ODESSA NATIONAL MEDICAL UNIVERSITY
PHARMACEUTICAL FACULTY

DEPARTMENT OF DRUGS TECHNOLOGY

WORKBOOK

for seminar lesson

in the discipline «**DEVELOPMENT OF DRUGS**»

Student (s) _____

(full name)

Faculty of pharmacy

Course_____group _____

Specialty pharmacy

20___/ 20___academic year

Workbook is intended for conducting seminar protocols by students Classes in the discipline "Medicinal Development". For each topic Classes formulated specific goals, data control issues to study the topic, Proposed tasks for self -performance. Each student performs The individual task of the presented, processes them and writes in a workbook. In the notebook this reference information and recommended literature for self study.

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INTRODUCTION

The basic discipline «Development of the drugs» is a theoretical and practical basis of the totality of knowledge and skills forming the future specialists in the field of pharmacy, industrial pharmacy, and also is is the theoretical basis of the totality of knowledge and skills forming the profile of a specialist in the field of natural sciences.

The purpose of teaching discipline «Development of the drugs» is the disclosure of modern scientific concepts, concepts and methods of developing new drugs using all the capabilities of modern pharmacy.

The tasks:

1) formation of basic concepts about the scheme of development of modern medical products and methods for their subsequent verification;

2) familiarization with modern biotechnological methods used in the development of a medicinal product;

3) forecasting of perspective directions based on computer methods for the development of medicinal products;

4) determination of ways and methods for improving the efficiency of the use of natural raw materials for the creation of new drugs;

5) the formation of a scientific outlook and contemporary thinking in the field of pharmaceutical biotechnology

6) ensuring the quality of life and safety of people's lives.

As a result of studying the discipline, the applicant must

Know:

1) the specific terminology of pharmaceutical technology;
2) main groups of medicines;

3) methods of administering medicinal products to animals and humans;

4) stages of the development of modern medicines;

5) methods of analysis and testing of new drugs;

6) the rules for the approval of new drugs in the European Union, the United States and Ukraine.

Be able:

1) to work with the original English-language scientific literature; to carry out purposeful search of scientific articles and to critically analyze the presented data;

2) to determine the principles of rational development of the medicinal product;

3) to make informed decisions in evaluating the object of pharmacological action of the developed medicinal product;

4) to predict the necessary physical and chemical characteristics of the potential medicinal product, depending on the specific molecular structure of the receptor;

5) to develop a new delivery system of a medicinal product, using as a carrier a synthetic polymer capable of degradation;

6) to plan and carry out preclinical and clinical research of new drugs using a scientific approach;

7) to predict and evaluate the effects of adverse effects of medicinal products upon entry into the market

8) to prevent pollution of the environment by the pharmaceutical industry.

SAFETY INSTRUCTIONS:

1. Practical classes on development of the drugs (hereinafter referred to as drugs) are conducted in classrooms. When working in the classroom, it is necessary to strictly follow the rules of personal hygiene and safety.
2. Students must comply with the requirements for life safety, provided by the relevant rules and instructions, adhere to discipline, study diligently.
3. There should be nothing superfluous in the workplace, except for reference books and materials used to perform individual tasks.
4. Perform only the work assigned by the teacher.
5. Do not go into the classroom and do not leave it without the permission of the teacher.
6. At the end of the lesson, students must put their workplace in order, hand over the reference book issued to the next student, as well as submit a completed workbook for the teacher's signature.

Student's signature _____

№PROGRAM AND CONTENT OF SEMINAR LESSON

№	Topic	Volume in hours
1	Auxiliary operations in the manufacture of drugs. I manufactured solid drugs (powders).	2
2	Manufacturing technology of solid dosage forms.	2
3	Solid dosage forms of prolonged action. Microcapsulation of medicinal substances.	2
4	Extraction drugs. Technology of making tinctures. Novogalene preparations.	2
5	Preparation and analysis of aqueous solutions. Alcoholic solutions.	2
6	Syrups Solutions for injection in ampoules.	2
7	Liquid chromatography. Methods of microbiological control of drugs (beginning).	2
8	Methods of microbiological control of drugs (ending).	2
9	Pre-clinical testing of medicines. Choice of assessment methods.	2
10	The main phases of clinical trials of new drugs.	2
Total		**20**

Seminar lesson on the topic № 1 Date _____

TOPIC: **AUXILIARY OPERATIONS IN THE MANUFACTURE OF DRUGS. I MANUFACTURED SOLID DRUGS (POWDERS).**

The purpose of the lesson: to study the features of the technology of obtaining powders in the conditions of industrial production, to study the basic technological operations and equipment necessary for the manufacture of powders.

Information material

Powders as a solid drug форма are produced in single-dose (bags or sticks of foil, special types of paper or polyethylene cellulose film) and multi-dose containers (dark glass jars, plastic bottles with screw caps, packaging with mechanical spray, pressure containers, plastic, multilayer paper or multilayer dosing from a multi-dose container is carried out using a special spoon, and when using single-dose containers, each dose is pre-weighed. They contain one or more active substances with or without fillers. If necessary, add dyes and flavors that are approved for medical use.

