

INSTITUTE OF ENGINEERING PHYSICS FOR BIOMEDICINE

APPROVED ИТС ИФИБ

Protocol No. 3.1

dated 30.08.2024

**ACADEMIC COURSE OUTLINE**

**ФАРМАКОЛОГИЯ / PHARMACOLOGY**

Educational program track (speciality) [1] 31.05.01 General Medicine

| <b>Semester</b> | <b>Labour input, credits</b> | <b>Total course academic, hours</b> | <b>Lectures, hrs.</b> | <b>Practical sessions, hrs.</b> | <b>Laboratory sessions, hrs.</b> | <b>In the form of practical studies, hrs.</b> | <b>Independent studies, hrs.</b> | <b>Independent studies monitoring, hrs.</b> | <b>Course progress, Exam/Pass-fail exam/Term</b> |
|-----------------|------------------------------|-------------------------------------|-----------------------|---------------------------------|----------------------------------|---|----------------------------------|---|--|
| 5               | 3                            | 108                                 | 18                    | 54                              | 0                                |   | 36                               | 0   | PFE  |
| 6               | 5                            | 180                                 | 16                    | 48                              | 0                                |   | 62                               | 0   | Ex   |
| Total           | 8                            | 288                                 | 34                    | 102                             | 0                                | 0   | 98                               | 0   |  |

## **ABSTRACT**

The academic discipline includes the parts of general, autonomic pharmacology and pharmacology used for treatment of different disorders of various organs and systems of the human body. Taught in the third year.

The course of Pharmacology is a basic discipline for medical specialists, designed to educate students with pharmacology as a fundamental discipline.

In the first semester, the main sections of General Pharmacology (Fundamentals of Pharmacokinetics and Pharmacodynamics of Medicines) and General Prescription Guidelines (the main forms of medicines and rules for their prescription) are studied. In the first and second semesters, the students study the pharmacology of drugs used in the treatment of diseases of various organs and systems of the human body.

The knowledge gained during the course is a foundation for further education in clinical disciplines and pharmacological treatment and monitoring of its effectiveness and safety.

### **1. ACADEMIC COURSE GOALS AND OBJECTIVES**

Goal: To train a physician specialist who possesses systemic pharmacological thinking, knowledge, skills, and abilities, and is capable to apply this knowledge in their professional activities and in the context of innovative societal development. To provide knowledge in general and specific pharmacology, principles of evidence-based medicine, rational pharmacotherapy, and knowledge and skills in selecting effective, safe medications and their dosage regimens.

Objectives:

- To educate students on general and specific pharmacology and current innovations in this field.
- To educate students on pharmacodynamics and pharmacokinetics of the main groups of medicines used to prevent and treat the most common and socially significant human diseases, as well as the indications and contraindications of these groups of drugs;
- To develop students' skills to apply knowledge of drug-drug interactions and adverse drug events (AEs) for effective and safe drug therapy and rational drug combinations;
- To educate students to apply clinical-pharmacological algorithms for rational drug selection and dosage regimens for major diseases, as well as methods for assessing the efficacy and safety of drug use.

### **2. PLACE OF THE ACADEMIC COURSE IN THE MAIN HIGHER EDUCATION CURRICULUM**

Studying this discipline requires knowledge and skills developed in such previous disciplines as chemistry, biochemistry, anatomy, histology, embryology, cytology, normal physiology, medical microbiology and virology, etc.

To gain a holistic understanding of the patterns of drug action on the human body, the mechanisms and effects of pharmacological groups and individual drugs, their pharmacodynamics and pharmacokinetics, side effects in the most common diseases with typical clinical courses, in order to understand approaches to choosing drug therapy and rational drug combinations, it is advisable to

study pharmacology in parallel with clinical disciplines such as internal medicine, general surgery, and radiation diagnostics.

Studying this discipline is necessary for acquiring knowledge, skills and abilities formed by subsequent clinical disciplines included in the curriculum (internal medicine, surgical diseases, faculty therapy, occupational diseases; hospital therapy, hospital surgery, endocrinology; outpatient therapy, infectious diseases, neurology, gynecology, urology, pediatrics, oncology, etc.), and the study of pharmacology also precedes the development of clinical pharmacology.

### 3. DEVELOPED COMPETENCIES AND INTENDED LEARNING OUTCOMES

Universal and/or general professional competencies:

| <b>Competency code and title</b>   | <b>Code and title of competency-based rubrics</b>  |
|--|--|
| <p>OПK-7 [1] – Capable of prescribing treatment and monitoring its effectiveness and safety.</p> | <p>3-OПK-7 [1] – Know: - pharmacological groups of medicinal drugs and their intended purposes; - mechanisms of action of pharmacological and non-pharmacological treatments, indications and contraindications for their use, side effects, and complications caused by their application; - methods for monitoring the effectiveness and safety of various treatment approaches.</p> <p>Y-OПK-7 [1] – Be able to: - make rational choices for pharmacological and non-pharmacological treatments based on clinical guidelines and in accordance with medical care standards; - develop a treatment plan for a disease or condition considering the diagnosis, age, disease course characteristics, and comorbidities, based on clinical guidelines and medical care standards; - prescribe medications, medical devices, and therapeutic nutrition considering the diagnosis, age, disease course characteristics, and comorbidities, based on clinical guidelines and medical care standards; - justify prescribed pharmacological and non-pharmacological treatments; - evaluate the effectiveness and safety of medications, medical devices, therapeutic nutrition, and other treatment methods.</p> <p>B-OПK-7 [1] – Possess skills in: - administering medications through various routes of administration; - developing treatment plans for diseases or conditions considering diagnosis, age, disease course characteristics, and comorbidities; - assessing the effectiveness and safety of prescribed treatments.</p> |

### 4. PEDAGOGIC POTENTIAL OF THE COURSE

| <b>Pedagogic tracks/objectives</b>    | <b>Pedagogic goals (code)</b>  |
|---------------------------------------|--|
| <p>Vocational and labor education</p> | <p>Establishing conditions for: formation of a deep understanding of the profession's social role, a positive and active commitment to the values of the chosen specialty, and a responsible attitude towards professional activity and work (B14)</p> |

|                        |   |
|------------------------|---|
| Professional education | Establishing conditions for: formation of responsibility for professional choice, professional development and professional decisions (B18) |
|------------------------|---|

## 5. ACADEMIC COURSE STRUCTURE AND CONTENT

Academic course sections, their scope, terms of study and assessment:

| No. | Academic course section name            | Weeks | Lectures/ Practical (seminars)/ Laboratory sessions, hrs. | Compulsory current assessment (form*, week) | Maximum grade per section** | Section assessment (form*, week) | Competency-based rubrics  |
|-----|---|-------|---|---|-----------------------------|----------------------------------|---------------------------|
|     | <i>5 Semester</i>                       |       |   |   |                             |                                  |                           |
| 1   | The First Section                       | 1-10  | 10/36/0   | Cq-7 (25)                                   | 25                          | Cq-8                             | 3-ОПК-7, У-ОПК-7          |
| 2   | The Second Section                      | 11-15 | 8/18/0  | Cq-13 (25)                                  | 25                          | Cq-13                            | 3-ОПК-7, У-ОПК-7          |
|     | <i>Totals for 5 Semester</i>            |       | 18/54/0   |   | 50                          |                                  |                           |
|     | <b>Assessment events for 5 Semester</b> |       |   |   | 50                          | PFE                              | 3-ОПК-7, У-ОПК-7          |
|     | <i>6 Semester</i>                       |       |   |   |                             |                                  |                           |
| 1   | The First Section                       | 1-8   | 6/24/0  | Cq-7 (25)                                   | 25                          | Cq-7                             | 3-ОПК-7, У-ОПК-7          |
| 2   | The Second Section                      | 9-15  | 10/24/0   | Cq-15 (25)                                  | 25                          | T-15                             | 3-ОПК-7, У-ОПК-7, В-ОПК-7 |
|     | <i>Totals for 6 Semester</i>            |       | 16/48/0   |   | 50                          |                                  |                           |
|     | <b>Assessment events for 6 Semester</b> |       |   |   | 50                          | Ex                               | 3-ОПК-7, У-ОПК-7, В-ОПК-7 |

\* – abbreviated name of assessment

\*\* – 100 maximum points per semester including a pass/fail exam and (or) an exam

