PROSPECTUS

UNIFORM MASTER'S PHARMACY PROGRAMME, UNIVERSITY OF LJUBLJANA, FACULTY OF PHARMACY (MASTER OF PHARMACY)

Presentation of the study programme:

1. Information on the study programme:

Uniform master's programme *Pharmacy* lasts 5 years (10 semesters) and comprises 300 credits. The academic title awarded to the students is magister/magistra farmacije – mag. farm. (Master of Pharmacy).

2. Fundamental objectives of the programme and general competences

The main objective of the uniform master's programme is to train skilled personnel for the implementation of professional works and tasks in the pharmaceutical field (pharmacy services, industry, clinical biochemical and other diagnostic laboratories), and, at the same time, provide them with an adequate fundamental knowledge to continue the studies at the doctoral level.

General competences:

- ability of analysing, critically evaluating, searching for solutions and solving relevant professional pharmaceutical, clinical biochemical, pharmaceutical technological, pharmaceutical biotechnological and toxicological problems arising in different working environments;
- skills and relevant knowledge for further training at the doctoral level;
- appropriate qualifications for autonomous and responsible implementation of professional work and analysis of subject-specific problems;
- capacity to perform individual professional work, to work in a team, and knowledge needed for professional communication with the patients and the experts from their field and related fields of expertise;
- proper skills for understanding and application of modern techniques and methods at all levels of complexity within the entire fields of pharmacy and clinical biochemistry;
- competence for assurance of quality medicinal products and procedures;
- appropriately ethically shaped professional personality for the realization of pharmaceutical mission.

3. Enrolment requirements and selection criteria in case of restricted enrolment

The uniform master's pharmacy programme is intended for the students:

a) who have passed matura examination,

b) who have passed vocational matura examination

- at the end of the high school programme Pharmacy Technician and chemistry or physics exam within the matura examination, and Cosmetic Technician with a physics exam within the matura examination;
- at the end of the high school programme Chemistry Technician and biology exam within the matura examination;
- at the end of the high school programme Veterinary Technician and physics

exam within the matura examination.
c) who completed any four-year secondary programme prior to June 1st 1995.

In case of restricted entry,
candidates under point a) will be selected based on:
-general success in the matura examination 60% of the points,
-general success in years 3 and 4 40% of the points;

candidates under point b) will be selected based on:
-general success in vocational matura examination 40% of the points;
-general success in years 3 and 4 – 40% of the points;
-success in the mandatory subject exam within the matura examination 20% of the points.

4. Criteria for recognition of knowledge and skills acquired prior to the enrolment in the programme

Upon the candidate's request, the Academic Affairs Commission may submit to the Senate a proposal for recognition of knowledge and skills that have been acquired by the candidate prior to their enrolment in the study programme Pharmacy and may be recognised as fulfilled study obligations. Passed foreign language exam, for example, may therefore be recognised within the general optional courses in the fourth year.

5. Requirements for advancement within the programme

• Requirements for advancement from one year to another:

Students may enrol in the next year of study if they complete by the end of the year all the obligations determined in the curriculum for the enrolment in the next year.
To be able to advance to the second year, students must meet all academic requirements laid down in the curriculum and course schemes for the first year, in the amount of 60 ECTS credits.
To be able to advance to the third year, students must meet all academic requirements laid down in the curriculum and course schemes for the second year, in the amount of 60 ECTS credits.
To be able to advance to the fourth year, students must meet all the requirements laid down in the curriculum and course schemes in the amount of 55 ECTS credits, with the exception of the optional course, which amounts to 5 ECTS credits. To be able to advance to the fifth year, students must meet all the requirements laid down in the curriculum and course schemes in the amount of 50 ECTS credits.

• Requirements for the repetition of the year:

During their studies, students are allowed to repeat a year once, provided they have met half of the requirements for the attending year, which amounts to no less than 30 ECTS credits.
During their studies, students are entitled to one exceptional enrolment in the next year. This is decided upon by the FFA Academic Affairs Commission which can, according to the UL Statute and the FFA Academic Regulations, allow exceptional advancement when it determines the student has failed to fulfil required conditions due to substantial and verified reasons.

6. Requirements for completion of studies

To be able to complete the studies, students of the uniform master's pharmacy programme must fulfil all obligations determined by the study programme and course curricula, in total amount of 300 ECTS credits. Based on the research work, students must submit master's thesis in written form and defend it orally in front of the commission appointed by the FFA senate. One of the requirements for finishing the studies is a successful completion of practical training, which is concluded by professional exam. All the information will be provided in detail in the FFA Academic Regulations.

7. Transfers between study programmes

In the field of medicinal product design, manufacture and evaluation, the uniform master's pharmacy programme is the only programme that provides the education for a regulated pharmacist profession, and is therefore subject to stricter verification in case of potential transfers of students from other programmes than in case of pharmacy students transferring to other programmes.