Control questions for input control:

1. What are powders as a dosage form? Why do we classify powders in principle? Name the advantages and disadvantages of powders.

2. Name the main technological stages in the production of breeds.

3. What is grinding? Name the main requirements for grinding the substance. What equipment is offered for the grinding process.

4. Describe the process of forgiveness. Name the main types and principles of industrial sieves.

5. Describe the process of changing the place. Name the main technological characteristics and equipment that are in the place of change.

6. Packing and packaging of powders. The principle of choosing packaging materials and type of packaging.

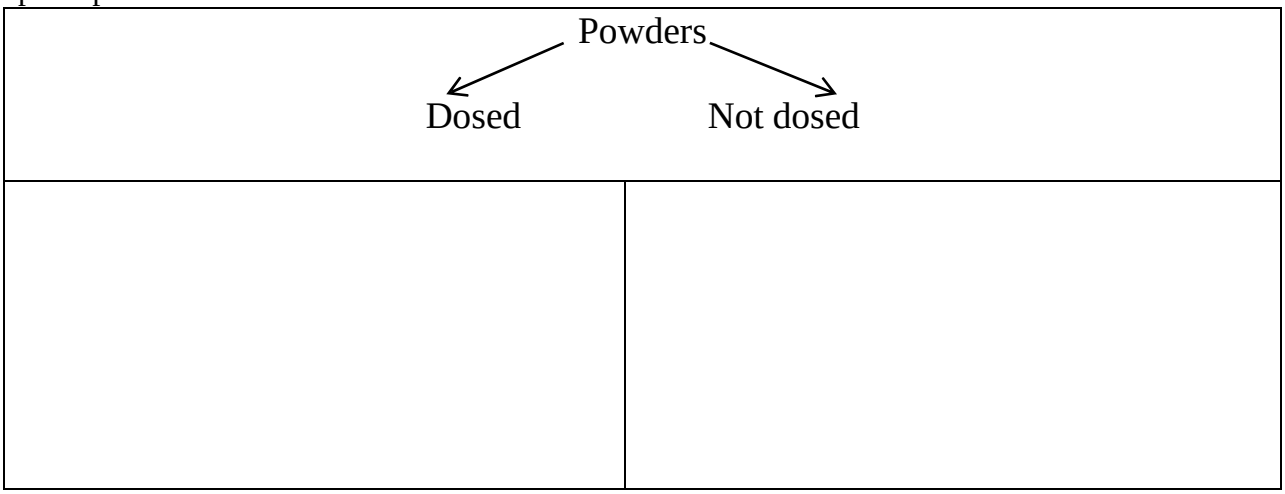
Task 1: Define DF «Powders» in accordance with the current SP:

Task 2: Give the classification of powders according to the proposed principle:

By method of use:	
By composition:	
By the nature of the dosage:	
According to the method of discharge:	

By degree of fragmentation:	

Task 3: Give the classification of methods of packaging powders according to the proposed principle:



Task 4: Describe the basic requirements for powders. List the advantages and disadvantages of powders:

Requirements:1.

2.

3.

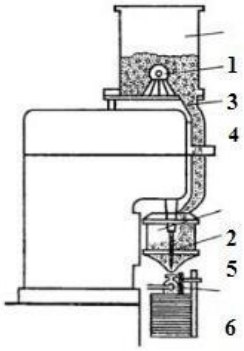
4.

5.

Benefits	***Disadvantages***

Task 5: Give and give a brief description of the main technological stages of preparation of powders:

Task 6: According to the following scheme, give the main parts and describe the principle of operation of the screw and vacuum dispensers:



The device of the screw batcher

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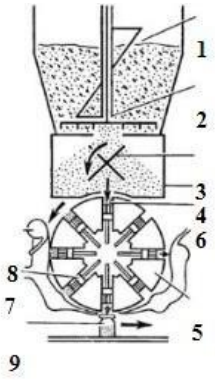

The device of the vacuum batcher

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Task 7: How is the standardization of powders as a dosage form?

Teacher's signature _____

Seminar lesson on the topic № 2 Date _____

TOPIC: **MANUFACTURING TECHNOLOGY OF SOLID DOSAGE FORMS.**

The purpose of the lesson: to study the features of the technology of solid drugs on the example of obtaining tablets using modern methods of granulation; expand knowledge of modern excipients used in the preparation of tablets.

Information material

Tablets are solid dosage form, according to the method of application are divided into tablets without modified release and modified release. Granulation is a directed aggregation of particles, which is necessary to: improve the flowability of the tablet mixture, improve compression, prevent delamination, ensure accurate dosing and reduce dust in the workplace. Existing methods of granulation are divided into the following main types: 1) dry granulation; 2) wet granulation; 3) structural granulation; 4) mixed granulation.