Abbreviated current assessment forms and section assessment

| Abbreviation | Full name             |
|--------------|-----------------------|
| Cq           | Colloquium            |
| T            | Testing               |
| PFE          | Pass/fail examination |
| Ex           | Exam                  |

## SYLLABUS

| Weeks | Topics / Content | Lect., | Pr./sem., | Lab., |
|-------|------------------|--------|-----------|-------|
|-------|------------------|--------|-----------|-------|

|             |  | hrs.   | hrs. | hrs. |
|-------------|--|--------|------|------|
|             | <i>5 Semester</i>  | 18     | 54   | 0    |
| <b>1-10</b> | <b>The First Section</b>   | 10     | 36   | 0    |
| 1           | <p><b>The concept of pharmacology. The main stages of pharmacology's development. The concepts of pharmacokinetics and pharmacodynamics.</b></p> <p>The concept of pharmacology. The main stages of pharmacology's development. The concepts of pharmacokinetics and pharmacodynamics.</p> <ol style="list-style-type: none"> <li>1. The concept of pharmacokinetics.</li> <li>2. The mechanism of absorption and comparative characteristics of drug administration routes.</li> <li>3. Factors determining drug concentrations in blood plasma.</li> <li>4. Bioavailability and presystemic elimination of drugs from the body.</li> <li>5. Dose and its types. The breadth of therapeutic action of a drug.</li> <li>6. The concept of pharmacodynamics.</li> <li>7. Types of action and the spectrum of therapeutic action of drugs.</li> <li>8. Primary pharmacological response.</li> <li>9. The dependence of drug action on chemical structure, physical properties, the state of the body, age, gender, and time of day.</li> <li>10. Phenomena observed with combined and repeated use of drugs.</li> </ol>      | All    |      |      |
|             |  | 2      | 3    | 0    |
|             |  | Online |      |      |
|             |  | 0      | 0    | 0    |
| 2           | <p><b>Introduction to Prescription. Solid Dosage Forms.</b></p> <p>Introduction to Prescription. Solid Dosage Forms</p> <ol style="list-style-type: none"> <li>1. Concepts of a medicinal substance, drug, medicinal raw material, and dosage form.</li> <li>2. Galenic and neogalenic medicines.</li> <li>3. The Pharmacopoeia, its contents and purpose.</li> <li>4. Official, Magistraliter (extratemporaneous) , Metered, Bulk and divided, Short and Detailed Prescriptions.</li> <li>5. Prescription and its Structure.</li> <li>6. Prescription Forms.</li> <li>7. Medicinal Doses in the Decimal System.</li> <li>8. Acceptable abbreviations in prescriptions.</li> <li>9. Brief grammatical notes regarding prescriptions.</li> <li>10. Guide for storing and prescribing poisonous, potent, and narcotic drugs.</li> <li>11. Guide for dispensing medications from pharmacies.</li> <li>12. Solid dosage forms, their comparative characteristics, and prescribing rules.</li> <li>13. Purpose and specifics of prescribing dosage forms in capsules, tablets, powders, pills, granules, and dragees</li> </ol> | All    |      |      |
|             |  | 0      | 3    | 0    |
|             |  | Online |      |      |
|             |  | 0      | 0    | 0    |
| 3           | <p><b>Soft and liquid dosage forms</b></p> <p>Soft dosage forms.</p> <ol style="list-style-type: none"> <li>1. Types of soft dosage forms.</li> <li>2. General characteristics of ointments. Ointment bases and their importance for medicinal action. Requirements for</li> </ol>   | All    |      |      |
|             |  | 0      | 3    | 0    |
|             |  | Online |      |      |
|             |  | 0      | 0    | 0    |

|   |   |        |   |   |
|---|---|--------|---|---|
|   | <p>ointment bases.</p> <p>3. Official and magistraliter (extratemporaneous) ointments. Short and detailed ointment prescriptions. Prescriptions of ophthalmologic ointments.</p> <p>4. General characteristics of pastes. Short and detailed prescriptions.</p> <p>5. Suppositories is a type of soft dosage form. Characteristics of the components and prescription forms for suppositories.</p> <p>Liquid dosage forms.</p> <p>1. General characteristics of solutions and solvents.</p> <p>2. Methods of prescribing and designating the concentration of solutions for external use. Prescriptions of oral solutions.</p> <p>3. Requirements for injection dosage forms. Rules for prescribing dosage forms in ampoules, vials, and sterile bulk dosage forms.</p> <p>4. Characteristics of liquid dosage forms obtained from herbal medicinal raw materials (infusions, decoctions, tinctures, extracts). Rules for prescribing tinctures, extracts, infusions, and decoctions.</p> <p>5. Neogalenic medicines and liquid organ medicines, rules for their prescription.</p> <p>6. Characteristics and rules for prescribing suspensions and emulsions. Liquid ointments.</p> <p>7. Prescribing officinal and main liniments. Methods for prescribing mixtures.</p> <p>8. Characteristics and prescribing of aerosols</p>                                       |        |   |   |
| 4 | <p><b>Drugs acting on the cholinergic synapse: N-cholinomimetics, ganglionic blockers, and muscle relaxants.</b></p> <p>Drugs acting on the cholinergic synapse: M-cholinomimetics, anticholinesterase agents, and M-cholinergic blockers.</p> <p>1. Anatomy and physiology features of the autonomic nervous system.</p> <p>2. Classification of nerve fibers and receptors depending on the chemical nature of the neurotransmitter.</p> <p>3. Structure and function of the cholinergic synapse. Classification and topography of cholinergic-reactive structures.</p> <p>4. Acetylcholine, its synthesis and inactivation in the body. Enzymes involved in acetylcholine metabolism.</p> <p>5. Classification of drugs affecting the cholinergic synapse.</p> <p>6. Pharmacodynamics of M-cholinomimetic agents, drugs, indications and contraindications</p> <p>7. Pharmacology of anticholinesterase agents: classification, pharmacodynamics, drugs, indications and contraindications.</p> <p>8. Differences between anticholinesterase agents and M-cholinomimetics in the mechanism and pharmacological action.</p> <p>9. Acute poisoning with M-cholinomimetics and anticholinesterase agents. Treatment measures for these conditions.</p> <p>10. M-anticholinergic agents: pharmacodynamics, drugs, indications and contraindications for their use.</p> | All    |   |   |
|   |   | 2      | 3 | 0 |
|   |   | Online |   |   |
|   |   | 0      | 0 | 0 |

|   |  |        |   |   |
|---|--|--------|---|---|
|   | <p>11. Acute poisoning with M-anticholinergic agents, treatment measures</p> <ol style="list-style-type: none"> <li>1. N-cholinomimetics.</li> <li>2. Nicotine action on N-cholinergic receptors. The effect of nicotine on the central nervous system, cardiovascular system, and gastrointestinal tract.</li> <li>3. The social and medical significance of nicotine addiction. The importance and opportunities of combating with nicotine addiction.</li> <li>4. N-cholinomimetic drugs. Features of their action on N-cholinergic receptors. Pharmacodynamics, medicines, indications and contraindications for N-cholinomimetics.</li> <li>5. Ganglionic blockers. Mechanism of action, effects, classification, indications and contraindications for use, side effects of ganglionic blockers.</li> <li>6. Clinical manifestations and first aid in acute ganglion blocker poisoning.</li> <li>7. Muscle relaxants. Concept of peripheral and central muscle relaxants. Pharmacology of curare-like agents. Classification, medicines, pharmacokinetics, and pharmacodynamics.</li> <li>8. Indications and contraindications for the use of peripheral muscle relaxants, side effects, and their management</li> </ol>   |        |   |   |
| 5 | <p><b>Drugs acting on the adrenergic synapse: <math>\alpha</math>- and <math>\beta</math>-adrenergic agonists, <math>\beta</math>-adrenergic agonists, <math>\alpha</math>-adrenergic agonists.</b></p> <p>Drugs acting on the adrenergic synapse: <math>\alpha</math>- and <math>\beta</math>-adrenergic agonists, <math>\beta</math>-adrenergic agonists, <math>\alpha</math>-adrenergic agonists. Drugs acting on the adrenergic synapse: adrenergic blockers and sympatholytics.</p> <ol style="list-style-type: none"> <li>1. Structure of the adrenergic synapse. Concept of the synthesis and inactivation of norepinephrine, the functional significance of the sympathetic autonomic nervous system.</li> <li>2. Classification, localization, and functional purpose of adrenergic receptors.</li> <li>3. Classification of drugs affecting transmission at adrenergic synapses.</li> <li>4. Pharmacodynamics of direct-acting <math>\alpha</math>- and <math>\beta</math>-adrenergic agonists, the effects of adrenaline on metabolism and the cardiovascular system after subcutaneous and intravenous administration.</li> <li>5. Indications and contraindications for use, side effects of adrenaline. Differences between noradrenaline and adrenaline.</li> <li>6. Pharmacodynamics of indirect-acting <math>\alpha</math>- and <math>\beta</math>-adrenergic agonists, the pharmacokinetics and pharmacodynamics of ephedrine.</li> <li>7. Pharmacodynamics, classification, indications and contraindications for use, and side effects of <math>\beta</math>-adrenergic agonists.</li> <li>8. Pharmacodynamics, classification, indications and contraindications for use, and side effects of <math>\alpha</math>-adrenergic agonists.</li> </ol> | All    |   |   |
|   |  | 0      | 4 | 0 |
|   |  | Online |   |   |
|   |  | 0      | 0 | 0 |