- Transfers between the university education study programmes within the UL

Direct transfers of the students from other programmes of the UL members are not envisaged. Students from university programmes may enrol in the first year of pharmacy studies if they meet the requirements for the enrolment in the uniform master's study programme Pharmacy, but only as new candidates. After the enrolment, the Academic Affairs Commission may recognise some of the obligations fulfilled at the other faculties.

- Transfers between the study programmes of other universities

Pharmacy students from other universities may transfer to the second or higher year of the uniform master's study programme Pharmacy, provided they meet the requirements for the enrolment in the next year that apply to the study programme they are enrolled in. The FFA Senate approves the advancement on a proposal from the FFA Academic Affairs Commission that also determines a year a student may enrol in, potential bridge exams or other obligations.

- Transfer between the FFA programmes

Transfer from other education programmes of 1st cycle to the uniform master's programme Pharmacy is not possible.

- Old - new programme transfer

In case the student enrolled in the university study programme Pharmacy fails to fulfil the current obligations for the enrolment in the next year, and therefore the students of the uniform master's programme Pharmacy catch up with him/her, he/she may enrol in the next year upon the fulfilment of all obligations within the old programme, whereas the Academic Affairs Commission determines potential additional obligations and the deadline to fulfil them.

- Enrolment in doctoral programmes

When they complete the training and gather 300 ECTS credits according to the last paragraph of article 38.a and article 16 of the previous provisions of the Higher Education Act, the students of the uniform master's study programme Pharmacy may enrol in the university doctoral programme Biomedicine or any other doctoral studies.

8. Assessment schemes

Each course has its own assessment scheme which is set in the course curriculum.

Assessment schemes include oral and written exams, partial exams, seminar papers, etc. The assessment scale ranges from 6 – 10 (positive) and 1 – 5 (negative). Assessment is subject to the provisions laid down in the Statute of the University of Ljubljana and FFA Academic Regulations.

9. Programme curriculum

		Contact hours				ECTS
	1st year	**L**	**S**	**P**	**O**	
	Semester 1					
1.	Mathematics	55		30	5	7
2.	Physics	75		30		8
3.	General and Inorganic Chemistry	60		45		8
4.	Pharmaceutical Biology with Genetics	45	15	30		7
	Semester 2					
5.	Anatomy and Histology	30		15		4
6.	Pharmaceutical Chemistry I	60	15			6
7.	Pharmaceutical Informatics	30	15	15		5
8.	Introduction to Pharmacy	15	30	0		3
9.	Analytical Chemistry	45	15	45		8
10	Microbiology	10	20	15		4
	2nd year					
	Semester 3					
11.	Organic Chemistry	60	15	45		9
12.	Physical Chemistry	30	15	30		6
13.	Physiology	30		45		6
14.	Pharmaceutical Technology I	60		60		9
	Semester 4					
14.	Pharmaceutical Technology I	60	15	75		11
15.	Physical Pharmacy	35	5	15	5	5
16.	Pharmaceutical Chemistry II	45	15	30		7
17.	Pharmaceutical Biochemistry	45	15	30		7
	3rd year					
	Semester 5					
18. 19	Instrumental Pharmaceutical Analysis Social Pharmacy	30 30		30 30		4 4
20.	Pathologic Physiology	45	30			6
21.	Pharmacognosy I	60		30		9
22.	Pharmaceutical Chemistry III	60		75		7
	Semester 6					
22.	Pharmaceutical Chemistry III	60	30	75		13
23.	Pharmaceutical Technology II	55		45	5	8
24.	Pharmacognosy II			75		4
	Optional Course	45	15			5
	4th year					
	Semester 7					
25.	Pharmacology	45	15	15		5
26.	Biopharmaceutics with Pharmacokinetics	60	30	30		9
27.	Pharmaceutical Biotechnology	30	30	30		6
28. 29.	Alternative Courses A2	45		15		5
30.	Stability of Medicinals	45		15		5
	Semester 8					
31.	Clinical Chemistry	60		45		7
32.	Analysis and Control of Medicinals	45		60		8
33. 34.	Alternative Courses A3	45		15		5
	Optional Course	45	15			5

	Optional Course	45	15			5
	5th year					

	Semester 9 and 10					
57.	Practical Training				450	30
58.	Individual Research Work for the Master's Thesis				250	25
59.	Master's Thesis Defence				50	5

L – lectures; S – seminar; P – practice; O – other forms of direct pedagogical work (especially project work); ECTS – European Credit Transfer System (1 credit equals to 30 hours of student workload)