Control questions for input control:

1. Describe the tablets as one of the types of solid dosage form.
2. Describe the process and stages of granulation.
3. What processes and stages of structural granulation do you know?
4. What are the main groups of excipients in the production of tablets do you know?
5. Fillers used in the manufacture of tablets. What are the main types, properties and uses of fillers you know?

6. What modern binders are used in the manufacture of tablets?
7. Describe the types and uses of corrective substances in the manufacture of tablets.

Task 1: Give the definition of dosage form «Tablets» in accordance with the current SP:

Task 2: Give the characteristics of the tablets in accordance with the proposed principle:

Gastro-resistant:	
Uncovered:	
Covered:	
Effervescent:	
For oral use:	
Depending on the application:	

Task 3: Describe the requirements for substances used in the manufacture of tablets. List the properties according to the suggested principle:

Physicochemical properties of powdered medicinal substances	Technological properties of powdered medicinal substances

Task 4: Define the terms «granulation». Describe the main types of granulation.

Task 5: Describe the excipients in the production of tablets in accordance with the proposed principle:

Fillers:	

Binders:	
Looseners:	
Antifriction:	
Film formers:	
Prolongators and substances to create a hydrophobic layer:	
Solvents:	
Plasticizers:	

Task 6: Define and name the main groups and functions of dyes:

Dyes are

Dyes approved for use in pharmaceutical technology are classified into groups:

Functions of dyes:

Task 7: Name the main groups of tablet coatings and their functions.

Type of coating	Function

Teacher's signature _____

Seminar lesson on the topic № 3 Date _____

TOPIC: **SOLID DOSAGE FORMS OF PROLONGED ACTION. MICROCAPSULATION OF MEDICINAL SUBSTANCES.**

The purpose of the lesson: to study the features of the technology of obtaining solid dosage forms of prolonged action and tablets and capsules with modified release of active substances, to characterize tablets coated or without a shell, to be able to select equipment and evaluate the quality of the obtained microcapsules.

Information material

Prolongation is considered to be an extension of the validity of drugs. To create a pharmaceutical with prolonged action using different methods: chemical method, physiological method, technological method.

Dosage forms with modified release are classified according to:

1) technology of creation; 2) the mechanism of release; 3) release kinetics; 4) According to the characteristics of the media used; 5) by modifying the therapeutic effect. The application of the coating can be dictated by the need to protect the active substances from the effects of external factors, to give the drug an aesthetic appearance, to correct the unpleasant color, taste, smell.

Currently there are the following types of microcapsules: 1) with a single shell; 2) with a double or multilayer shell; 3) «capsule in capsule»; 4) emulsion in a microcapsule or microcapsules in a liquid medium in a common shell.

Control questions for input control:

1. What is the main goal of creating long-acting drugs?
2. What drugs of prolonged action and with given pharmacokinetic properties do you know?
3. How the coating is applied to change the rate of release of the active substance. Types of coatings.
4. Describe multilayer tablets.
5. What are the main mechanisms for the release of substances from the dosage form? Prolongation by obtaining matrices. Polymers for the formation of matrices.
6. Characteristics of the microencapsulation process. Shape, size and structure of microcapsules.
7. Describe the shell of the microcapsule and its types.
8. What are the prospects for the development of the technology of prolonged-release drugs?

Task 1: Define the terms «prolongation» and «prolongator»:

Task 2: Describe how the prolonged action of API can be achieved and give the advantages of using prolonged pharmaceutical drugs:

Завдання 3: Prolonged dosage forms are classified:

On the way of introduction:	**Taking into account the kinetics of the process:**

Task 4: Prolonged-release drugs are intended to achieve the following goals:

Task 5: Define the concept of «modified-release dosage forms», give the classification of DF with modified-release:

Task 6: Define the terms «microencapsulation» and «microcapsules», give a classification of types of microcapsules:

Task 7: Define «multilayer tablets». List the main disadvantages and advantages.

Benefits	***Disadvantages***

Teacher's signature _____

Seminar lesson on the topic № 4 Date _____

TOPIC: **EXTRACTION DRUGS. TECHNOLOGY OF MAKING TINCTURES. NOVOGALENE PREPARATIONS.**

The purpose of the lesson: to get acquainted with galenic drugs and novogalenic drugs, with the main methods and ways of extracting BAS from LRS in the production of pharmaceuticals, with the technology of tinctures, learn to make a technological block diagram of production, quality control, packaging and labeling of the finished product before release.

Information material

Galenic drugs should be considered as a specific group of drugs that, together with chemical-pharmaceutical and other drugs, are part of the drug. Novogalenic drugs undergo

maximum purification in order to allocate the amount of active substances and are characterized by almost complete absence of concomitant, increased stability and fewer side effects. Tinctures as a dosage form must meet the requirements of State Pharmacopoeia of Ukraine or Regulatory and Technical Documentation for the content of active substances - alkaloids, tannins, essential oils, organic acids and more. The process of obtaining tinctures consists of successive stages: preparation of production, preparation of raw materials and extractant, obtaining extracts of their purification, standardization, packaging, packaging.

