Working and Living Environment	Ministry of Education and Science of the Republic of Macedonia, 2011
		Published Professional Papers in the Last Five Years (up to five)			
	.4.	No.	Authors	Title	Publisher / Year

		1.	Toni Mickov, Biljana Bauer, Official control of food safety and quality, requirements for national reference laboratory, Macedonian Pharmaceutical bulletin, 2022; 67(2)	Official control of food safety and quality, requirements for national reference laboratory,	Macedonian Pharmaceutical bulletin, 2022; 67(2)
		2.	Dragica Doneva, Biljana Bauer, Determination of quercetin in dietary supplements by isocratic RP-HPLC method, Macedonian Pharmaceutical bulletin, 2022; 67(2)	Determination of quercetin in dietary supplements by isocratic RP-HPLC method,	Macedonian Pharmaceutical bulletin, 2022; 67(2)
		3.	Ramize Kruezi, Rejhan Muhamed Xhumkar, Zana Mustafa, Biljana Bauer , Validation of ion chromatographic method for determination of inorganic anions in drinking water, Macedonian Pharmaceutical bulletin, 2025; 71(1):31-41	Validation of ion chromatographic method for determination of inorganic anions in drinking water,	Macedonian Pharmaceutical bulletin, 2025; 71(1):31-41

		4.	Margarita Timofejeva, Anita Najdenkoska, Biljana Bauer , Development and validation of a GC-ECD method for pesticide residue detection in flour, Macedonian Pharmaceutical bulletin, 2025; 71(1):43-53	Development and validation of a GC-ECD method for pesticide residue detection in flour,	Macedonian Pharmaceutical bulletin, 2025; 71(1):43-53
		5.	Semra Dzemaili, Rejhan Muhamed Dzumkar, Vera Kostovska, Zoran Kavrakovski, Biljana Bauer , Comparison of titrimetric and ion chromatographic techniques for the determination of calcium and magnesium in raw water, Macedonian Pharmaceutical bulletin, 72 Vol. (1) 2026	Comparison of titrimetric and ion chromatographic techniques for the determination of calcium and magnesium in raw water,	Macedonian Pharmaceutical bulletin, 72 Vol. (1) 2026
11.	Mentorships				
	11 .1.	Diploma Theses	23		
	11 .2.	Master’s Theses	/		
	11 .3.	Doctoral Dissertations	1+2 in progress		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	Donika Hoxha, Biljana Bauer, Gjoshe Stefkov, Gresa Hoxha,	Phenolic phytochemicals for treatment of Alzheimer’s condition – a review,	Macedonian Pharmaceutical bulletin, 2022; 68(2):

		2.	Suzana Apostolovska, Biljana Bauer,	Identification of medicinal plants of interest for the development of new drugs,	Macedonian Pharmaceutical bulletin, 2022; 68(Suppl 1): 379-180
		3.	Suzana Apostolovska, Biljana Bauer,	Preservation of traditional knowledge related to plant biodiversity,	Macedonian Pharmaceutical bulletin, 2022; 68(Suppl 1): 527-528
		4.	Gordana Dameska, Biljana Bauer,	The quality of drinking water in the Prilep region supplied by the Studenchica Regional Water Supply System and PHI General Hospital Prilep,	Macedonian Pharmaceutical bulletin, 2022; 68(2):
		5.	Biljana Bauer, Ana Cvijic,	Extracts from the history of cannabis,	Acad Med J 2024;4(2):8-17
	12 .2.	Evidence of at least two published scientific research papers in international scientific journals with an impact factor in the given field in the last five years			
		No	Authors	Title	Publisher / Year
		1.	Bajraktari, D.; Bauer, B.; Zeneli, L.	Antioxidant Capacity of <i>Salix alba</i> (Fam. Salicaceae) and Influence of Heavy Metal Accumulation.	Horticulturae 2022, 8, 642. https://doi.org/10.3390/horticulturae8070642 (IF = 3.1 / Cite Score = 2.4)
		2.	Ana Cvijic, Biljana Bauer,	History and medicinal properties of cannabis,	Pharmacognosy review, 2024; 18(36): 159-164
	12 .3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
		No	Authors	Title	International meeting/conference year
		1.	Biljana Bauer, Ana Cvijic,	Fungi usage through the ages,	Ethnomedicinal study of <i>Quercus sp.</i> from the folk and traditional medicine of Republic of Macedonia, CMAPSEEC-2024, 17-19 October 2024, İzmir-Türkiye 2024

		2.	Biljana Bauer, Olga Kirovska Cigulevska,	Ethnomedicinal study of Cydonia oblonga M. from the folk and traditional medicine of Republic of Macedonia,	6 th Interntional conference on natural products utilization, from plants to pharmacy shelf, ICNPU 27.05- 30.05.2025, Bansko, Bulgaria	2025
		3.	Biljana Bauer, Sanja Kostadonovic Velickovska,	The usage of medicinal plants thought history,	Third conference about medicinal and wild- growing edible plants, 26-28 June, 2025, Pirot, Serbia	2025