Alternative Courses

Alternative Courses A2
28. Design and Synthesis of Active Substances
29. Toxicological Chemistry
Alternative Courses A3
33. Clinical Pharmacy
34. Industrial Pharmacy

Optional courses

35. Biopharmaceutical Evaluation of Pharmaceutical Forms
36. Biochemistry of Cancer Development and Progression
37. Hospital Pharmacy
38. Eutomers
39. Modified Release Pharmaceutical Forms
40. Pharmaceutical Engineering
41. Pharmaceutical Marketing and Management
42. Pharmacoeconomics
43. Pharmacogenomics and Genetic Medicines
44. Phytopharmaceuticals
45. Immunology
46. Selected Topics in Pharmaceutical Biotechnology
47. Selected Topics in Clinical Biochemistry
48. Selected Methods of Pharmaceutical Analysis
49. Quality of Medicinal Products
50. Cosmetology
51. Nutritional Supplements
52. Psychotropic substances and Abuse of Medicinal Products
53. The Use of Genetic and Cellular Testing in Biomedicine and Pharmacy
54. Medicinal Products of Alternative Medicine
55. Instrumental Analythical Methods in Pharmacy
56. Research Methods in Social Pharmacy

10. Information on available optional courses and mobility

There are 26 optional courses. They are divided in two groups, namely optional courses (22) and alternative optional courses (4). In case of alternative courses, students may choose from two courses offered. Two alternatives are planned in the third year – A2 and A3:

A2 – alternative 2: Design and Synthesis of Active Substances or Toxicological Chemistry;
A3 – alternative 3: Clinical Pharmacy or Industrial Pharmacy.

Among the optional courses offered, the students choose three – one in the third year and two in the fourth year of studies. A2 and A3 comprise 60 contact hours or 5 ECTS credits. One of the optional courses may also be selected from the general optional courses of other UL members or other universities. General optional course must be approved by the pro-dean responsible for the field of study. Students may select it in the fourth year.

Optional courses offer in-depth knowledge from strictly specialised fields with respect to students' professional interest and desired profession. At the same time, they represent a welcome acquaintance with a relevant field of research necessary for the preparation of the master's thesis. Topical subjects and wide offer enable free selection. The conditions for the admission into certain course are provided in individual curricula. Their percentage in the programme amounts to 50 ECTS credits or 16,7%.

According to point 6 of *Criteria for credit evaluation of study programmes*, students can transfer no less than 10 ECTS credits gathered within programme obligations or optional units from one study programme to another. A part of study obligations can be fulfilled within international student exchange programmes.

11. Presentation of individual courses

1. Mathematics (7 ECTS credits):
The basic principles of mathematical analysis. Mapping. Functions: inverse functions, continuity and limits, plane curves. Derivative of a single variable function. Integral. Multivariable functions. Differential equation. Introduction to systems theory.

2. Physics (8 ECTS credits):
Mechanics: kinematics, force and movement, work and kinetic energy, gravitation, oscillation, rotation, hydrostatics, hydrodynamics, wave propagation, sound, hearing. Heat: thermodynamics, ideal gas. Electricity and magnetism: electrical charge and force, condenser, electric dipole, electric current, magnetic field, induction, membrane potential, nerve impulse. Optics: refraction, reflection, eye, lenses, wave optics. Modern physics: photoelectric effect, electron diffraction on crystal, wave function.

3. General and Inorganic Chemistry (8 ECTS credits):
Stoichiometric laws. Energetics of chemical reactions. Wave mechanical model of the atom. Classical theory of a chemical bond. Crystals and amorphous substances. Colligative properties of solutions. Chemical equilibrium. The basics of chemical kinetics. Oxidation-reduction processes. Coordination compounds. The periodic table of elements: sources of elements, extraction and usage, physical properties, oxides and oxoacids, halides.

4. Pharmaceutical Biology with Genetics (7 ECTS credits):
Comparison of a plant and animal cell. The structure and function of cell organelles. Cell cycle. Mitosis. Exchange of generations. Meiosis. Mendel's genetics: dominant, recessive, incomplete dominant and co-dominant expression. Multiple alleles. Pleiotropy. Polygenic inheritance. Linked inheritance. Recombination. Population genetics. The origin of life. Evolution. Systematics.

5. Anatomy and Histology (4 ECTS credits):
Anatomy of the digestive tract, respiratory tract, urinary tract, cardiovascular system, endocrine glands, musculoskeletal apparatus, nervous system. Tissue histology: epithelial, glandular, connective and support tissue, cartilage, bone and muscle. Histology of the digestive tract, respiratory tract, urinary tract, blood, cardiovascular system, lymphatic organs, endocrine glands, nervous system, skin and reproductive organs.