|   |   |        |   |   |
|---|---|--------|---|---|
|   | <p>9. Pharmacodynamics, classification, indications and contraindications for use, and side effects of <math>\alpha</math>-adrenergic blockers.</p> <p>10. Mechanism of action, effects, classification, and clinical use of <math>\beta</math>- adrenergic blockers.</p> <p>11. Pharmacodynamics, classification, indications and contraindications, side effects of <math>\alpha</math>- and <math>\beta</math>-blockers.</p> <p>12. Pharmacodynamics, classification, indications and contraindications, side effects of sympatholytics</p>  |        |   |   |
| 6 | <p><b>General anesthetics.</b><br/> Concept of anesthesia and anesthesia theories. Classification of anesthetics based on their routes of administration and chemical structure. Stages of anesthesia. Concept of combined, induction, basic, mixed, and potentiated anesthesia. Characteristics of inhalation anesthetics and factors influencing on their absorption and elimination.<br/> Classification of non-inhalation anesthetics and their differences from inhalation anesthetics. Characteristics of individual groups of non-inhalation anesthetics.</p>  | All    |   |   |
|   |   | 2      | 4 | 0 |
|   |   | Online |   |   |
|   |   | 0      | 0 | 0 |
| 7 | <p><b>Pharmacology of drugs acting on the central nervous system. Hypnotics.</b><br/> Hypnotics. Hypnotic poisoning.<br/> 1. Effects of hypnotics.<br/> 2. Classification of hypnotics based on chemical structure.<br/> 3. Characteristics of hypnotics - barbituric acid derivatives and benzodiazepine receptor agonists.<br/> 4. Requirements for hypnotics and principles of their use.<br/> 5. Problems of the hypnotic use (accumulation, drug addiction, rebound phenomenon).<br/> 6. Symptoms of acute hypnotic poisoning and measures for this condition.<br/> Antiepileptic and antiparkinsonian drugs.<br/> 1. Classification of antiepileptic drugs.<br/> 2. Requirements for antiepileptic drugs.<br/> 3. Pharmacodynamics of antiepileptic drugs.<br/> 4. Characteristics of anticonvulsants used to relieve seizures of various origins.<br/> 5. Classification, pharmacodynamics, and side effects of antiparkinsonian drugs</p> | All    |   |   |
|   |   | 2      | 4 | 0 |
|   |   | Online |   |   |
|   |   | 0      | 0 | 0 |
| 8 | <p><b>Narcotic and non-narcotic analgesics</b><br/> Pharmacology of drugs acting on the central nervous system.<br/> Narcotic analgesics.<br/> 1. Concept of the nociceptive and antinociceptive systems.<br/> Classification and physiological role of opioid receptors.<br/> 2. Classification of analgesics and their comparative characteristics.<br/> 3. Classification of drugs acting on opioid receptors.<br/> 4. Narcotic analgesics. Characteristics and mechanism of analgesic action<br/> 5. Pharmacodynamics of morphine.<br/> 6. The effect of morphine on the psychoemotional sphere.<br/> Current understanding of the mechanisms of euphoria and drug</p>  | All    |   |   |
|   |   | 2      | 4 | 0 |
|   |   | Online |   |   |
|   |   | 0      | 0 | 0 |

|        |  |     |   |  |
|--------|--|-----|---|--|
|        | <p>addiction to narcotic analgesics.</p> <p>7. Comparative characteristics of the pharmacodynamics of various opioid receptor agonists.</p> <p>8. Opioid receptor agonist-antagonists.</p> <p>9. Indications, contraindications, and side effects of narcotic analgesics.</p> <p>10. Functional antagonists of narcotic analgesics.</p> <p>11. Acute poisoning with narcotic analgesics. First aid.</p> <p>Non-narcotic analgesics and non-narcotic antitussives.</p> <p>1. The mechanism of analgesic action of non-narcotic analgesics and the specific features of this effect.</p> <p>2. The mechanism of anti-inflammatory action of non-narcotic analgesics.</p> <p>3. The mechanism of antipyretic action of non-narcotic analgesics.</p> <p>4. Classification of these agents based on chemical structure, medicines, and the specific features of each group.</p> <p>5. Analgesics - antipyretics. Non-steroidal anti-inflammatory drugs.</p> <p>6. Indications for non-narcotic analgesics. Selecting the drug based on on pharmacodynamics.</p> <p>7. Contraindications e and side effects of non-narcotic analgesics</p>   |     |   |  |
| 9      | <p><b>Pharmacology of drugs acting on the central nervous system. Psychotropic drugs:</b></p> <p>1. Achievements of modern psychopharmacology.</p> <p>2. Classification of drugs acting on the central nervous system. Psychotropic drugs: sedatives, anxiolytics (tranquilizers), and antipsychotics (neuroleptics). Classification of drugs acting on the psychoemotional sphere.</p> <p>3. Pharmacology of sedatives: drugs and indications for their use.</p> <p>4. Pharmacodynamics of anxiolytics.</p> <p>5. Classification of anxiolytics by chemical structure and their comparative characteristics, indications for use, and side effects.</p> <p>6. Pharmacodynamics of antipsychotics.</p> <p>7. Classification, drugs, and comparative characteristics of various groups of antipsychotic drugs based on their pharmacokinetics.</p> <p>8. Indications for use of these drugs.</p> <p>9. Prevention and treatment of side effects of antipsychotic drugs.</p> <p>10. Comparative characteristics of the pharmacodynamics of anxiolytics, sedatives, and antipsychotics</p> <p>Psychotropic drugs: antidepressants, psychostimulants, and general tonics. Analeptics.</p> <p>1. Classification of agents that activate the psychoemotional sphere.</p> <p>2. Classification, pharmacodynamics, indications for use, and side effects of antidepressants.</p> | All |   |  |
|        | 0  | 4   | 0 |  |
| Online |  |     |   |  |
| 0      | 0  | 0   |   |  |