No. 38	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Marija Karapandzova		
2.	Date of Birth	21.12.1978		
3.	Educational Qualification	VIII (Doctor of science)		
4.	Academic and Professional Titles	Full professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		BSc Pharm	2003	UKIM, Faculty of Pharmacy - Skopje
		MSc	2011	UKIM, Faculty of Pharmacy - Skopje
		PhD	2015	UKIM, Faculty of Pharmacy - Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical sciences and healthcare	Pharmacy	Pharmacognosy
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical sciences and healthcare	Pharmacy	Pharmacognosy
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	UKIM, Faculty of Pharmacy - Skopje	Full professor	Pharmaceutical botany and Pharmacognosy
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Phytochemistry	Master of Pharmacy, UKIM, Faculty of Pharmacy - Skopje	
	2.	Examination and analysis of natural products	Laboratory bioengineer, UKIM, Faculty of Pharmacy - Skopje	
	3.	Basics of phytotherapy	Dietetics and diet therapy, UKIM, Faculty of Pharmacy - Skopje	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	Analysis of herbal supstances	Master's degree in laboratory analysis and engineering in pharmacy	
	2.	Analysis of mycotoxins in herbal raw materials, herbal processings and food supplements	Master's degree in laboratory analysis and engineering in pharmacy	

		3.	Analysis of pesticide residues in herbal raw materials, herbal processing and food additives	Master's degree in laboratory analysis and engineering in pharmacy	
		4.	Application of modern analysis techniques: GC	Master's degree in laboratory analysis and engineering in pharmacy	
	9.	List of courses taught by the instructor in the third cycle of studies			
	3.	No.	Course Title	Study Program / Institution	
		1.	Secondary plant metabolites and their analysis	Doctor of Pharmaceutical sciences, UKIM, Faculty of Pharmacy - Skopje	
		2.	Natural medicinal and aromatic raw materials	Doctor of Pharmaceutical sciences, UKIM, Faculty of Pharmacy - Skopje	
10.	Selected Results in the Last Five Years				
	10	Relevant Published Scientific Papers (up to five)			
	.1.	No.	Authors	Title	Publisher / Year
		1.	Darko Dukovski, Tanja Petreska Ivanovska, Maja Dimitrovska, Zoran Zhivikj, Jasmina Jovanovska Veljanovska, Marija Karapandzova, Lidija Petrushevska-Tozi, Biljana Chuleva.	Detection of sibutramine adulteration in slimming teas using HPLC-DAD,	Macedonian Pharmaceutical Association/ 2025, Macedonian Pharmaceutical Bulletin, in press.
		2.	Zhivikj Z, Petreska Ivanovska T, Karapandzova M, Kulevanova S, Kadifkova Panovska T, Petrushevska-Tozi L.	Safety issues of herbal weight loss dietary supplements: hepatotoxicity and adulteration.	Centre for Evaluation in Education and Science/ Archives of Pharmacy, 2024, 74, 316-34.

		3.	Stoilkovska Gjorgievska V, Cvetkovikj Karanfilova I, Trajkovska A, Karapandzova M, Petrovska BB, Kulevanova S, Stefkov G.	Monitoring of Cannabis Cultivar Technological Maturity by Trichome Morphology Analysis and HPLC Phytocannabinoid Content.	Medknow Publications/ 2023 Pharmacognosy Research, 15(1), 94-100.
		4.	Cvetkovikj Karanfilova I, Stoilkovska Gjorgievska V, Stefkov Gj, Karapandzova M, Trajkovska A, Davkova I, Acevska J, Kulevanova S, Brezovska K.	DAB method transfer for potency of cannabinoids in dry cannabis flower.	Macedonian Pharmaceutical Association/ 2022, Macedonian Pharmaceutical Bulletin, 68(2).
		5.	Stefkov, G., Cvetkovikj Karanfilova, I., Labroska, V., Krsteska, O., Qazimi, B., Karapandzova, M., Gjoni, Z., Bardhi, N., Kulevanova, S.	Variability of the arbutin content in wild growing populations of <i>Arctostaphylos uva-ursi</i> (L.) Spreng from Korab Mountain, Western Balkan. 2021.2095	Society of chemist and technologists of Macedonia/ 2021 Macedonian Journal of Chemistry and Chemical Engineering, 40 (1), 69-74.
	10 .2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	Development of 3D cell bioreactor systems and application of fluorescence microscopy in various areas of pharmaceutical interest.	Ministry of education and science, 2025-2027