6. Pharmaceutical Chemistry I (6 ECTS credits):
Definition of basic principles: agent, materia medica. Monographs in European Pharmacopoeia and the Slovenian national formulary within the European Pharmacopoeia. Water. Systematic approach to materia medica based on the periodic system. Basic principles of bioinorganic chemistry. Radionuclides. Radicals. Homeopathic materia medica.

7. Pharmaceutical Informatics (5 ECTS credits):
Healthcare information systems: the elements of information systems in healthcare settings, biomedical databases, bibliography search with the use of online tools. Research design with statistical analysis and interpretation of results: basic principles of statistics and sampling, descriptive statistics, probability theory, statistical inference, z-test, t-test, F-test, variance analysis, multiple comparisons, regression and correlation.

8. Introduction to Pharmacy (3 ECTS credits):
Definition of a medicinal product. Marketing authorizations for medicinal products. Summary of product characteristics (SPC). Patient information leaflet (PIL). The history of pharmacy. The role of a pharmacist in healthcare setting and patient care through time. Pharmaceutical ethics and deontology.

9. Analytical Chemistry (8 ECTS credits):
Methods for qualitative and quantitative substance composition and basic principles of instrumental analytics. Standard methods: gravimetry, titrimetry. Electro-analytical methods. Spectroscopic methods: atomic absorption spectrometry, atomic emission and absorption spectrometry, mass spectrometry. Separation methods: gas chromatography, high resolution liquid chromatography, ion chromatography, capillary electrophoresis. Statistical methods. Evaluation of results.

10. Microbiology (4 ECTS credits):
Structure of bacterial cells, fungi, viruses and parasites. Genetics of microorganisms. Pathogenesis of infection. Pathogenic bacteria (mechanisms of pathogenicity, genetic mechanisms of resistance). Pathogenic viruses (antiviral substances, genetic basis of resistance). Pathogenic fungi. Parasites. Treatment of diseases caused by bacteria, viruses, fungi and parasites. Diagnostic procedures in microbiology (standard and molecular biological procedures).

11. Organic Chemistry (9 ECTS credits):
The structure and reactivity of basic organic compounds and the mechanisms of basic organic reactions: Nomenclature. Bonding in organic compounds. Resonance and aromaticity. The basics of stereochemistry. Types of reactions. Electronic effects. Acids and bases. Tautomery. Substitutions. Eliminations. Additions. Radical reactions. Oxidations and reductions. Organic compounds of biological significance: carbohydrates, amino acids, peptides, proteins, nucleic acids.

12. Physical Chemistry (6 ECTS credits):
Physical quantities and dimensions. States of matter. The functions of a state. Gases. Laws of thermodynamics: work, heat, internal energy, enthalpy, calorimetry, entropy. General equilibrium conditions for closed systems. Open systems. Solutions. Chemical

equilibrium. Electrochemistry.

13. Physiology (6 ECTS credits):
Physiological principles: homeostasis, transport phenomena, thermodynamics of biological solutions, membrane potential, electrical communication, skeletal and smooth muscle. Blood circulation. Respiration. Kidneys and electrolyte trafficking in the body. The nervous system. The gastrointestinal system. Endocrinology. Metabolism.

14. Pharmaceutical Technology 1 (20 ECTS credits):
Pharmacopoeia and rules and regulations. Physicochemical basis of drug design. Basic technological operations. Excipients. Pharmaceutical packaging. Water. Storage of medicinal products. Powders. Grains. Capsules. Tablets. Peroral, dermal, rectal, vaginal and parenteral forms. Pharmaceutical preparations for inhalation. Pharmaceutical preparations for nose, eye and ear. Phytopharmaceuticals. Radiopharmaceuticals. Sterilization. Liposomes. Nanoparticles.

15. Physical Pharmacy (5 ECTS credits):
Physical approaches to explanation and evaluation of pharmaceutical systems: single-component, two-component and multi-component systems. Phase diagrams. Interfacial phenomena. Forces between particles and solid surfaces. Interfacial electric phenomena. Surface adsorption. Surface energy. Wetting. Contact angle. Inverse gas chromatography.

16. Pharmaceutical Chemistry II (7 ECTS credits):
Classification of active substances on the basis of their functional groups: carbohydrates, alcohols, ethers, acids, esters, aldehydes, ketones, aromates, amines, amides, heterocyclic systems. The relationship between structure and function: vitamins, hormones, chemotherapeutic agents, anti-parasitic agents, anti-mycotic agents, disinfectants and antiseptics, local and general anaesthetics, prostaglandins and leukotrienes, indole alkaloids, contrast agents and radiopharmaceuticals.

17. Pharmaceutical Biochemistry (7 ECTS credits):
Biomolecules: water, amino acids, peptides, proteins, enzymes, carbohydrates, lipids, hormones, nucleic acids. Immune response. Catabolism. Anabolism. Carbohydrate and amino acid metabolism. Hormonal regulation of metabolism. Storage and transfer of genetic information: structure of chromosomes and genes, DNA replication and transcription, RNA, the genetic code, protein synthesis, recombinant DNA. Biomolecules in pharmacy.