Control questions for input control:

1. How do you understand the concept of «galenic» and «novogalenic» drugs? Describe the main differences between them.
2. Describe the extraction process and technology for obtaining extraction preparations.
3. Describe the intensification of the herbal medicinal substance extraction process.
4. Describe the technology for making tinctures.
5. Describe the definition and main characteristics of novogalenic drugs (NGD).
6. Methods of cleaning in the production of NGD. The essence of the method of dialysis, electrodialysis, salting out, alcohol purification.
7. Describe the nomenclature of novogalenic drugs.

Task 1: Define the terms «galenic drugs» and «novogalenic drugs». Name the main differences between them.

Task 2: The basis of the production of extraction preparations are extraction processes. Describe the concepts of «extraction» and «extraction» substances, describe the extraction methods known to you.

Task 3: Requirements for extractants:

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Task 4: Define the concepts of «tincture». Name the main stages of preparation of tinctures in industrial conditions.

Task 5: Describe how standardization, packaging, packaging and labeling of tinctures is performed.

Task 6: Describe the new galenic or maximally purified drugs. Briefly describe the technology of obtaining drugs of this group.

Task 7: Describe the main methods of clearing seizures and give the main nomenclature of the maximally purified drugs:

Preparations of cardiac glycosides:	

Alkaloids preparations:	
Preparations of steroid saponins:	
Preparations of triterpene glycosides:	
Preparations of sesquiterpene lactones:	
Drugs anthracene derivatives:	
Preparations of phenolic compounds:	

Teacher's signature _____

Seminar lesson on the topic № 5 Date _____

TOPIC: PREPARATION AND ANALYSIS OF AQUEOUS SOLUTIONS. ALCOHOLIC SOLUTIONS**.**

The purpose of the lesson: to study the features of the technology of obtaining aqueous, alcoholic, glycerol, oil, solid solutions, solutions of liquid substances and aromatic waters. Orient in the processes of their preparation and equipment. Know the general evidence of obtaining aromatic waters, understand their purpose and nomenclature.

Information material

Solutions for medical use have a wide variety of properties, composition, methods of preparation, application and occupy an intermediate position between chemical compounds and mechanical mixtures. The technology of preparation of pharmaceutical solutions is reduced to the operations of dissolution or mixing, purification and packaging. Dissolution is a physicochemical process, in the case of a physical phenomenon the crystal lattice is destroyed and the solute molecules are diffused, and in the case of a chemical phenomenon in the process of dissolution the solute molecules react with the solvent molecules.

Control questions for input control:

1. Describe pharmaceutical solutions. What is the biopharmaceutical evaluation of solutions?
2. The concept of solubility and characteristics of solvents. What solutions are used as dosage forms according to SPU.
3. Describe some of the solvents used to prepare liquid dosage forms.
4. Characteristics of alcohol solutions. What are the rules for preparing alcohol solutions?
5. Characteristics, purpose and nomenclature of aromatic waters. General indications for obtaining aromatic waters.

Task 1: Define the concept of «solutions», describe the types and technology of preparation of aqueous pharmaceutical solutions.

Task 2: Describe the technological operations of obtaining non-aqueous solutions:

Task 3: Describe the types of non-aqueous solutions according to this principle:

Type of solution	**Characteristic**
Solutiones glycerinatae	
Solutiones oleosae	
Aromatic waters	
Solutiones spirituosae	

Task 4: Describe the theoretical foundations of the dissolution process. List the main types of solvents.

Task 5: According to the degree of solubility, there are substances:

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Task 6: Define the concept of «aromatic waters». Name the main methods of obtaining aromatic waters.

Task 7: Describe the purpose and range of aromatic waters.

Teacher's signature _____

Seminar lesson on the topic № 6 Date _____

TOPIC: **SYRUPS. SOLUTIONS FOR INJECTION IN AMPOULES.**

The purpose of the lesson: get acquainted with the peculiarities of the technology of obtaining syrups and innovative solutions, operating in the main technological schemes of vial production of ampoules, in the rational selection of possession, folding the technological block diagram of production of production.

Information material

The main purpose of syrups is to correct the unpleasant taste of medicinal substances. The syrup is added in an amount of 10-15% of the total amount of the mixture. Syrups are divided into two groups: flavor syrups and medicinal syrups.

Solutions for injection are a liquid form for parenteral use, in which the drug bypasses the digestive system, in particular the liver, which prevents it from being affected by enzymes, destroying and reducing the activity of the substance. The main requirements for injectable solutions are: sterility, purity, stability, pyrogenicity, and in some cases - isotonicity.

Control questions for input control:

1. What are syrups as medicines? What are the main groups of syrups?

2. What is the peculiarity of the technology for preparing flavoring syrups?

3. What is the peculiarity of the technology for preparing medicinal syrups?

4. What is the main use of syrups in pediatric practice?

5. What are the main additional substances in the production of syrups.

6. What is the essence of the study of pharmacological, technological and microbiological properties of syrups?

7. How is the quality control of syrups? What are the main and directions of development of dosage forms in the form of syrups.