		2.	Participant	Milk Thistle (<i>Silybum marianum</i> L. Gaerth) - a weed or useful medicinal plant with potential for soil phytoremediation.	Faculty of pharmacy, UKIM, 2024-2025
		3.	Participant	Innovative biomimetic system - a carrier of natural products for the treatment of chronic wounds.	Faculty of pharmacy, UKIM, 2024-2025
		4.	Participant	Stability analysis of cannabis and its processings and preparations.	Ministry of education and science, 2022-2023
		5.	Participant	Determination of pesticide residues in cereal products.	Faculty of pharmacy, UKIM, 2020-2022
	10 .3.	Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Svetlana Kulevanova, Gose Stefkov, Marija Karapandzova, Ivana Cvetkovik Karanfilova	Pharmacognosy, natural medicinal and aromatic raw materials	UKIM, Skopje, 2023
	10 .4.	Published Professional Papers in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Stefkov Gj, Todorov F, Jachovski A, Stoilkovska Gjorgjievska V, Trajkovska A, Davkova I, Cvetkovikj Karanfilova I, Karapandzova M, Jovanovska M, Hristovski S.	<i>Empetrum nigrum</i> in national park - Shar mountain: ecological significance, phytochemical profile and medicinal applications.	Institute of Ecology and Technology – Tetovo/ ECOTEC International Journal of Sciences, Environment and Technology, 2024, 4 (7-8), 31-38.I

		2.	Aleksandra Chakarjanevska, Marika Bogoevska Nikolovska, Mirsada Dervisevic Andonova, Irena Slaveska Spirevska, Marija Karapandzova, Suzana Trajkovic Jolevska, Jasmina Tonic Ribarska	Stability study of Fluconazole capsules with Bracketing Design.	Macedonian Pharmaceutical Association/ Macedonian Pharmaceutical Bulletin, 2023, 69 (1), 77-86.
		3.	Filip Todorov, Laze Ramanchev, Ivana Cvetkovikj Karanfilova, Ana Trajkovska, Gjose Stefkov, Svetlana Kulevanova, Marija Karapandzova.	Headspace GC/MS analysis of volatile terpenoids in native Helichrysum plicatum and Helichrysum zivojinii from Macedonian flora.	Macedonian Pharmaceutical Association/ Macedonian pharmaceutical bulletin 2022, 68 (1), 587-588.
		4.	Iskra Davkova, Nadica Trajkovska, Ivana Cvetkovikj Karanfilova, Gjose Stefkov, Ana Trajkovska, Veronika Stoilkovska Gjorgievska, Svetlana Kulevanova, Marija Karapandzova	Comparation of different methods for determination of cannabis inflorescences humidity.	Macedonian Pharmaceutical Association/ Macedonian pharmaceutical bulletin 2022, 68 (2), 127-128.
		5.	Trajkovska N, Davkova I, Cvetkovikj Karanfilova I, Stefkov G, Stoilkovska Gjorgievska V, Petrevska Ivanovska T, Kulevanova S, Karapandzova M.	Evaluation of the antioxidant capacity of four Cannabis cultivars	Macedonian Pharmaceutical Association/ Macedonian pharmaceutical bulletin 2022, 68 (1), 589-590.
		11.	Mentorships		
	11 .1.	Diploma Theses	40		
	11 .2.	Master's Theses	/		

	11 .3.	Doctoral Dissertations	3 in progress		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years				
	No	Authors	Title	Publisher / Year	
	1.	Davkova I, Zhivikj I, Cvetkovikj Karanfilova I, Trajkovska A, Stoilkovska Gjorgievska V, Stefkov Gj, Kadifkova Panovska T, Karapandzova M.	Determination of chemical composition and cytotoxic activity of selected essential oils from Macedonian origin.	World Journal of Pharmaceutical Science and Research, 2024, 3(2), 257-266.	
	2.	Davkova I, Zivikj Z, Kukic Markovic J, Cvetkovikj Karanfilova I, Stefkov Gj, Kulevanova S, Karapandzova M.	Natural Products in the Management of Obesity.	Centre for Evaluation in Education and Science/ Archives of Pharmacy, 2024, 74, 298-315.	
12 .2.	Evidence of at least two published scientific research papers in international scientific journals with an impact factor in the given field in the last five years				
	No	Authors	Title	Publisher / Year	
	1.	Trajkovska A, Tusevski O, Stoilkovska Gjorgievska V, Cvetkovikj Karanfilova I, Davkova I, Karapandzova M, Stefkov Gj, Kulevanova S, Gadzovska Simic S.	Cannabinoid production in various Cannabis sativa L. in vitro cultures.	Plant Cell, Tissue and Organ Culture (PCTOC), 160, 1-10 (2025).	
	2.	Stoilkovska Gjorgievska V, Geskovski N, Makreski P, Trajkovska A, Cvetkovikj Karanfilova I, Karapandzova M, Kulevanova S, Stefkov Gj.	Differentiation of Cannabis seeds employing digital morphological screening and infrared spectroscopy coupled with multivariate modeling.	Industrial Crops and Products, 211, 1-10 (2024).	