18. Instrumental Pharmaceutical Analysis (4 ECTS credits):
Analytical process, signals. Spectroscopic methods: UV+VIS, infrared spectroscopy, nuclear magnetic resonance, mass spectrometry. Polarimetry. Chromatography: HPLC, gas chromatography, capillary electrophoresis. Preparation of biological samples for analysis. Thermal analysis. Enzymatic immunological, radioimmunological and radiological tests. Analyzers in clinical biochemical laboratory.

19. Social Pharmacy (4 ECTS credits):
Public health: healthcare system, health insurance system, legislation, health promotion, ethics. Pharmacotherapy: supply and provision of medicinal products, pharmacy services, the use of medicinal products and associated problems. Pharmacoepidemiology and pharmacovigilance: risks, types of research, sampling, errors. Therapy outcomes: clinical, humanistic and economical. Evaluation of healthcare interventions.

20. Pathologic Physiology (6 ECTS credits):
Disease-inducing mechanisms. Causes (etiology) and mechanisms (pathogenesis) of the appearance and development of various pathological processes and diseases.

Biochemical basis of disease processes.

21. Pharmacognosy I (9 ECTS credits):
Drugs of plant origin, their active substances and pharmacodynamic effects. Drugs with carbohydrates: mucilage, gums, pectins. Drugs with glycosides: cardiotonic, anthraquinone, flavonoid, coumarin, glucosinolate, cyanogen, saponin, iridoid. Bitter drugs. Drugs with etheric oils. Tannoid drugs. Alkaloid drugs. Gum drugs.

22. Pharmaceutical Chemistry 3 (20 ECTS credits):
Strategies for identifying active substances. Acid/base, distribution coefficient, water solubility and chirality of active substances. The basics of modelling. Target interactions. Isosterism and bioisosterism. Radicals. Antioxidants. Intermolecular recognition. SAR and QSAR. Targets of active substances: enzymes, receptors, nucleic acids, the tubular system and cell membranes. The relationship between the structure and function in various groups of active substances.

23. Pharmaceutical Technology 2 (8 ECTS credits):
Thermodynamics. Chemical potential. Colligative properties. Isotonicity. Buffers. States of matter. Phase rule. Triphasic diagram. Condensed systems. Compound characterization. Preformulation. Polymorphism. Powders. Stokes' Law. Particle size. Powder density. Solubility. Dissociation constant. Distribution coefficient. Reaction kinetics. The rate of dissolution. Polymers. Systems for delivery of active substances.

24. Pharmacognosy II (4 ECTS credits):
Practicum: Basic phytochemical testing of drugs and extracts, drugs with etheric oils. Methods of isolation and analysis of etheric oils. Drugs with glycosides: cardiotonic, anthraquinone, flavonoid, coumarin, glucosinolate, cyanogen, saponin, iridoid. Plant morphology, field work: determination of plant species in habitats, composition of herbarium.

25. Pharmacology (5 ECTS credits):
General pharmacology: target molecules, mechanisms of action of medicinal products, pharmacokinetic processes and medicinal product's fate in an organism, testing of medicinal products. Overview of medicines according to pharmacodynamic groups: the mechanism of action and effects, indications and contraindications, pharmacokinetic properties, posology and method of administration of medicinal products. Pharmacological approaches to therapy of various diseases. Experimental models in pharmacology.

26. Biopharmaceutics with Pharmacokinetics (9 ECTS credits):
Temporal and spatial aspects of passage of active substances in the body and methods of their evaluation. LADME system. Mechanisms, kinetics and methods of evaluation of release, absorption, distribution, metabolism and elimination processes. Pharmacokinetics: pharmacokinetics of single and multiple dosing, pharmacokinetic models, posology. Biological applicability. Biological equivalence.

27. Pharmaceutical Biotechnology (6 ECTS credits):
Modern and classical biotechnology. Basic principles of production of recombinant active substances and synthetic peptides. Function of the immune system. Cytokines. Growth factors. Monoclonal antibodies. Analytics of active substances of biotechnological origin. The use and mechanism of action of biopharmaceuticals. Plant and animal tissue and cell cultures. Gene therapy. Ethics and the regulatory process in the field of pharmaceutical biotechnology.

28. Design and Synthesis of Active Substances (5 ECTS credits):
Core strategies for identification, design and synthesis of active substances. High-throughput screening of compounds and identification of new target macromolecules. Computer-supported approaches to the design of structure and synthesis of active substances. Molecular modelling, conformational analyses, molecular mechanics and dynamics. Design of ADME properties. Design and synthesis of inhibitors of various mechanisms of action, modulators, agonists as well as antagonists and mimetics.