8. Describe solutions for injection. What are the main requirements for injection solutions do you know?

9. Describe the injection solutions in ampoules. What are the aseptic manufacturing conditions.

10. What are ampoules? What are the main stages of manufacturing and filling with solutions.

Task 1: Define the concept of «syrups», describe the main purpose of syrups.

Task 2: Provide the characteristics and functions of the main excipients used in the process of making syrups according to the table.

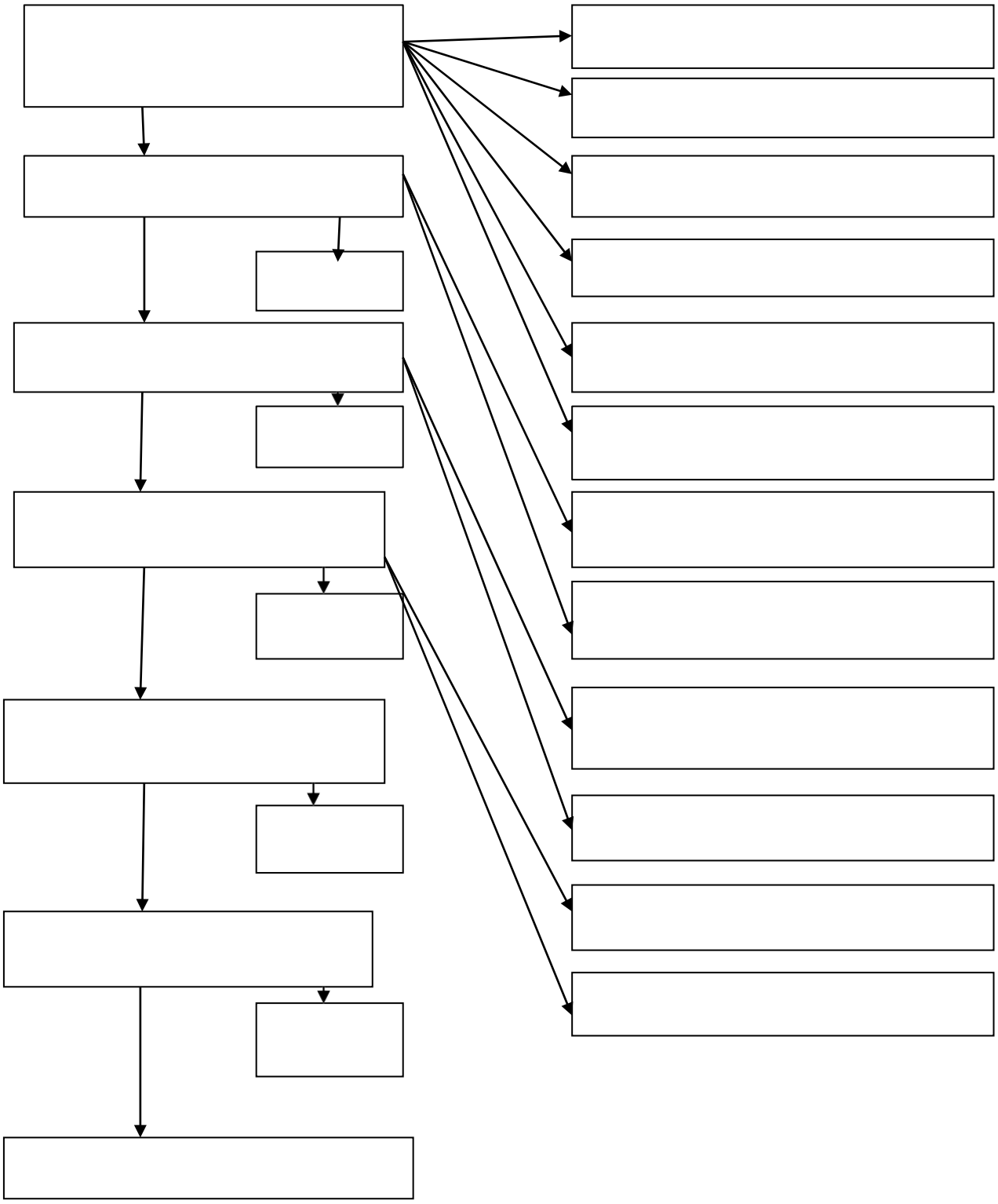
Excipient	Characteristics and function
1. Solvents	
2. Thickeners	
3. The group of pH regulators	
4. Correctors	
5. Dyes	
6. Flavors	
7. Sweeteners	

Task 3: Briefly describe the technology of preparation of flavor (simple sugar) and medicinal (altea) syrups.

Task 4: Define «injectable solutions» and describe how they differ from simple solutions.

Task 5: Name the known solvents used in the technology of preparation of solutions for injection. Describe the main requirements for them.

Task 5: Fill in the technological scheme of preparation of solutions for injections.