12 .3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
	No	Authors	Title	International meeting/conference	year
	1.	Cvetkovikj Karanfilova I, Gjorgievska J, Todorovska M, Todorov F, Stoilkovska Gjorgievska V, Karapandzova M, Markoski M, Stefkov Gj.	Phytoremediation potential of milk thistle (Silybum marianum) - A sustainable approach to mitigate soil contamination while supporting pharmaceutical applications.	6th International Conference on Natural Products Utilization: from Plants to Pharmacy Shelf (ICNPU), Bansko, Bulgaria.	2025
	2.	Davkova I, Gašić U, Nikolic F, Trajkovska T, Cvetkovikj Karanfilova I, Stefkov Gj, Mišić D, Karapandzova M.	Unveiling the Bioactive Potential of Plantago major in Wound Healing: Insights from UHPLC/MS-MS Orbitrap Analysis.	12th Conference on Medicinal and Aromatic Plants of Southeast European Countries (CMAPSEEC), Izmir, Turkey.	2024
	3.	Davkova I, Gašić U, Nikolic F, Cvetkovikj Karanfilova I, Stefkov Gj, Mišić D, Karapandzova M	Phenolic and Iridoid Profiles in Verbena officinalis - insights from the UHPLC-ESI-HRMS/MS Analysis.	5th International Conference on Plant Biology, Srebreno Jezero, Serbia.	2024

No. 39	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Ivana Cvetkovikj Karanfilova		
2.	Date of Birth	23.11.1984		
3.	Educational Qualification	VIII (Doctor of science)		
4.	Academic and Professional Titles	Assistant Professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Master of Pharmacy	2008	UKIM, Faculty of Pharmacy – Skopje
		Master's Degree	2011	MAICH-CIHEAM, Paris, France
		Doctoral Studies	2015	UKIM, Faculty of Pharmacy – Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Biotechnical Sciences	Biotechnology	Natural Products and Biotechnology
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical sciences and healthcare	Pharmacy	Pharmacognosy
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	UKIM, Faculty of Pharmacy - Skopje	Assistant Professor	Pharmaceutical botany and Pharmacognosy
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	Introduction to Laboratory Biomedical Engineering	Laboratory bioengineer, UKIM, Faculty of Pharmacy - Skopje	
	2.	Natural Products and Their Analysis	Laboratory bioengineer, UKIM, Faculty of Pharmacy - Skopje	
	3.	Extraction and Isolation of Natural Products	Laboratory bioengineer, UKIM, Faculty of Pharmacy - Skopje	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	Protocols and Standards for Sampling for Analysis	Master's Studies in Laboratory Analysis and Engineering in Pharmacy	
9.	List of courses taught by the instructor in the third cycle of studies			
3.	No.	Course Title	Study Program / Institution	
	1.	/	/	
	2.	/	/	
	3.	/	/	
10.	Selected Results in the Last Five Years			

10	.1.	Relevant Published Scientific Papers (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	Piponski, M., Beneta, A., Stefkov, G., Cvetkovikj Karanfilova, I., Horyn, M., Zarivna, N., Ivanets, L. and Logoyda, L.	Approaches to the Development of New Simple Rapid HPLC– Photodiode Array Method for the Simultaneous Determination of Levomenthol and Ibuprofen in Gel Pharmaceutical Formulation.	Separation Science Plus, 8(5), IF=1.3 (2025)
		2.	Trajkovska A, Tusevski O, Stoilkovska Gjorgievska V, Cvetkovikj Karanfilova I, Davkova I, Karapandzova M, Stefkov Gj, Kulevanova S, Gadzovska Simic S.	Cannabinoid production in various Cannabis sativa L. in vitro cultures.	Plant Cell, Tissue and Organ Culture (PCTOC), 160, 1-10 IF=2.5, (2025).
		3.	Stoilkovska Gjorgievska V, Geskovski N, Makreski P, Trajkovska A, Cvetkovikj Karanfilova I, Karapandzova M, Kulevanova S, Stefkov Gj.	Differentiation of Cannabis seeds employing digital morphological screening and infrared spectroscopy coupled with multivariate modeling.	Industrial Crops and Products, 211, 1-10 (2024).
		4.	Stefkov Gj, Cvetkovikj Karanfilova I, Stoilkovska Gjorgievska V, Trajkovska A, Geskovski N, Karapandzova M, Kulevanova S.	Analytical Techniques for Phytocannabinoid Profiling of Cannabis and Cannabis-Based Products—A Comprehensive Review.	Molecules. 27, 975, IF=4.6, 1- 42. (2022)

		5.	Cvetkovikj Karanfilova I., Stoilkovska Gjorgievska V., Stefkov Gj., Karapandzova M., Trajkovska A., Davkova I., Acevska J., Kulevanova S., Brezovska K.	DAB method transfer for potency of cannabinoids in dry cannabis flower.	Macedonian Pharmaceutical Association/ 2022, Macedonian Pharmaceutical Bulletin, 68 (2).
	10 .2.	Participation in National and International Research Projects (up to five)			
		No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project
		1.	Participant	Development of 3D cell bioreactor systems and application of fluorescence microscopy in various areas of pharmaceutical interest.	Ministry of Education and Science of N. Macedonia, Skopje, 2025–2027
		2.	Participant	Implementation of an electrochemical method with a potentiostat for simulation and analysis of the metabolism of drugs acting on the central nervous system (CNS).	Ministry of Education and Science of N. Macedonia, Skopje, 2025–2027
		3.	Menthor	Milk Thistle (<i>Silybum marianum</i> L. Gaertn) – weed or useful medicinal plant with potential for soil phytoremediation.	Macedonian Ecological Society, Support Programme for Young Ecologists “Dr. Ljupcho Melovski”, 2024–2025
		4.	Principal Investigator	“Green” analytical approaches in the evaluation of the quality of preparations and herbal raw material from <i>Silybum marianum</i> L.	UKIM, Faculty of Pharmacy – Skopje, 2023–2024