29. Toxicological Chemistry (5 ECTS credits):
Specific and unspecific poisons. Determination of substance toxicity. Toxicogenomics. Gene toxic, carcinogenous and co-carcinogenous substances. Immunotoxic substances. Toxicological chemistry of inhalation poisons, metals, heavy metals, organic solvents, pesticides, insecticides, herbicides, fungicides and rodenticides, chemical weapons, toxins of eukaryotes and prokaryotes, toxicomanogenous substances. Analytics of poisons. Antidotes and medicinal products.

30. Stability of Medicinals (5 ECTS credits):
Studying and testing of the stability of medicinal products: Thermodynamic and kinetic aspects of medicinal product stability. Reaction kinetics in medicinal product stability. The effect of temperature on the rate of processes. Chemical changes of active substances and excipients: hydrolyses, oxidations, isomerisations. Physical changes of substances and final pharmaceutical forms. Microbiological quality. Stress testing. Methods of analysis.

31. Clinical Chemistry (7 ECTS credits):
Biological material. Regulatory process in this scientific field. Methods in clinical chemistry. The basic principles of haematological and urinary analysis. Water and electrolytes. Important groups of analytes: non-protein nitrogen compounds, carbohydrates, amino acids, proteins, enzymes and isoenzymes, lipids, iron and trace elements, nucleic acids, hormones, tumor markers, specific antibodies. Monitoring of the level of medicines and toxins.

32. Analysis and Control of Medicinals (8 ECTS credits):
Validations of methods of analysis. Qualification of analytical equipment. Pharmaceutical analytical documentation. The surveillance of medicinal products. Systems of quality control. Overview of analytical methods based on pharmacopoeias. Impurities, residual solvents. Determination of water content. Analytical techniques and instruments in pre-formulation studies. Extraction methods. Analysis of solids. Modern approaches to the analysis of medicinal products in pharmaceutical industry. Analysis of active substances based on chemical groups.

33. Clinical Pharmacy (5 ECTS credits):
Clinical outcomes of medicinal products. Meta-analyses. Pharmacotherapy: cardiovascular diseases, asthma and chronic obstructive pulmonary disease (COPD), psychoses, depression and anxiety disorders, Alzheimer's and Parkinson's disease, infections, diabetes, pain disorders, osteoarthritis and rheumatoid arthritis, peptic ulcer disease, cancers. Pharmacotherapy during pregnancy and lactation. Clinical pharmacokinetics. Interactions and adverse effects. Clinical trials.

34. Industrial Pharmacy (5 ECTS credits):
Industrial activities before, during and after the end of the medicinal products manufacturing process: legislation, standards and regulations. Industrial property. Pre-clinical and clinical studies of medicinal products. Pre-formulation studies of medicinal products. Manufacturing premises. The industrial-scale manufacture of sterile, solid and semisolid pharmaceutical forms. Packaging. Quality assurance and validation.

35. Biopharmaceutical Evaluation of Pharmaceutical Forms (5 ECTS credits):
Pharmaceutical form: constituents, interactions. The effects of physicochemical properties on biopharmaceutical properties. Analytical methods for evaluation of biopharmaceutical properties. Physiological / pathological conditions at the site of administration. Oral administration. Digestive tract: pH, volumes, media, flows, movement. Release. Absorption. Presystemic metabolism. Stability. In vitro models. In vitro – in vivo correlation. Regulatory system. Industrial approaches.

36. Biochemistry of Cancer Development and Progression (5 ECTS credits):
Biochemical processes in the development of cancer. Genotypical and phenotypical differences between malignant and non-malignant cells. Changes in cellular communication. Proteolytic processes. Chemotaxis. Tumor invasion. Biochemical processes in anti-tumor immune response. Biological macromolecules as indicators of diagnosis and prognosis of malignancy. Targeted delivery of anti-tumor active substances into cancerous tissues and cells.

37. Hospital Pharmacy (5 ECTS credits):
The function of hospital pharmacies. Total parenteral nutrition: sterilization, manufacturing technology, indications. Radiopharmaceutical products: radiotherapeutic and radiodiagnostic agents. Cytostatic agents: work guidelines, work premises. Medical equipment: wound care products, stoma care products and products for the care of incontinent patients. State-of-the-art methods of active substance delivery: skin substitutes, iontophoresis, electroporation, sonophoresis, microneedles.

38. Eutomers (5 ECTS credits):
Significance of stereoisomerism of active substances. Stereochemical aspects of biotransformation and interaction. Legislative and regulative measures in registration of racemates, pure enantiomers and diastereomers. Selected examples of stereoselective action of active substances. Physicochemical methods of chiral active substance characterization. Extraction of pure enantiomers and diastereoisomers. Selected examples of stereoselective synthesis of active substances.