Task 7: Define the term «sterilization», describe the main methods of sterilization in the pharmaceutical industry.

Teacher's signature _____

Seminar lesson on the topic № 7 Date _____

TOPIC: **LIQUID CHROMATOGRAPHY. METHODS OF MICROBIOLOGICAL CONTROL OF DRUGS (BEGINNING).**

The purpose of the lesson: to get acquainted with the features of the method of liquid chromatography, to expand knowledge about modern methods of microbiological control of drugs. Orient in the modern stages of microbiological control of drugs.

Information material

The phenomenon of chromatography was discovered by M.S. Tsvet in 1903 in the form of columns of the eye liquid-adsorption method. Liquid chromatography (LC) is based on the mechanisms of oddsorption, partition, ion exchange, or molecular size separation. High performance liquid chromatography (HPLC) is widely used to separate and identify a wide variety of substances: optically active compounds, proteins, nucleic and amino acids, polysaccharides, dyes, explosives, biological objects, drugs, etc. Among the indicators that characterize the quality of drugs: tablets, capsules, solutions, ointments, etc., which are not sterilized during production, is their microbiological purity. The level of microbial contamination of the drug depends on the type of action, the ingress of microbes with acquired resistance, the presence in the composition of substances that reduce the antimicrobial action of the drug.

Control questions for input control:

1. What is the main essence of liquid chromatography in drug quality control?

2. What are the rules for the determination of organic matter impurities using chromatography?

3. Describe the individual blocks and modules of liquid chromatographs.

4. Describe the most widespread optical detectors of liquid chromatographs: photometric and refractometric.

5. What is the essence of microbiological control of medicines?

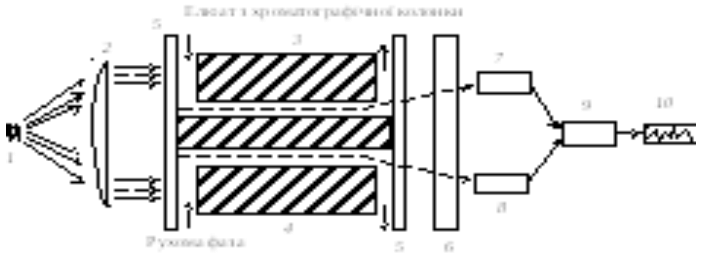
6. Describe the concept of «biotesting». What are the main stages of TSH biotesting**.**
Task 1: Define the concept of «liquid chromatography», describe the main types. Name the main parts of the liquid chromatograph.

Task 2: Define the concept of «High performance liquid chromatography».

Task 3: Describe the advantages of HPLC over other methods of chromatography:

Task 4: Define the concept of «impurities in drugs», describe the methods for estimating the composition of impurities in drugs by HPLC.

Task 5: According to the given scheme, give the main parts (opposite) and describe the principles of operation of photometric and refractometric detectors.



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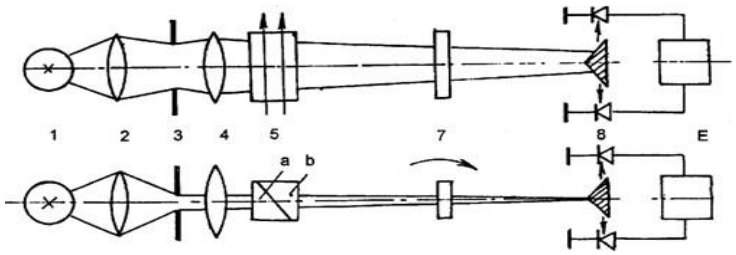

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Task 6: Define the terms «microbiological purity» and «contaminated microorganisms». Describe the signs of the presence of microorganisms in drugs..

Task 7: Describe according to the category of the drug certain quantitative standards that characterize the level of microbial contamination of drugs.

Teacher's signature _____

Seminar lesson on the topic № 8 Date _____

TOPIC: **METHODS OF MICROBIOLOGICAL CONTROL OF DRUGS (ENDING).**

The purpose of the lesson: to get acquainted with the basic methods of microbiological control of medicines, to expand the knowledge about microbiological purity of medicines, to generalize knowledge about the concept of sterility and asepsis at manufacturing of medicines.

Information material

Medicines that are not sterilized during production can be contaminated with microorganisms and should therefore be tested for microbiological purity. The microbiological purity of medicines, substances and auxiliary materials for the production of medicines must comply with the requirements set out in the Manual Ministry of Health 42-3.1: 2004 «Medicines. Quality guide. Pharmaceutical development».

Control questions for input control:

1. Define the concept of sterility, list the goals 1. Describe the influence of microorganisms on the quality of medicines.

2. What nutrient media do you know. For what purpose are they used? Give a brief description of the concept of "sterility". What sterility tests are you aware of?

3. What tests for microbiological purity do you know? What is the essence of the quantitative determination of microorganisms. Describe the method of antimicrobiological activity of antibiotics using the agar method.