	5.	Participant	Stability analysis of cannabis and its derivatives and preparations.	Ministry of Education and Science of N. Macedonia, Skopje, 2022–2023
10 .3.	Printed Books in the Last Five Years (up to five)			
	No.	Authors	Title	Publisher / Year
	1.	S. Kulevanova, Gj. Stefkov, M. Karapandzova, I. Cvetkovikj Karanfilova	Pharmacognosy: Natural Medicinal and Aromatic Raw Materials, 3rd Edition	UKIM, 2023
10 .4.	Published Professional Papers in the Last Five Years (up to five)			
	No.	Authors	Title	Publisher / Year
	1.	Stefkov Gj, Todorov F, Jachovski A, Stoilkovska Gjorgjievska V, Trajkovska A, Davkova I, Cvetkovikj Karanfilova I, Karapandzova M, Jovanovska M, Hristovski S.	<i>Empetrum nigrum</i> in national park - Shar mountain: ecological significance, phytochemical profile and medicinal applications.	Institute of Ecology and Technology – Tetovo/ ECOTEC International Journal of Sciences, Environment and Technology, 2024, 4 (7-8), 31-38.
	2.	Kochoska I, Naneski M, Karapandzova M, Trajkovska A, Zivikj Z, Kulevanova S, Stefkov Gj, Cvetkovikj Karanfilova I.	Evaluation of the phenolic content and antioxidant capacity of <i>Tanacetum herba</i> from two locations from North Macedonia	Macedonian Pharmaceutical Association/ Macedonian pharmaceutical bulletin, 2022, 68 (1), 591-592.
	3.	Filip Todorov, Laze Ramanchev, Ivana Cvetkovikj Karanfilova, Ana Trajkovska, Gjose Stefkov, Svetlana Kulevanova, Marija Karapandzova.	Headspace GC/MS analysis of volatile terpenoids in native <i>Helichrysum plicatum</i> and <i>Helichrysum zivojinii</i> from Macedonian flora.	Macedonian Pharmaceutical Association/ Macedonian pharmaceutical bulletin 2022, 68 (1), 587-588.

		4.	Iskra Davkova, Nadica Trajkovska, Ivana Cvetkovikj Karanfilova, Gjose Stefkov, Ana Trajkovska, Veronika Stoilkovska Gjorgievska, Svetlana Kulevanova, Marija Karapandzova	Comparison of different methods for determination of cannabis inflorescences humidity.	Macedonian Pharmaceutical Association/ Macedonian pharmaceutical bulletin 2022, 68 (2), 127-128.
		5.	Trajkovska N, Davkova I, Cvetkovikj Karanfilova I, Stefkov G, Stoilkovska Gjorgievska V, Petrevska Ivanovska T, Kulevanova S, Karapandzova M.	Evaluation of the antioxidant capacity of four Cannabis cultivars	Macedonian Pharmaceutical Association/ Macedonian pharmaceutical bulletin 2022, 68 (1), 589-590.
11.	Mentorships				
	11 .1.	Diploma Theses		20	
	11 .2.	Master’s Theses		1 ongoing	
	11 .3.	Doctoral Dissertations		/	
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	/	/	/
	12 .2.	Evidence of at least two published scientific research papers in international scientific journals with an impact factor in the given field in the last five years			
		No	Authors	Title	Publisher / Year
		1.	/	/	/
	12 .3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			
		No	Authors	Title	International meeting/conference
		1.	/	/	/

No. 40	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Veronika Stoilkovska Gjorgievska		
2.	Date of Birth	24.08.1992		
3.	Educational Qualification	VIII (Doctor of science)		
4.	Academic and Professional Titles	Assistant professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Master of Pharmacy	2016	UKIM, Faculty of Pharmacy - Skopje
		PhD	2025	UKIM, Faculty of Pharmacy - Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical sciences and healthcare	Pharmacy	Pharmacy
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Medical sciences and healthcare	Pharmacy	Pharmacognosy
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	UKIM, Faculty of Pharmacy - Skopje	Assistant professor	Pharmacognosy and Pharmaceutical botany
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	/	/	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	/	/	
9.	List of courses taught by the instructor in the third cycle of studies			
3.	No.	Course Title	Study Program / Institution	
	1.	/	/	
10.	Selected Results in the Last Five Years			
10	Relevant Published Scientific Papers (up to five)			
.1.	No.	Authors	Title	Publisher / Year
	1.	Trajkovska A, Tusevski O, Stoilkovska Gjorgievska V, Cvetkovikj Karanfilova I, Davkova I, Karapandzova M., Stefkov Gj, Kulevanova S, Gadzovska Simic S.	Cannabinoid production in various <i>Cannabis sativa</i> L. in vitro cultures	Springer/2025, Plant Cell, Tissue and Organ Culture (PCTOC), 160, 1-10. IF=2,5