|       |  |        |    |   |
|-------|--|--------|----|---|
|       | <p>3. Classification of psychostimulants and medications.</p> <p>4. Classification, pharmacodynamics, and indications for use of psychomotor stimulants.</p> <p>5. Pharmacodynamic characteristics of psychometabolic stimulants (nootropic agents), indications for their use.</p> <p>6. Comparative characteristics of psychomotor and psychometabolic stimulants.</p> <p>7. Pharmacodynamics and indications for use of general tonics.</p> <p>8. Pharmacodynamics, classification, preparations, and indications for use of analeptics.</p> <p>9. Effects of strychnine-group drugs on the central nervous system and indications for use</p>  |        |    |   |
| 10    | <p><b>Colloquium "General Pharmacology Issues. Formulation. Drugs Affecting the Autonomic Nervous System." "Drugs Affecting the Central Nervous System."</b></p> <p>Tests, survey, situational</p>   | All    |    |   |
|       |  | 0      | 4  | 0 |
|       |  | Online |    |   |
|       |  | 0      | 0  | 0 |
| 11-15 | <b>The Second Section</b>  | 8      | 18 | 0 |
| 11    | <p><b>Cardiotonic agents: cardiac glycosides and non-glycoside inotropic agents.</b></p> <p>1. Medicinal plants containing cardiac glycosides.</p> <p>2. Chemical structure and role of cardiac glycoside components.</p> <p>3. Effect of cardiac glycosides on the basic functions of the cardiac muscle. The importance of electrocardiographic examination in cardiac glycoside therapy.</p> <p>4. Mechanism of the positive inotropic and negative chronotropic effects of cardiac glycosides.</p> <p>5. The effect of cardiac glycosides on myocardial metabolism.</p> <p>6. Effects of cardiac glycosides in circulatory failure.</p> <p>7. Classification of cardiac glycosides based on their pharmacokinetics.</p> <p>8. Indications and contraindications for the use of cardiac glycosides.</p> <p>9. Factors contributing to cardiac glycoside intoxication.</p> <p>10. Clinical manifestations of glycoside intoxication, its prevention, and treatment.</p> <p>11. Non-glycoside inotropic agents.</p> | All    |    |   |
|       |  | 2      | 3  | 0 |
|       |  | Online |    |   |
|       |  | 0      | 0  | 0 |
| 12    | <p><b>Antiarrhythmic agents.</b></p> <p>1. Mechanisms of cardiac rhythm disturbances.</p> <p>2. Medications used to correct rhythm by affecting extracardiac innervation (in sinus tachycardia and bradycardia, atrioventricular block).</p> <p>3. Classification of antiarrhythmic agents.</p> <p>4. Mechanism of antiarrhythmic action, indications for use, and side effects of quinidine and quinidine-like agents (subgroup IA).</p> <p>5. Mechanism of antiarrhythmic action, pharmacokinetic characteristics, and indications for the use of local anesthetics (subgroup IB).</p> <p>6. Antiarrhythmic action of <math>\beta</math>-blockers, indications for their use, and side effects (group II).</p>   | All    |    |   |
|       |  | 2      | 3  | 0 |
|       |  | Online |    |   |
|       |  | 0      | 0  | 0 |

|    |  |        |   |   |
|----|--|--------|---|---|
|    | <p>7. Antiarrhythmic activity of agents that prolong the action potential (group III).</p> <p>8. Mechanism of antiarrhythmic action, indications for use, and side effects of calcium channel blockers (group IV).</p> <p>9. Antiarrhythmic activity of potassium containing medicines.</p> <p>10. Antiarrhythmic action of cardiac glycosides and indications for their use.</p> <p>11. Basic approaches to selecting antiarrhythmic drugs</p>  |        |   |   |
| 13 | <p><b>Antianginal agents. Agents used for cerebrovascular accidents and angioprotectors.</b></p> <p>1. Pathogenesis of coronary insufficiency and its medicinal treatment.</p> <p>2. Classification of antianginal agents.</p> <p>3. Pharmacodynamics, indications for use, and side effects of organic nitrates.</p> <p>4. Antianginal action of calcium channel blockers.</p> <p>5. Beta-blockers as antianginal agents.</p> <p>6. Classification and pharmacodynamics of agents that increase oxygen delivery to the myocardium (coronary active agents).</p> <p>7. Main approaches to selecting antianginal drugs</p> <p>8. Pharmacodynamics of agents used for cerebrovascular accidents.</p> <p>9. Pharmacology of angioprotectors</p>   | All    |   |   |
|    |  | 2      | 3 | 0 |
|    |  | Online |   |   |
|    |  | 0      | 0 | 0 |
| 14 | <p><b>Drugs used to increase blood pressure, drugs used to treat migraines. Hypolipidemic - drugs</b></p> <p>Classification and pharmacodynamics of drugs used for hypotensive conditions.</p> <p>Classification and pharmacodynamics of drugs used to treat migraines (symptomatic and pathogenetic).</p> <p>Lipid-lowering drugs</p> <p>Pathogenesis of atherosclerosis. Classification of lipoproteins.</p> <p>Atherogenicity index.</p> <p>Complications of atherosclerosis. Classification of lipid-lowering agents</p> <p>Statins. Mechanism of pharmacological action of statins.</p> <p>Indications for use of statins. Contraindications for use of statins. Side effects of statins.</p> <p>Fibrates. Mechanism of pharmacological action of fibrates.</p> <p>Indications for use of fibrates. Contraindications for use of fibrates. Side effects of fibrates.</p> <p>Bile acid sequestrants. Mechanism of lipid-lowering action of bile acid sequestrants. Indications for use. Contraindications for use of bile acid sequestrants. Side effects of bile acid sequestrants.</p> <p>Inhibitors of intestinal cholesterol absorption. Ezetimib.</p> <p>Mechanism of lipid-lowering action. Indications for use. Contraindications. Side effects.</p> <p>Nicotinic acid. Mechanism of lipid-lowering action of nicotinic acid. Indications for use of nicotinic acid preparations. Contraindications for use of nicotinic acid preparations. Side effects of nicotinic acid preparations. Nicotinic acid</p> | All    |   |   |
|    |  | 0      | 3 | 0 |
|    |  | Online |   |   |
|    |  | 0      | 0 | 0 |

|            |  |        |    |   |
|------------|--|--------|----|---|
|            | preparations.<br>Probucol. Mechanism of lipid-lowering action. Indications for use. Contraindications. Side effects.   |        |    |   |
| 15         | <b>Antihypertensives.</b><br>1. Neuroendocrine mechanisms regulating vascular tone and blood pressure.<br>2. Classification of antihypertensive agents.<br>3. Medications used in the treatment of arterial hypertension (drug names, mechanism of action, indications, contraindications, side effects, drug-drug interactions):<br>• Angiotensin-converting enzyme inhibitors (ACE inhibitors)<br>• Angiotensin receptor blockers (ARBs)<br>• Calcium channel blockers<br>• Drugs affecting sympathetic activity (subgroups by mechanism of action)<br>Direct-acting vasodilators • Drugs opening potassium channels<br>Diuretics<br>1. Classification of diuretics<br>2. Mechanism of diuretic and hypotensive action, indications and side effects of thiazide and thiazide-like diuretics<br>3. Mechanism of diuretic action, indications and side effects of loop diuretics<br>4. Mechanism of diuretic action and effect on acid-base balance, indications and side effects of carbonic anhydrase inhibitors<br>5. Mechanism of diuretic action and indications of potassium-sparing diuretics<br>6. Mechanism of the dehydrating and diuretic effects of osmotic diuretics and indications for their use<br>7. Diuretics of herbal origin<br>Combination of drugs used to treat hypertension and the sequence of their use in different patient groups | All    |    |   |
|            |  | 2      | 3  | 0 |
|            |  | Online |    |   |
|            |  | 0      | 0  | 0 |
| 16         | <b>Colloquium: Drugs Used for Cardiovascular Diseases</b><br>Tests, surveys, clinical cases  | All    |    |   |
|            |  | 0      | 3  | 0 |
|            |  | Online |    |   |
|            |  | 0      | 0  | 0 |
|            | <i>6 Semester</i>  | 16     | 48 | 0 |
| <b>1-8</b> | <b>The First Section</b>   | 6      | 24 | 0 |
| 1          | <b>Drugs affecting afferent innervation. Pharmacodynamics and indications for use of drugs that reduce uterine contractility (tocolytics). Venotonics.</b><br>1. Classification of drugs acting on sensory nerve endings.<br>2. Classification of drugs that reduce the sensitivity of afferent nerves.<br>3. Pharmacodynamics and classification of local anesthetics.<br>4. Comparative characteristics of local anesthetics.<br>5. Principles of action, classification, and indications for use of astringent enveloping and adsorbent agents.<br>6. Classification and pharmacodynamic characteristics of agents that stimulate receptors of mucous membranes, skin, and subcutaneous tissues.  | All    |    |   |
|            |  | 0      | 3  | 0 |
|            |  | Online |    |   |
|            |  | 0      | 0  | 0 |