39. Modified Release Pharmaceutical Forms (5 ECTS credits):
Mechanisms of modified release. Biopolymers. Intelligent polymers. Colloidal carrier systems: nanoparticles, liposomes, micro- and nanoemulsions. Solid pharmaceutical forms with modified release: gastroresistant, for peroral use, swimming, bioadhesive, matrix. Peptide and protein delivery systems. Modern technological approaches to modelling: nanolayering, micronization with supercritical fluids.

40. Pharmaceutical Engineering (5 ECTS credits):
Fluid flow. Transfer of heat and mass. Powder rheology. Design of new technological equipment. Processes: air conditioning, drying, mixing of powder compounds, agglomerations, solid particle compression, layering, fluid bed technology. Tools of process analytical technology: online measurement of particle sizes, particle growth modelling. Scale-up tools. Numerical analysis of technological processes.

41. Pharmaceutical Marketing and Management (5 ECTS credits):
Marketing: market segmentation, target market selection, supply positioning, marketing forms, micro and macro marketing environment, marketing network, the concept of medicinal product's life cycle, marketing strategies, marketing research, marketing plan, communication network, pharmaceutical marketing. Management in pharmaceutical industry: innovative drug development management, generic drug development management. Pharmacy management: public pharmacy, hospital pharmacy.

42. Pharmacoeconomics (5 ECTS credits):

Therapy outcomes. Pharmacotherapy costs. Pharmacoeconomic analyses: cost analysis, cost-minimization analysis, cost-effectiveness analysis, cost-benefit analysis and cost-utility analysis. Types of pharmacoeconomic studies. Modelling in pharmacoeconomics. Organization of healthcare systems. Healthcare costs. Healthcare policy design based on pharmacoeconomic principles.

43. Pharmacogenomics and Genetic Medicines (5 ECTS credits):
Pharmacogenetics / pharmacogenomics. The human genome. Genotype / phenotype of individual variations. Biomarkers. Pharmacogenetics of metabolizing enzymes, receptors, transporters. Individualized therapy. DNA microarrays. Pharmacogenomics in the project of medicinal product design. Pharmacogenomics / proteomics. Applicative bioinformatics. Social, ethical and legal aspects of pharmacogenomic research. Genetic medicines.

44. Phytopharmaceuticals (5 ECTS credits):
Phytopharmaceuticals and phytotherapy. Overview of plant drugs based on pharmacodynamic groups. Phytopharmaceuticals for: cardiovascular, gastrointestinal, respiratory and urogenital tract as well as the nervous system. Adaptogenic phytopharmaceuticals. Immunostimulatory phytopharmaceuticals.

45. Immunology (5 ECTS credits):
Defense mechanisms. Complement. Immune system composition. Congenital and acquired immunity. Antibodies. Antigens and immunogens: superantigens, haptens, vaccines, adjuvants. Cellular cooperation: cell receptor repertoire, signalling and activation, cytokines.
Effector system of acquired immunity. Introduction to immunopathology: inflammation, immune deficiencies, allergy, immune system and cancer, autoimmunity, transplantations and rejections.

46. Selected Topics in Pharmaceutical Biotechnology (5 ECTS credits):
Broadening the knowledge base of pharmaceutical biotechnology. State-of-the-art techniques of formation. Recombinant biopharmaceuticals: state-of-the-art techniques of formation, pharmacology with pharmacokinetics, pharmaceutical forms. Application and developmental potential of various groups of biopharmaceuticals. Analytics of active substances of biotechnological origin.

47. Selected Topics in Clinical Biochemistry (5 ECTS credits):
Laboratory diagnosis of common congenital digestive disorders, diabetes, galactosemia, congenital disorders of amino acid metabolism, atherosclerosis, systemic rheumatic diseases, organ-specific autoimmune diseases. Hormonal diagnostics of chromosomal diseases (Down's syndrome). Laboratory doping detection. Diagnostics of immune deficiencies. Identification and classification of hypersensitivity and allergic reactions.

48. Selected Methods of Pharmaceutical Analysis (5 ECTS credits):
Broadening the knowledge base of pharmaceutical analysis methods: spectroscopic methods (UV, IR, fluorescence). Resonance methods (NMR, EPR). Mass spectrometry. X-ray cristallography. Surface plasmon resonance. Electron microscopy. Complex analysis systems (coupling of separation and spectroscopic methods). Complex analytics design.

49. Quality of Medicinals (5 ECTS credits):
Processes and procedures required for quality assurance of medicinal products from the perspective of manufacture as well as control and analytical procedures. Legislature and regulatory process in the area of medicinal products. Pharmaceutical chemical documentation. Quality manuals. Protocols. Standard operating procedures. The basic principles of holistic quality management. Good practices. Validation of technological equipment, processes, analytical methods and analytical instruments. Calibration and

qualification.