		2.	Stoilkovska Gjorgievska V, Geskovski N, Makreski P, Trajkovska A, Cvetkovikj Karanfilova I, Karapandzova M., Kulevanova S, Stefkov Gj.	Differentiation of Cannabis seeds employing digital morphological screening and infrared spectroscopy coupled with multivariate modeling	ScienceDirect/2024, Industrial Crops and Products, 211, 1-10. IF=5,6.
		3.	Stoilkovska Gjorgievska V, Cvetkovikj Karanfilova I, Trajkovska A, Karapandzova M, Bauer Petrovska B, Kulevanova K, Stefkov Gj.	Monitoring of Cannabis Cultivar Technological Maturity by Trichome Morphology Analysis and HPLC Phytocannabinoid Content	Medknow Publications/2023, Pharmacognosy Research, 2023; 15(1):94-100.
		4.	Mihailova Lj., Tchekalarova J, Shalabalija D, Geskovski N, Stoilkovska Gjorgievska V, Stefkov Gj, Krasteva P, Simonoska Crcarevska M, Glavas Dodov M.	Lipid nano-carriers loaded with Cannabis sativa extract for epilepsy treatment – in vitro characterization and in vivo efficacy studies	Springer/2022, Journal of Pharmaceutical Sciences, 111, 12, 3384-3396. IF=3,7
		5.	Stefkov, G., Cvetkovikj Karanfilova, I., Stoilkovska Gjorgievska, V., Trajkovska, A., Geskovski, N., Karapandzova, M., Kulevanova, S.	Analytical Techniques for Phytocannabinoid Profiling of Cannabis and Cannabis-Based Products-A Comprehensive Review.	MDPI/ 2022, Molecules, 27(3):975. IF=4.6.
		Participation in National and International Research Projects (up to five)			
10	.2.	No.	Role (Principal Investigator or Participant)	Title	Duration Institution Organizing, Funding, or Implementing the Project

		1.	Participant	Development of 3D cell bioreactor systems and application of fluorescence microscopy in various areas of pharmaceutical interest.	MON, Skopje, 2025-2028
		2.	Participant	"Green" analytical approaches in assessing the quality of preparations and herbal raw materials from <i>Silybum marianum</i> L.	UKIM, Faculty of Pharmacy – Skopje, 2023-2024
		3.	Participant	Application of vibrational spectroscopic techniques for rapid in situ characterization of samples of pharmaceutical interest	UKIM, Faculty of Pharmacy – Skopje, 2022-2025
		4.	Participant	Innovative biomimetic system - carrier of natural products for the treatment of chronic wounds.	UKIM, Faculty of Pharmacy – Skopje, 2022-2025
		5.	Participant	Development of vibrational spectroscopy methods for rapid screening of phytocannabinoids in hemp and its preparations	ADSI/MON, 2022-2023
	10 .3.	Printed Books in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year
		1.	/	/	/
		2.	/	/	/
	10 .4.	Published Professional Papers in the Last Five Years (up to five)			
		No.	Authors	Title	Publisher / Year

		1.	Stefkov Gj, Todorov F, Jachovski A, Stoilkovska Gjorgievska V, Trajkovska A, Davkova I, Cvetkovikj Karanfilova I, Karapandzova M, Jovanovska M, Hristovski S.	<i>Empetrum nigrum</i> in national park - Shar mountain: ecological significance, phytochemical profile and medicinal applications.	Institute of Ecology and Technology – Tetovo/ ECOTEC International Journal of Sciences, Environment and Technology, 2024, 4 (7-8), 31- 38.
		2.	Davkova I, Zhivikj I, Cvetkovikj Karanfilova I, Trajkovska A, Stoilkovska Gjorgievska V, Stefkov Gj, Kadifkova Panovska T, Karapandzova M.	Determination of chemical composition and cytotoxic activity of selected essential oils from Macedonian origin	WJPSR/2025, World Journal of Pharmaceutical Science and Research, 3(2), 257-266. IF=5,11
		3.	Cvetkovikj Karanfilova I, Stoilkovska Gjorgievska V, Stefkov Gj, Karapandzova M, Trajkovska A, Davkova I, Acevska J, Kulevanova S, Brezovska K. Macedonian Pharmaceutical Association/ Macedonian Pharmaceutical Bulletin,	DAB method transfer for potency of cannabinoids in dry cannabis flower	Macedonian Pharmaceutical Association/ Macedonian Pharmaceutical Bulletin, 68(2), 27-34.
		4.	Stoilkovska Gjorgievska V, Cvetkovikj Karanfilova I, Karapandzova M, Trajkovska A, Kulevanova S, Stefkov Gj.	Terpene profile in fresh flowers of outdoor cultivated commercial strains and wildtype of Cannabis	Macedonian pharmaceutical Association/2022, Macedonian Pharmaceutical Bulletin, 68(2), 113-114.