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|   | <p>7. Pharmacodynamics and indications for use of agents that reduce uterine contractility (tocolytic agents).</p> <p>8. Classification and preparations of uterine agents.</p> <p>9. Comparative characteristics of uterine agents that increase uterine tone and contractility.</p> <p>Venotonics</p>   |        |   |   |
| 2 | <p><b>Medicines used for respiratory diseases</b></p> <p>Classification of drugs affecting respiratory function.</p> <p>Pharmacodynamic characteristics of respiratory stimulants.</p> <p>Pharmacodynamics, classification, and indications for use of antitussives.</p> <p>Classification and pharmacodynamic characteristics of expectorants.</p> <p>Classification and pharmacodynamic characteristics of drugs used for bronchoconstriction. Drugs used for acute respiratory failure.</p>  | All    |   |   |
|   |   | 2      | 3 | 0 |
|   |   | Online |   |   |
|   |   | 0      | 0 | 0 |
| 3 | <p><b>Drugs affecting digestive function.</b></p> <p>Drugs affecting digestive function.</p> <p>1. Drugs used to treat diseases of the stomach and duodenum (gastritis, peptic ulcers). Proton pump inhibitors, H<sub>2</sub>-histamine blockers. Antacids, gastroprotectors.</p> <p>2. Classification, preparations, pharmacodynamics, indications and contraindications for the use of laxatives.</p> <p>3. Classification of hepatotropic agents (hepatoprotectors). Drugs.</p> <p>4. Classification, mechanism of action, indications and contraindications of choleric agents.</p> <p>5. Pharmacodynamics, indications for use, and side effects of hepatoprotective agents.</p> <p>6. Enzyme preparations. Antienzyme drugs.</p> <p>7. Use of enveloping and adsorbing agents in medical practice.</p> <p>8. 4. Emetics: classification, drugs, pharmacodynamics, and indications for their use.</p>  | All    |   |   |
|   |   | 2      | 3 | 0 |
|   |   | Online |   |   |
|   |   | 0      | 0 | 0 |
| 4 | <p><b>Medicines affecting hematopoiesis, blood clotting, fibrinolysis, and platelet aggregation.</b></p> <p>Concept of hemocoagulation mechanisms. Classification of agents affecting blood clotting. Pharmacodynamics, comparative characteristics, indications, and contraindications for direct-acting anticoagulants. Pharmacodynamics, comparative characteristics, indications, and contraindications for indirect-acting anticoagulants. Symptoms of anticoagulant overdose and first aid.</p> <p>Classification of antiplatelet medications. Pharmacodynamics, indications for use, and their role in practical medicine, side effects and contraindications.</p> <p>Classification of medications affecting fibrinolysis. Pharmacodynamics, indications for use, and side effects of fibrinolytics. Pharmacology of medications affecting blood clotting, drugs, indications and side effects.</p> | All    |   |   |
|   |   | 2      | 3 | 0 |
|   |   | Online |   |   |
|   |   | 0      | 0 | 0 |

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|---|--|--------|---|---|
|   | Pharmacodynamics, indications and side effects of agents that inhibit fibrinolysis   |        |   |   |
| 5 | <b>Vitamin supplements, sodium, potassium, calcium, and magnesium supplements.</b><br>Vitamin supplements, sodium, potassium, calcium, and magnesium supplements.<br>Understanding the biological role of vitamins in the body and the causes of vitamin deficiency. Classification of vitamins and their preparations. The biological role and pharmacological properties of vitamins B1, B2, PP (nicotinic acid), and indications for use. Vitamins B6, B12 (cyanocobalamin), B9, C, P, A, D2 and D3, K, E (tocopherol).   | All    |   |   |
|   |  | 0      | 3 | 0 |
|   |  | Online |   |   |
|   |  | 0      | 0 | 0 |
| 6 | <b>Hormonal Agents - Seminar 1</b><br>Understanding the principles of endocrine gland regulation<br>Classification of hormonal drugs by chemical structure.<br>Indications for the use of hormonal drugs.<br>Mechanisms of hormonal action. Classification and biological role of hypothalamic and pituitary hormones.<br>Pharmacodynamics and indications for the use of hypothalamic hormones. Pharmacodynamics and indications for the use of anterior pituitary hormones.<br>Pharmacodynamics and indications for the use of posterior pituitary hormones.<br>The biological role of thyroid hormones.<br>Pharmacodynamics of thyroid hormone preparations, indications for their use, and side effects. Pharmacology of antithyroid drugs, indications for their use, and side effects.<br>Corticosteroids and their biological role. Effect of cortisol on metabolic processes. Glucocorticoid medications and their main pharmacological effects. Mechanism of the anti-inflammatory effect of glucocorticoids. Mechanism of the immunosuppressant and anti-shock effects of glucocorticoids. Mechanism of the antitoxic and hypothermic effects of glucocorticoids. Indications for the use of glucocorticoids. Side effects of glucocorticoids.<br>The biological role of insulin. Classification, pharmacodynamics, indications for use, and side effects of insulin preparations.<br>Classification, pharmacodynamics, indications for use, and side effects of oral antidiabetic agents. | All    |   |   |
|   |  | 0      | 3 | 0 |
|   |  | Online |   |   |
|   |  | 0      | 0 | 0 |
| 7 | <b>Hormonal Drugs - Seminar 2</b><br>The concept of corticosteroids and their biological role. The effect of cortisol on metabolic processes. Glucocorticoids and their main pharmacological effects. The mechanism of the anti-inflammatory effect of glucocorticoids. The mechanism of the immunosuppressant and anti-shock effects of glucocorticoids. The mechanism of the antitoxic and hypothermic effects of glucocorticoids. Indications for the use of glucocorticoids. Side effects of glucocorticoids.<br>Pharmacodynamics and indications for mineralocorticoid use.<br>Biological role, classification of female sex hormones,  | All    |   |   |
|   |  | 0      | 3 | 0 |
|   |  | Online |   |   |
|   |  | 0      | 0 | 0 |

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|-------------|---|--------|----|---|
|             | <p>pharmacodynamics, and indications for use of these hormones. Female sex hormone antagonists.</p> <p>Classification (drugs) and pharmacodynamics of oral and implantable contraceptives.</p> <p>Biological role of male sex hormones, pharmacodynamics, and indications for use of these hormones. Antiandrogen agents.</p> <p>Pharmacodynamics, indications for use, and side effects of anabolic steroids</p>   |        |    |   |
| 8           | <p><b>Colloquium 1</b></p> <p>Drugs affecting the cardiovascular system, gastrointestinal tract, hormones, and vitamins</p>   | All    |    |   |
|             |   | 0      | 3  | 0 |
|             |   | Online |    |   |
|             |   | 0      | 0  | 0 |
| <b>9-15</b> | <b>The Second Section</b>   | 10     | 24 | 0 |
| 9           | <p><b>Antimicrobial drugs.</b></p> <p>Classification of antimicrobial agents.</p> <p>Main problems of clinical use of chemotherapeutic agents (resistance strainsm dysbiosis).</p> <p>Understanding the biological phenomenon underlying the antimicrobial action of antibiotics.</p> <p>Classification of antibiotics by structure, spectrum, mechanism, and type of antimicrobial action.</p> <p>Antibiotics: beta-lactam group: penicillins, cephalosporins, carbapenems. Classification, pharmacodynamics, pharmacokinetics. Antibiotics: penicillin group, cephalosporins, carbapenems.</p> <p>Classification, pharmacodynamics, pharmacokinetics, indications and contraindications for use, and side effects of these agents.</p> <p>Antibiotics: aminoglycosides, macrolides, tetracyclines, polypeptides, and lincosamines.</p>  | All    |    |   |
|             |   | 2      | 3  | 0 |
|             |   | Online |    |   |
|             |   | 0      | 0  | 0 |
| 10          | <p><b>Antibiotics: aminoglycosides, macrolides, tetracyclines, polypeptides, and lincosamines.</b></p> <p>Antibiotics: aminoglycosides, macrolides, tetracyclines, polypeptides, and lincosamines. Classification, pharmacodynamics, pharmacokinetics, indications, contraindications, and side effects of these agents. Antibiotics for topical use.</p> <p>Sulfonamides, derivatives of nitrofurantoin, naphthylidene, quinoxaline, 8-hydroxyquinoline, and fluoroquinolones. Sulfonamide drugs, derivatives of nitrofurantoin, 8-hydroxyquinoline, and quinoxaline. Fluoroquinolones. Classification, pharmacodynamics, pharmacokinetics, indications and contraindications for use, and side effects of these drugs.</p> <p>Anti-tuberculosis agents. Anti-syphilitic. Antiprotozoal, antifungal, and antihelminthic agents.</p> <p>Pharmacology of antimalarial agents and indications for their use.</p> <p>Characteristics of the antimicrobial action and pharmacokinetics of agents used to treat amoebic dysentery, giardiasis and amebiasis, toxoplasmosis, leishmaniasis, and trichomoniasis.</p> | All    |    |   |
|             |   | 2      | 3  | 0 |
|             |   | Online |    |   |
|             |   | 0      | 0  | 0 |