4. Characterize the analysis of medicinal substances and their metabolites in biological fluids.

5. Microflora of finished dosage forms. Microflora of non-sterile dosage forms. What ways of increasing the microbial purity of non-sterile medicines do you know? Describe sterile and aseptic dosage forms.

6. Characterize the main phases of the process for the proper development of microbiological methods.

Task 1: Define the term «contamination». Name the consequences of drug contamination.

Task 2: Describe the main sources of microbial contamination of drugs.

Task 3: Define the terms «sterile» and «non-sterile» drugs.

Task 4: Name the methods known to you to determine the sterility of drugs.

Task 5: Define the term «nutrient media». Describe their purpose.

Task 6: Name ways to increase the microbial purity of non-sterile drugs.

Task 7: Describe the main phases of the process of proper development of microbiological techniques.

Teacher's signature _____

Seminar lesson on the topic № 9 Date _____

TOPIC: **PRE-CLINICAL TESTING OF MEDICINES. CHOICE OF ASSESSMENT METHODS.**

The purpose of the lesson: to get acquainted with the concept and documentation of pre-clinical development of medicines, to form theoretical knowledge in the basic principles of pre-clinical researches, to get acquainted with biotic norms of carrying out preclinical researches.

Information material

Pre-clinical trials of drugs are mandatory and one of the most important stages in the development of drugs. Appropriate implementation of the whole set of research procedures and operations to study the safety and specific activity of potential drugs further ensures their safety and high therapeutic efficacy under clinical conditions. These studies should be comparative in nature and should be designed to identify differences in the body's response to a biologically similar drug and a comparator, and not merely to assess the response as such.

Control questions for input control:

1. How do you understand the concept of «pre-clinical studies» of drugs? What is the essence of preclinical drug research?

2. What is Good Laboratory Practice? What are the main GLP requirements for pre-clinical research?

3. Name the general provisions, basic terms, concepts and basic documentation of pre-clinical studies of drugs.

4. What documentation is used for pre-clinical study of drugs? Describe the general principles of pre-clinical study and the main categories for clinical trials of drugs.

5. What is the scope of pre-clinical study? Give a brief description.

6. Describe the main stages and types of pre-clinical studies.

7. Describe the bioethical standards of pre-clinical studies. What is the essence of the «3R» Concept?

Task 1: Define the concept of «pre-clinical studies of drugs», describe the main objectives of preclinical studies:

Task 2: Name the main requirements of GLP in pre-clinical studies:

Task 3: Describe the general provisions of the pre-clinical study:

Task 4: Describe the main terms and concepts of pre-clinical research according to the table:

Term	**Characteristic**
Test audit	
Responsible performer	
Sample	
Good Laboratory Practice	
Test report	
Grid chart	
Test system	
Standard operating procedures	

Task 5: Name the main categories in which pre-clinical studies of drugs are conducted:

Task 6: Name the main general ethical principles of working with animals during pre-clinical research:

Task 7: Describe the ethical principles for pre-clinical research («3R» principle). Decipher each letter R.

Teacher's signature _____

Seminar lesson on the topic № 10 Date _____

TOPIC: **THE MAIN PHASES OF CLINICAL TRIALS OF NEW DRUGS.**

The purpose of the lesson: to get acquainted with the peculiarities of clinical trials in different countries, as well as in Ukraine, to be guided in the basic terms, concepts and documentation of clinical development of drugs, to get acquainted with the main types and phases, as well as biotic standards of clinical trials.

Information material

Clinical trials of a drug are a necessary step in the development of any new drug, or the expansion of indications for the use of a drug that has been known to physicians.

Clinical trials are conducted in several phases: **phase 0** - study of human microdoses; **phase I** - the first experience of using a new active substance in humans; **phase II** - the first experience of the study drug in patients with the disease; **phase III** - to determine the safety and effectiveness of the drug; **phase IV** - post-marketing tests.

Control questions for input control:

1. How do you understand the concept of «clinical research»? What are the main documents of the clinical trial: clinical trial protocol and informed consent?

2. Describe the main types of clinical trials.

3. What phases of clinical trials you know. Describe them. What phase of clinical trials is most often conducted in Ukraine?

4. Features of conducting clinical trials in Ukraine.

5. What are the benefits of participating in clinical research?

6. Describe the basic concepts used in clinical trials of drugs.

7. Describe the ethical principles, methods and reorganization of health care in Ukraine.

Task 1: Define the term «clinical trial», name and describe the types of clinical trials.

Task 2: Define the concept of «clinical trial protocol», name the main purpose of this document.

Task 3: Name and describe the main phases of clinical trials.

Phase of the Clinical Study	**Characteristic**
0	

1	
2	
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4	

Task 4: Name the main documents governing the conduct of clinical trials.

Task 5: Describe the main terms and concepts of clinical trials according to the table:

Term	**Characteristic**
Side effect	
Clinical trial protocol	
Sponsor	
Counterfeit drug	
Informed consent	
Individual registration form	

Task 6: Privileges of patient and state participation in clinical trials.