		5.	Trajkovska A, Tushevski O, Stoilkovska Gjorgievska V, Cvetkovikj Karanfilova I, Karapandzova M, Stefkov Gj, Kulevanova S, Gadzovska Simic S.	Biomass production and cannabinoid accumulation in Cannabis (Cannabis sativa L.) callus cultures	Macedonian Pharmaceutical Association/2022, Macedonian pharmaceutical bulletin, 68(2), 211-212.	
11.	Mentorships					
	11 .1.	Diploma Theses	/			
	11 .2.	Master’s Theses	/			
	11 .3.	Doctoral Dissertations	/			
12.	For PhD Mentors: Selected Results in the Last Four/Five Years					
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years				
		No	Authors	Title	Publisher / Year	
		1.	/	/	/	
		2.	/	/	/	
		3.	/	/	/	
		4.	/	/	/	
		5.	/	/	/	
	12 .2.	Evidence of at least two published scientific research papers in international scientific journals with an impact factor in the given field in the last five years				
		No	Authors	Title	Publisher / Year	
		1.	/	/	/	
		2.	/	/	/	
	12 .3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years				
		No	Authors	Title	International meeting/conference	year
		1.	/	/	/	/
		2.	/	/	/	/
		3.	/	/	/	/

No. 41	Information on Teaching Staff and PhD Mentors			
1.	Name and Surname	Ana Trajkovska Matevska		
2.	Date of Birth	17.12.1995		
3.	Educational Qualification	VIII (Doctor of Science)		
4.	Academic and Professional Titles	Assistant professor		
5.	Information on Completed Education and Acquired Academic and Scientific Degrees	Degree	Year	Institution
		Master of Pharmacy	2019	UKIM, Faculty of Pharmacy – Skopje
		Doctoral Studies	2025	UKIM, Faculty of Natural Sciences and Mathematics – Skopje
6.	Scientific Area, Field and Discipline of the Master's Degree	Scientific Area	Field	Discipline
		Medical sciences and healthcare	Pharmacy	Pharmacy
7.	Area, field and discipline of the scientific degree Doctor of Sciences, with the corresponding code number of the scientific discipline of the doctoral studies in accordance with the International Frascati Classification of 2015 and the relevant national acts that determine the research fields of the third-level disciplines	Scientific Area	Field	Discipline
		Natural and Mathematical Sciences	Biological Sciences	Biochemistry and Physiology
8.	If employed, the institution where	Institution	Academic Title	Scientific Field

	the person works and the academic title to which the person has been elected shall be stated, as well as the scientific field in which the title has been obtained, with the corresponding code number in accordance with the International Frascati Classification of 2015 and the relevant national acts that define the research fields of the third-level disciplines.	UKIM, Faculty of Pharmacy - Skopje	Assistant professor	Pharmaceutical botany and Pharmacognosy
9.	List of courses taught by the instructor, presented separately for the first, second, and third cycle of studies			
9.	List of courses taught by the instructor in the first cycle of studies			
1.	No.	Course Title	Study Program / Institution	
	1.	/	/	
9.	List of courses taught by the instructor in the second cycle of studies			
2.	No.	Course Title	Study Program / Institution	
	1.	/	/	
9.	List of courses taught by the instructor in the third cycle of studies			
3.	No.	Course Title	Study Program / Institution	
	1.	/	/	
10.	Selected Results in the Last Five Years			
10	Relevant Published Scientific Papers (up to five)			
.1.	No.	Authors	Title	Publisher / Year

		1.	Trajkovska A, Tusevski O, Stoilkovska Gjorgievska V, Cvetkovikj Karanfilova I, Davkova I, Karapandzova M., Stefkov Gj, Kulevanova S, Gadzovska Simic S.	Cannabinoid production in various <i>Cannabis sativa</i> L. in vitro cultures	Springer/2025, Plant Cell, Tissue and Organ Culture (PCTOC), 160, 1-10. IF=2,5
		2.	Stoilkovska Gjorgievska V, Geskovski N, Makreski P, Trajkovska A, Cvetkovikj Karanfilova I, Karapandzova M, Kulevanova S, Stefkov Gj	Differentiation of Cannabis seeds employing digital morphological screening and infrared spectroscopy coupled with multivariate modeling	Elsevier/ 2024, Industrial Crops and Products, 211, 1-10. IF=5,6
		3.	Gjoshe Stefkov, Ivana Cvetkovikj Karanfilova, Veronika Stoilkovska Gjorgievska, Ana Trajkovska, Nikola Geskovski, Marija Karapandzova, Svetlana Kulevanova	Analytical techniques for phytocannabinoid profiling of Cannabis and Cannabis based products - A comprehensive Review	Molecules/2022, Molecules 27, 975, 1-42. IF=4,6
		4.	Cvetkovikj Karanfilova I, Stoilkovska Gjorgievska V, Stefkov Gj, Karapandzova M, Trajkovska A, Davkova I, Acevska J, Kulevanova S, Brezovska K.	DAB method transfer for potency of cannabinoids in dry cannabis flower	Macedonian Pharmaceutical Association/ Macedonian Pharmaceutical Bulletin, 68(2), 27-34.