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|    | Pharmacology of antihelminthic agents. Classification, pharmacodynamics, pharmacokinetics, indications for use, and side effects.  |        |   |   |
| 11 | <b>Antiviral agents</b><br>Antiviral agents<br>Medicines for the treatment of acute respiratory viral infections and influenza. Mechanism of pharmacological action. Indications for use. Contraindications for use. Side effects.<br>Medicines for the treatment of herpes. Mechanism of pharmacological action. Indications for use. Contraindications for use. Side effects.<br>Medicines for the treatment of hepatitis C and B. Mechanism of pharmacological action. Indications for use. Contraindications for use. Side effects.<br>Medicines for the treatment and prevention of HIV infection. Mechanism of pharmacological action. Indications for use. Contraindications for use. Side effects. | All    |   |   |
|    |  | 2      | 3 | 0 |
|    |  | Online |   |   |
|    |  | 0      | 0 | 0 |
| 12 | <b>Antifungal medications</b><br>Medications used to treat topical and systemic mycoses. Mechanism of action. Indications. Contraindications. Side effects.  | All    |   |   |
|    |  | 2      | 3 | 0 |
|    |  | Online |   |   |
|    |  | 0      | 0 | 0 |
| 13 | <b>Antitumor Agents. Seminar 1</b><br>Understanding the current capabilities and perspectives of malignant tumor chemotherapy. Requirements for antitumor agents. Principles of malignant tumor chemotherapy. Side effects associated with malignant tumor chemotherapy and their prevention. Classification of antitumor agents.  | All    |   |   |
|    |  | 2      | 3 | 0 |
|    |  | Online |   |   |
|    |  | 0      | 0 | 0 |
| 14 | <b>Antitumor Agents. Seminar 2</b><br>Mechanism of antitumor action, indications for use of alkaloids and antibiotics. Pharmacokinetics, pharmacodynamics, indications for use, and side effects of antitumor enzymes and antienzyme agents. Pharmacokinetics, pharmacodynamics, indications for use, and side effects of antitumor cytokines. Pharmacokinetics, pharmacodynamics, indications for use, and side effects of monoclonal antibodies as antitumor agents. Hormonal drugs and hormone antagonists used in tumors.  | All    |   |   |
|    |  | 0      | 6 | 0 |
|    |  | Online |   |   |
|    |  | 0      | 0 | 0 |
| 15 | <b>Colloquium No. 2</b><br>Antibiotics, Antitumor Drugs  | All    |   |   |
|    |  | 0      | 3 | 0 |
|    |  | Online |   |   |
|    |  | 0      | 0 | 0 |

Abbreviated names of online options:

| Abbreviation | Full name          |
|--------------|--------------------|
| EC           | E-course           |
| FtM          | Full-text material |
| FtL          | Full-text lectures |
| VM           | Video materials    |
| AM           | Audio materials    |
| Prs          | Presentations      |
| T            | Tests              |

|     |                       |
|-----|-----------------------|
| ERM | E-reference materials |
| IS  | Interactive site      |

## PRACTICAL SESSIONS TOPICS

| Weeks | Topics / Content   |
|-------|--|
|       | <i>5 Semester</i>  |
| 1     | <p><b>The concept of pharmacology. The main stages of pharmacology's development. The concepts of pharmacokinetics and pharmacodynamics.</b></p> <p>The concept of pharmacology. The main stages of pharmacology's development. The concepts of pharmacokinetics and pharmacodynamics.</p> <ol style="list-style-type: none"> <li>1. The concept of pharmacokinetics.</li> <li>2. The mechanism of absorption and comparative characteristics of drug administration routes.</li> <li>3. Factors determining drug concentrations in blood plasma.</li> <li>4. Bioavailability and presystemic elimination of drugs from the body.</li> <li>5. Dose and its types. The breadth of therapeutic action of a drug.</li> <li>6. The concept of pharmacodynamics.</li> <li>7. Types of action and the spectrum of therapeutic action of drugs.</li> <li>8. Primary pharmacological response.</li> <li>9. The dependence of drug action on chemical structure, physical properties, the state of the body, age, gender, and time of day.</li> <li>10. Phenomena observed with combined and repeated use of drugs</li> </ol>       |
| 2     | <p><b>Introduction to Prescription. Solid Dosage Forms.</b></p> <p>Introduction to Prescription. Solid Dosage Forms</p> <ol style="list-style-type: none"> <li>1. Concepts of a medicinal substance, drug, medicinal raw material, and dosage form.</li> <li>2. Galenic and neogalenic medicines.</li> <li>3. The Pharmacopoeia, its contents and purpose.</li> <li>4. Official, Magistraliter (extratemporaneous) , Metered, Bulk and Divided, Short and Detailed Prescriptions.</li> <li>5. Prescription and its Structure.</li> <li>6. Prescription Forms.</li> <li>7. Medicinal Doses in the Decimal System.</li> <li>8. Acceptable abbreviations in prescriptions.</li> <li>9. Brief grammatical notes regarding prescriptions.</li> <li>10. Guide for storing and prescribing poisonous, potent, and narcotic drugs.</li> <li>11. Guide for dispensing medications from pharmacies.</li> <li>12. Solid dosage forms, their comparative characteristics, and prescribing rules.</li> <li>13. Purpose and specifics of prescribing dosage forms in capsules, tablets, powders, pills, granules, and dragees</li> </ol> |
| 3     | <p><b>Soft and liquid dosage forms</b></p> <p>Soft dosage forms.</p> <ol style="list-style-type: none"> <li>1. Types of soft dosage forms.</li> <li>2. General characteristics of ointments. Ointment bases and their importance for medicinal action. Requirements for ointment bases.</li> <li>3. Official and magistraliter (extratemporaneous) ointments. Short and detailed ointment prescriptions. Prescriptions of ophthalmologic ointments.</li> <li>4. General characteristics of pastes. Short and detailed prescriptions.</li> <li>5. Suppositories is a type of soft dosage form. Characteristics of the components and prescription forms for suppositories.</li> </ol>   |

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|   | <p>Liquid dosage forms.</p> <ol style="list-style-type: none"> <li>1. General characteristics of solutions and solvents.</li> <li>2. Methods of prescribing and designating the concentration of solutions for external use. Prescriptions of oral solutions.</li> <li>3. Requirements for injection dosage forms. Rules for prescribing dosage forms in ampoules, vials, and sterile bulk dosage forms.</li> <li>4. Characteristics of liquid dosage forms obtained from herbal medicinal raw materials (infusions, decoctions, tinctures, extracts). Rules for prescribing tinctures, extracts, infusions, and decoctions.</li> <li>5. Neogalenic medicines and liquid organ medicines, rules for their prescription.</li> <li>6. Characteristics and rules for prescribing suspensions and emulsions. Liquid ointments.</li> <li>7. Prescribing officinal and main liniments. Methods for prescribing mixtures.</li> <li>8. Characteristics and prescribing of aerosols</li> </ol>  |
| 4 | <p><b>Drugs acting on the cholinergic synapse: M-cholinomimetics, anticholinesterase agents, and M-cholinergic blockers.</b></p> <p>Drugs acting on the cholinergic synapse: M-cholinomimetics, anticholinesterase agents, and M-cholinergic blockers.</p> <ol style="list-style-type: none"> <li>1. Anatomy and physiology features of the autonomic nervous system.</li> <li>2. Classification of nerve fibers and receptors depending on the chemical nature of the neurotransmitter.</li> <li>3. Structure and function of the cholinergic synapse. Classification and topography of cholinergic-reactive structures.</li> <li>4. Acetylcholine, its synthesis and inactivation in the body. Enzymes involved in acetylcholine metabolism.</li> <li>5. Classification of drugs affecting the cholinergic synapse.</li> <li>6. Pharmacodynamics of M-cholinomimetic agents, drugs, indications and contraindications</li> <li>7. Pharmacology of anticholinesterase agents: classification, pharmacodynamics, drugs, indications and contraindications.</li> <li>8. Differences between anticholinesterase agents and M-cholinomimetics in the mechanism and pharmacological action.</li> <li>9. Acute poisoning with M-cholinomimetics and anticholinesterase agents. Treatment measures for these conditions.</li> <li>10. M-anticholinergic agents: pharmacodynamics, drugs, indications and contraindications for their use.</li> <li>11. Acute poisoning with M-anticholinergic agents, treatment measures.</li> </ol> |
| 5 | <p><b>Drugs acting on the cholinergic synapse: N-cholinomimetics, ganglionic blockers, and muscle relaxants. Drugs acting on the adrenergic synapse: <math>\alpha</math>- and <math>\beta</math>-adrenergic agonists, <math>\beta</math>-adrenergic agonists, <math>\alpha</math>-ad</b></p> <ol style="list-style-type: none"> <li>1. N-cholinomimetics.</li> <li>2. Nicotine action on N-cholinergic receptors. The effect of nicotine on the central nervous system, cardiovascular system, and gastrointestinal tract.</li> <li>3. The social and medical significance of nicotine addiction. The importance and opportunities of combating with nicotine addiction.</li> <li>4. N-cholinomimetic drugs. Features of their action on N-cholinergic receptors. Pharmacodynamics, medicines, indications and contraindications for N-cholinomimetics.</li> <li>5. Ganglionic blockers. Mechanism of action, effects, classification, indications and contraindications for use, side effects of ganglionic blockers.</li> <li>6. Clinical manifestations and first aid in acute ganglion blocker poisoning.</li> <li>7. Muscle relaxants. Concept of peripheral and central muscle relaxants. Pharmacology of curare-like agents. Classification, medicines, pharmacokinetics, and pharmacodynamics.</li> </ol>  |