Task 7: Ethical principles of clinical trials.

Teacher's signature _____

The list of questions that the student must learn in the process of studying the discipline

1. History of drug development.
2. Pharmacology of the Ancient World, the Middle Ages and the beginning of the twentieth century.
3. An overview of the current state of the pharmaceutical industry.
4. Classification of medicines. Types of medications.
5. Prescription and over-the-counter medicines.
6. Ways of delivery of medicines.
7. Basic mechanisms of membrane transport of drugs. Liposomas, monoclonal antibodies, modified plasma proteins, microspheres and nanoparticles, polymeric micelles, collagen. Lysosomes, mitochondria, nuclei, and cell cytoplasm as delivery objects.
8. Principles of creating new drugs.
9. Rational design is the latest technology in the development of medicines.
10. Establishment of the object of the pharmacological action of the medicinal product.
11. Basic legislative and regulatory acts on the production and circulation of medicinal products. Bodies of state control. State Pharmacopoeia of Ukraine (DFU).
12. Pre-clinical studies. Liquid chromatography. Mass spectroscopy, nuclear magnetic resonance.
13. Clinical studies. The effectiveness of drugs as a pharmacoeconomic category. Conditions for effective treatment. Legislative base. Experimental-clinical investigations of substances – «candidates» in the drug.
14. Clinical trials of drugs, methods of treatment and reorganization of health care.
15. From the basic principles of the name of the medicinal products.
16. Major human diseases and leading groups of drugs in the modern pharmaceutical market.

17. Auxiliary operations in the manufacture of drugs. Manufacturing of solid medicines (powders).
18. Manufacturing technology of solid dosage forms.
19. Solid dosage forms of prolonged action.
20. Microcapsulation of medicinal substances.
21. Extraction drugs. Technology of making tinctures.
22. Novogalene preparations.
23. Preparation and analysis of aqueous solutions. Alcoholic solutions .
24. Syrups. Solutions for injection in ampoules.
25. Liquid chromatography.
26. Methods of microbiological control of medicinal products.

Recommended educational and methodical literature:

Regulations:

1. Лікарські засоби. Настанова з виробництва готових лікарських засобів. СТ-Н МОЗУ 42-3.4:2020. – Офіц. вид. – К.: М-во охорони здоров'я України, 2020. – 37 с. – (Настанова Міністерства охорони здоров'я України).
2. Лікарські засоби. Належна виробнича практика. СТ-Н МОЗУ 42-4.0:2020 - Офіц. вид. – К.: М-во охорони здоров'я України, 2020. – 338 с. – (Настанова Міністерства охорони здоров'я України).
3. Лікарські засоби. Принципи належної практики дистрибуції діючих речовин для лікарських засобів для людини. СТ-Н МОЗУ 42-5.2:2020 – К.: М-во охорони здоров'я України, 2020. – 28 с. – (Настанова Міністерства охорони здоров'я України).

Basic:

1. Допоміжні речовини у виробництві ліків: навч. посібн. для студ. вищ. фармац. навч. закл. / О.А. Рубан, І.М. Перцев, С.А. Куценко, Ю.С. Маслій; за ред. І.М. Перцева. – Х.: Золоті сторінки, 2016. – 720 с.
2. Забезпечення, контроль якості і стандартизація лікарських засобів: Навчально-методичний посібник / За ред. професора Н. О. Ветютневої. – Вінниця, ПП «ТД» Едельвейс і К», 2016. – 505 с.
3. Промислова технологія лікарських засобів: базовий підручник для студ. вищ. навч. фармац. закладу (фармац. ф-тів) / Є.В. Гладух, О.А. Рубан, І.В. Сайко [та ін.].; за ред. Є.В. Гладуха, В.І. Чуєшова. – Вид. 2-ге, випр. та допов. – Х: НФаУ: Новий світ-2000, 2018. – 526 с.
4. Розробка лікарських засобів. Навчальний посібник для практичних занять: Навч. посіб. для студ. вищих навч. закл. / Склали І.Ю. Борисюк, Н.С. Фізор, І.П. Валіводзь, Ю. О. Молодан. – Одеса.: ОНМедУ, 2021. – 79 с.

Additional:

1. Практикум з промислової технології лікарських засобів : навч. посіб. для студ. вищ. навч. закладів зі спеціальності «Фармація» / О. А. Рубан, Д. І. Дмитрієвський, Л. М. Хохлова [та ін.] ; за ред. О. А. Рубан. – Х. : НФаУ ; Оригінал, 2015. – 320 с.
2. Технологічне обладнання біотехнологічної і фармацевтичної промисловості: підручник [для вищ. навч. закл.] Стасевич М.В., Миланич., А.О., Стрельников Л.С., Крутських Т.В, Бучкевич І.Р., Зайцев О.І Гузьова., І.О., Стрілець О.П., Гладух Є.В., Новіков В.П. – Львів: «Новий Світ-2000», 2018. – 410 с.