		5.	Trajkovska A, Tushevski O, Stoilkovska Gjorgievska V, Cvetkovikj Karanfilova I, Karapandzova M, Stefkov Gj, Kulevanova S, Gadzovska Simic S.	Biomass production and cannabinoid accumulation in Cannabis (Cannabis sativa L.) callus cultures	Macedonian Pharmaceutical Association /2022, Macedonian pharmaceutical bulletin, 68(2), 211-212.
10 .2.	Participation in National and International Research Projects (up to five)				
	No.	Role (Principal Investigator or Participant)		Title	Duration Institution Organizing, Funding, or Implementing the Project
	1.	Participant		Development of 3D cell bioreactor systems and application of fluorescence microscopy in various areas of pharmaceutical interest.	Ministry of Education and Science of the Republic of Macedonia, 2025-2027
	2.	Participant		"Green" analytical approaches in assessing the quality of preparations and herbal raw materials from <i>Silybum marianum</i> L.	UKIM, Faculty of Pharmacy – Skopje, 2023-2024
	3.	Participant		Application of vibrational spectroscopic techniques for rapid in situ characterization of samples of pharmaceutical interest	UKIM, Faculty of Pharmacy - Skopje, 2022-2025

		4.	Participant	Innovative biomimetic system - carrier of natural products for the treatment of chronic wounds	UKIM, Faculty of Pharmacy - Skopje, 2022-2025
		5.	Participant	Development of vibrational spectroscopy methods for rapid screening of phytocannabinoids in hemp and its preparations	ADSI/MON, 2022-2023
	10	Printed Books in the Last Five Years (up to five)			
	.3.	No.	Authors	Title	Publisher / Year
		1.	/	/	/
	10	Published Professional Papers in the Last Five Years (up to five)			
	.4.	No.	Authors	Title	Publisher / Year
		1.	Stefkov Gj, Todorov F, Jachovski A, Stoilkovska Gjorgievska V, Trajkovska A, Davkova I, Cvetkovikj Karanfilova I, Karapandzova M, Jovanovska M, Hristovski S.	<i>Empetrum nigrum</i> in national park - Shar mountain: ecological significance, phytochemical profile and medicinal applications.	Institute of Ecology and Technology – Tetovo/ ECOTEC International Journal of Sciences, Environment and Technology, 2024, 4 (7-8), 31-38.
		2.	Stoilkovska Gjorgievska V, Cvetkovikj Karanfilova I, Trajkovska A, Karapandzova M, Bauer Petrovska B, Kulevanova S, Stefkov G	Monitoring of Cannabis Cultivar Technological Maturity by Trichome Morphology Analysis and HPLC Phytocannabinoid Content	Pharmacognosy Research, 15 (1), 94-100 (2023).

		3.	Davkova I, Karanfilova IC, Trajkovska A, Stoilkovska V, Gjorgievska SK, Stefkov G, Karapandzova M	Effects of temperature on THC and THCA content during storage	Macedonian Pharmaceutical Association/ Macedonian pharmaceutical bulletin 2023, 69 (1), 249-250.
		4.	Filip Todorov, Laze Ramanchev, Ivana Cvetkovikj Karanfilova, Ana Trajkovska, Gjose Stefkov, Svetlana Kulevanova, Marija Karapandzova.	Headspace GC/MS analysis of volatile terpenoids in native <i>Helichrysum plicatum</i> and <i>Helichrysum zivojinii</i> from Macedonian flora.	Macedonian Pharmaceutical Association/ Macedonian pharmaceutical bulletin 2022, 68 (1), 587-588.
		5.	Iskra Davkova, Nadica Trajkovska, Ivana Cvetkovikj Karanfilova, Gjose Stefkov, Ana Trajkovska, Veronika Stoilkovska Gjorgievska, Svetlana Kulevanova, Marija Karapandzova	Comparison of different methods for determination of cannabis inflorescences humidity.	Macedonian Pharmaceutical Association/ Macedonian pharmaceutical bulletin 2022, 68 (2), 127-128.
11.	Mentorships				
	11 .1.	Diploma Theses	/		
	11 .2.	Master’s Theses	/		
	11 .3.	Doctoral Dissertations	/		
12.	For PhD Mentors: Selected Results in the Last Four/Five Years				
	12 .1.	Evidence of Published Scientific Research Papers in International Scientific Journals or International Scientific Publications in the Given Field (up to six) in the Last Five Years			
		No	Authors	Title	Publisher / Year
		1.	/	/	/
	12 .2.	Evidence of at least two published scientific research papers in international scientific journals with an impact factor in the given field in the last five years			
		No	Authors	Title	Publisher / Year
		1.	/	/	/
	12 .3.	Evidence of at Least Three Participations in International Conferences in the Last Five Years			

		No	Authors	Title	International meeting/conference	year
		1.	/	/	/	/