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|   | <p>8. Indications and contraindications for the use of peripheral muscle relaxants, side effects, and their management.</p> <p>Drugs acting on the adrenergic synapse: <math>\alpha</math>- and <math>\beta</math>-adrenergic agonists, <math>\beta</math>-adrenergic agonists, <math>\alpha</math>-adrenergic agonists.</p> <ul style="list-style-type: none"> <li>• Drugs acting on the adrenergic synapse: <math>\alpha</math>- and <math>\beta</math>-adrenergic agonists, <math>\beta</math>-adrenergic agonists, <math>\alpha</math>-adrenergic agonists.</li> <li>• Drugs acting on the adrenergic synapse: adrenergic blockers and sympatholytics.</li> <li>• Structure of the adrenergic synapse. Concept of the synthesis and inactivation of norepinephrine, the functional significance of the sympathetic autonomic nervous system.</li> <li>• Classification, localization, and functional purpose of adrenergic receptors.</li> <li>• Classification of drugs affecting transmission at adrenergic synapses.</li> <li>• Pharmacodynamics of direct-acting <math>\alpha</math>- and <math>\beta</math>-adrenergic agonists, the effects of adrenaline on metabolism and the cardiovascular system after subcutaneous and intravenous administration.</li> <li>• Indications and contraindications for use, side effects of adrenaline. Differences between noradrenaline and adrenaline.</li> <li>• Pharmacodynamics of indirect-acting <math>\alpha</math>- and <math>\beta</math>-adrenergic agonists, the pharmacokinetics and pharmacodynamics of ephedrine.</li> <li>• Pharmacodynamics, classification, indications and contraindications for use, and side effects of <math>\beta</math>-adrenergic agonists.</li> <li>• Pharmacodynamics, classification, indications and contraindications for use, and side effects of <math>\alpha</math>-adrenergic agonists.</li> <li>• Pharmacodynamics, classification, indications and contraindications for use, and side effects of <math>\alpha</math>-adrenergic blockers.</li> <li>• Mechanism of action, effects, classification, and clinical use of <math>\beta</math>- adrenergic blockers.</li> <li>• Pharmacodynamics, classification, indications and contraindications, side effects of <math>\alpha</math>- and <math>\beta</math>-blockers.</li> </ul> <p>Pharmacodynamics, classification, indications and contraindications, side effects of sympatholytics</p> |
| 6 | <p><b>Pharmacology of drugs acting on the central nervous system.</b></p> <p>General anesthetics.</p> <ol style="list-style-type: none"> <li>1. Concept of anesthesia and anesthesia theories.</li> <li>2. Classification of anesthetics based on their routes of administration and chemical structure.</li> <li>3. Requirements for anesthetics. Concept of the breadth of anesthetic action of anesthetics.</li> <li>4. Characteristics of inhalation anesthetics, factors contributing to their absorption and elimination.</li> <li>5. Liquid volatile substances for inhalation anesthesia. Stages of anesthesia.</li> <li>6. Pharmacology of inhaled substances for inhalation anesthesia.</li> <li>7. Classification of non-inhalation anesthetics and their differences from inhalation agents.</li> <li>8. Characteristics of individual groups of non-inhalation anesthetics.</li> <li>9. Concept of combined, inductive, basic, mixed, and potentiated anesthesia.</li> <li>10. Resorptive effects, local action, and application of ethyl alcohol depending on concentration (95%, 90%, 70%, and 40%) in medical practice.</li> <li>11. Symptoms of acute ethyl alcohol poisoning and treatment measures.</li> </ol>  |
| 7 | <p><b>Pharmacology of drugs acting on the central nervous system. Hypnotics.</b></p> <p>Antiepileptic and antiparkinsonian drugs</p> <p>Hypnotics. Hypnotic poisoning.</p> <ol style="list-style-type: none"> <li>1. Effects of hypnotics.</li> <li>2. Classification of hypnotics based on chemical structure.</li> <li>3. Characteristics of hypnotics - barbituric acid derivatives and benzodiazepine receptor</li> </ol>  |

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|   | <p>agonists.</p> <p>4. Requirements for hypnotics and principles of their use.</p> <p>5. Problems of the hypnotic use (accumulation, drug addiction, rebound phenomenon).</p> <p>6. Symptoms of acute hypnotic poisoning and measures for this condition</p> <p>Antiepileptic and antiparkinsonian drugs.</p> <p>1. Classification of antiepileptic drugs.</p> <p>2. Requirements for antiepileptic drugs.</p> <p>3. Pharmacodynamics of antiepileptic drugs.</p> <p>4. Characteristics of anticonvulsants used to relieve seizures of various origins.</p> <p>5. Classification, pharmacodynamics, and side effects of antiparkinsonian drugs</p>   |
| 8 | <p><b>Narcotic and non-narcotic analgesics</b></p> <p>Pharmacology of drugs acting on the central nervous system.</p> <p>Narcotic analgesics.</p> <p>1. Concept of the nociceptive and antinociceptive systems. Classification and physiological role of opioid receptors.</p> <p>2. Classification of analgesics and their comparative characteristics.</p> <p>3. Classification of drugs acting on opioid receptors.</p> <p>4. Narcotic analgesics. Characteristics and mechanism of analgesic action</p> <p>5. Pharmacodynamics of morphine.</p> <p>6. The effect of morphine on the psychoemotional sphere. Current understanding of the mechanisms of euphoria and drug addiction to narcotic analgesics.</p> <p>7. Comparative characteristics of the pharmacodynamics of various opioid receptor agonists.</p> <p>8. Opioid receptor agonist-antagonists.</p> <p>9. Indications, contraindications, and side effects of narcotic analgesics.</p> <p>10. Functional antagonists of narcotic analgesics.</p> <p>11. Acute poisoning with narcotic analgesics. First aid.</p> <p>Non-narcotic analgesics and non-narcotic antitussives.</p> <p>1. The mechanism of analgesic action of non-narcotic analgesics and the specific features of this effect.</p> <p>2. The mechanism of anti-inflammatory action of non-narcotic analgesics.</p> <p>3. The mechanism of antipyretic action of non-narcotic analgesics.</p> <p>4. Classification of these agents based on chemical structure, medicines, and the specific features of each group.</p> <p>5. Analgesics - antipyretics. Non-steroidal anti-inflammatory drugs.</p> <p>6. Indications for non-narcotic analgesics. Selecting the drug based on on pharmacodynamics.</p> <p>7. Contraindications e and side effects of non-narcotic analgesics</p> |
| 9 | <p><b>Psychotropic drugs: sedatives, anxiolytics (tranquilizers), and antipsychotics (neuroleptics).</b></p> <p>Pharmacology of drugs acting on the central nervous system. Psychotropic drugs: sedatives, anxiolytics (tranquilizers), and antipsychotics (neuroleptics).</p> <p>1. Advances in modern psychopharmacology.</p> <p>2. Classification of agents that depress the psychoemotional sphere.</p> <p>3. Pharmacology of sedatives: drugs and indications for their use.</p> <p>4. Pharmacodynamics of anxiolytics.</p> <p>5. Classification of anxiolytics by chemical structure and their comparative characteristics, indications for use, and side effects of these drugs.</p> <p>6. Pharmacodynamics of antipsychotic drugs.</p> <p>7. Classification, drugs, and comparative characteristics of the pharmacodynamics of various groups of antipsychotic drugs.</p> <p>8. Indications for use of these drugs.</p>  |