50. Cosmetology (5 ECTS credits):
Skin: cellular structures of skin and hair, skin matrix compounds, polysaccharides, proteoglycans, skin lipids. Cosmetic products: manufacturing technology, evaluation and application. Ingredients of cosmetic products: cosmetically active compounds, surface active compounds, emulsifiers, preservatives, antioxidants. Cosmetics Act. Evaluation of safety and efficacy. Care and natural cosmetic products. Sun protection products.

51. Nutritional Supplements (5 ECTS credits):
Legislation in the area of nutritional supplements. Definitions of basic terms: nutraceuticals, functional food, diet food. Recommended daily intake of nutrients. Vitamins. Vitaminoids. Minerals. Amino acids. Lipids. Carbohydrates. Prebiotics and probiotics. Antioxidants. Bee products. Enzymes. Phytoestrogens.

52. Psychotropic Substances and Abuse of Medicinal Products (5 ECTS credits):
Groups of psychotropic substances and medicinal products that are commonly subject of abuse: illicit drugs – narcotics, anabolic steroid hormones, stimulants, diuretics, analgesics, local anesthetics, anxiolytics, antidepressants, hypnotics, glycoprotein hormones. Mechanisms of action. Symptoms of overdosing. The phenomenon of tolerance, addiction and withdrawal syndrome. Methods of poisoning and antidotes. Legislation.

53. The Use of Genetic and Cellular Testing in Biomedicine and Pharmacy (5 ECTS credits):
Types of diagnostic and prognostic genetic tests and ethical principles. Identification of genetic factors in multifactorial diseases. Procedures of nucleic acid extraction from various biological samples. Methods of detection of genetic mutation. Evaluation of gene expression. Techniques of primary cell culture preparation and cell line growth. The use of cellular and genetic markers in laboratory biomedicine.

54. Medicinal Products of Alternative Medicine (5 ECTS credits):
Alternative healing methods, their historical development and place in modern society. Homeopathy. Bach flower remedy drops. Spagyric quintessences. Ayurveda preparations. Naturopathic preparations. Chinese traditional medicine preparations. Other techniques: holistic medicine, Kampo, Unani, Shamanism. Legal aspects of alternative healing methods in Europe and Slovenia.

55. Instrumental Analytical Methods in Pharmacy (5 ECTS credits):
Spectroscopic and resonance methods (Upgrade of theoretical principles with practical use in pharmaceutical analytics. Selected methods of NMR, IR, EPR, fluorescence spectroscopy, mass spectrometry, capilary electrophoresis, complex analytical systems: LC-MS, GC-MS.

56. Research Methods in Social Pharmacy (5 ECTS credits):
Pharmacoepidemiology, pharmacovigilance, evidence based medicine, evidence based pharmacy practice, research of structure, proceses and health outcomes, problems connected with drug use, qualitative methods of research: questionnaire, interview, opinion poll, focus groups.

57. Practical Training (30 ECTS credits):
Training to become a medical professional. Professional and legislative practice: code of ethics, clinical surveillance, personal professional development, dispensing and supply of medicinal products, conditions for managing pharmacies, legislation on pharmaceutical activity, health and safety at work, protection of personal information and medical records. Clinical and pharmaceutical practice: mechanisms of action and usage of medicinal

products, adverse effects, contraindications, interactions, health promotion and disease prevention, good dispensing practice, labelling. Systems and procedures: financing of health services, the rules on and limitation of prescription practices, procedures in primary and secondary healthcare. Hospital pharmacy. Clinical pharmacy. Clinical diagnostics.

58. Individual Research Work for Master's Thesis (25 ECTS credits):
Master's thesis is an independent research project. Each student selects a topic and a supervising faculty member. Contents overview: definition of the central question, the aim of the study, scientific approach and methods. Understanding of the mentoring process. Use and overview of available bibliography data. Understanding of the central question. Basic approaches, methods and experimental techniques. Independent experimental work with adequate recording. Analysis of results, making partial decisions and their testing. Written submission of the scientific work. Research as a creative interdisciplinary teamwork.

59. Master's Thesis Defence (5 ECTS credits)
The student presents his/her own research project and demonstrates a broader understanding of the selected research topic. The master's thesis structure contains all elements of a scientific article (title, contents, summary, list of abbreviations, introduction, aim of the study with a working hypothesis, materials and methods, results, discussion, conclusions, bibliography). The thesis defence is marked by a clearly presented research topic, methods used, results obtained and the evaluation of the results. Master exam's aim is to test the student's ability to synthesize knowledge of a broader research area.