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|    | <p>9. Prevention and treatment of side effects arising from the use of antipsychotic drugs.<br/>10. Comparative characteristics of the pharmacodynamics of anxiolytics, sedatives and antipsychotics.</p> <p>Psychotropic drugs: antidepressants, psychostimulants, and general tonics. Analeptics.</p> <ol style="list-style-type: none"> <li>1. Classification of agents that activate the psychoemotional sphere.</li> <li>2. Classification, pharmacodynamics, indications for use, and side effects of antidepressants.</li> <li>3. Classification of psychostimulants and medications.</li> <li>4. Classification, pharmacodynamics, and indications for use of psychomotor stimulants.</li> <li>5. Pharmacodynamic characteristics of psychometabolic stimulants (nootropics), and indications for their use.</li> <li>6. Comparative characteristics of psychomotor and psychometabolic stimulants.</li> <li>7. Pharmacodynamics and indications for use of general tonics.</li> <li>8. Pharmacodynamics, classification, medications, and indications for use of analeptics.</li> <li>9. Effects of strychnine-group drugs on the central nervous system, and indications for use.</li> </ol>                          |
| 11 | <p><b>Cardiotonic agents: cardiac glycosides and non-glycoside inotropic agents.</b></p> <ol style="list-style-type: none"> <li>1. Medicinal plants containing cardiac glycosides.</li> <li>2. Chemical structure and role of cardiac glycoside components.</li> <li>3. Effect of cardiac glycosides on the basic functions of the cardiac muscle. The importance of electrocardiographic examination in cardiac glycoside therapy.</li> <li>4. Mechanism of the positive inotropic and negative chronotropic effects of cardiac glycosides.</li> <li>5. The effect of cardiac glycosides on myocardial metabolism.</li> <li>6. Effects of cardiac glycosides in circulatory failure.</li> <li>7. Classification of cardiac glycosides based on their pharmacokinetics.</li> <li>8. Indications and contraindications for the use of cardiac glycosides.</li> <li>9. Factors contributing to cardiac glycoside intoxication.</li> <li>10. Clinical manifestations of glycoside intoxication, its prevention, and treatment.</li> <li>11. Non-glycoside inotropic agents.</li> </ol>   |
| 12 | <p><b>Antiarrhythmic agents.</b></p> <ol style="list-style-type: none"> <li>1. Mechanisms of cardiac rhythm disturbances.</li> <li>2. Medications used to correct rhythm by affecting extracardiac innervation (in sinus tachycardia and bradycardia, atrioventricular block).</li> <li>3. Classification of antiarrhythmic agents.</li> <li>4. Mechanism of antiarrhythmic action, indications for use, and side effects of quinidine and quinidine-like agents (subgroup IA).</li> <li>5. Mechanism of antiarrhythmic action, pharmacokinetic characteristics, and indications for the use of local anesthetics (subgroup IB).</li> <li>6. Antiarrhythmic action of <math>\beta</math>-blockers, indications for their use, and side effects (group II).</li> <li>7. Antiarrhythmic activity of agents that prolong the action potential (group III).</li> <li>8. Mechanism of antiarrhythmic action, indications for use, and side effects of calcium channel blockers (group IV).</li> <li>9. Antiarrhythmic activity of potassium containing medicines.</li> <li>10. Antiarrhythmic action of cardiac glycosides and indications for their use.</li> <li>11. Basic approaches to selecting antiarrhythmic drugs</li> </ol> |
| 13 | <p><b>Antianginal agents. Agents used for cerebrovascular accidents and angioprotectors.</b></p> <ol style="list-style-type: none"> <li>1. Pathogenesis of coronary insufficiency and its medicinal treatment.</li> <li>2. Classification of antianginal agents.</li> <li>3. Pharmacodynamics, indications for use, and side effects of organic nitrates.</li> <li>4. Antianginal action of calcium channel blockers.</li> </ol>  |

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|    | <p>5. Beta-blockers as antianginal agents.<br/> 6. Classification and pharmacodynamics of agents that increase oxygen delivery to the myocardium (coronary-active agents).<br/> 7. Main approaches to selecting antianginal drugs.<br/> 8. Pharmacodynamics of agents used for cerebrovascular accidents.<br/> 9. Pharmacology of angioprotectors.</p>   |
| 14 | <p><b>Drugs used to increase blood pressure, drugs used in the treatment of migraines.</b><br/> <b>Hypolipidemic drugs</b><br/> Classification and pharmacodynamics of drugs used for hypotensive conditions.<br/> Classification and pharmacodynamics of drugs used in the treatment of migraines (symptomatic and pathogenetic)<br/> Lipid-lowering drugs<br/> Pathogenesis of atherosclerosis. Classification of lipoproteins. Atherogenicity index.<br/> Complications of atherosclerosis. Classification of lipid-lowering agents<br/> Statins. Mechanism of pharmacological action of statins. Indications for use of statins.<br/> Contraindications for use of statins. Side effects of statins.<br/> Fibrates. Mechanism of pharmacological action of fibrates. Indications for use of fibrates.<br/> Contraindications for use of fibrates. Side effects of fibrates.<br/> Bile acid sequestrants. Mechanism of lipid-lowering action of bile acid sequestrants.<br/> Indications for use. Contraindications for use of bile acid sequestrants. Side effects of bile acid sequestrants.<br/> Inhibitors of intestinal cholesterol absorption. Ezetimib. Mechanism of lipid-lowering action.<br/> Indications for use. Contraindications. Side effects.<br/> Nicotinic acid. Mechanism of lipid-lowering action of nicotinic acid. Indications for use of nicotinic acid preparations. Contraindications for use of nicotinic acid preparations. Side effects of nicotinic acid preparations. Nicotinic acid preparations.<br/> Probucol. Mechanism of lipid-lowering action. Indications for use. Contraindications. Side effects.</p> |
| 15 | <p><b>Antihypertensives.</b><br/> 1. Neuroendocrine mechanisms regulating vascular tone and blood pressure.<br/> 2. Classification of antihypertensive agents.<br/> 3. Medications used in the treatment of arterial hypertension (drug names, mechanism of action, indications, contraindications, side effects, drug-drug interactions):<br/> • Angiotensin-converting enzyme inhibitors (ACE inhibitors)<br/> • Angiotensin receptor blockers (ARBs)<br/> • Calcium channel blockers<br/> • Drugs affecting sympathetic activity (subgroups by mechanism of action)<br/> Direct-acting vasodilators • Drugs opening potassium channels<br/> Diuretics<br/> 1. Classification of diuretics<br/> 2. Mechanism of diuretic and hypotensive action, indications and side effects of thiazide and thiazide-like diuretics<br/> 3. Mechanism of diuretic action, indications and side effects of loop diuretics<br/> 4. Mechanism of diuretic action and effect on acid-base balance, indications and side effects of carbonic anhydrase inhibitors<br/> 5. Mechanism of diuretic action and indications of potassium-sparing diuretics<br/> 6. Mechanism of the dehydrating and diuretic effects of osmotic diuretics and indications for their use<br/> 7. Diuretics of herbal origin<br/> Combination of drugs used to treat hypertension and the sequence of their use in different patient groups</p>  |

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|   | <i>6 Semester</i>   |
| 1 | <p><b>Drugs affecting afferent innervation. Pharmacodynamics and indications for use of drugs that reduce uterine contractility (tocolytics). Venotonics.</b></p> <ol style="list-style-type: none"> <li>1. Classification of drugs acting on sensory nerve endings.</li> <li>2. Classification of drugs that reduce the sensitivity of afferent nerves.</li> <li>3. Pharmacodynamics and classification of local anesthetics.</li> <li>4. Comparative characteristics of local anesthetics.</li> <li>5. Principles of action, classification, and indications for use of astringent enveloping and adsorbent agents.</li> <li>6. Classification and pharmacodynamic characteristics of agents that stimulate receptors of mucous membranes, skin, and subcutaneous tissues.</li> <li>7. Pharmacodynamics and indications for use of agents that reduce uterine contractility (tocolytic agents).</li> <li>8. Classification and preparations of uterine agents.</li> <li>9. Comparative characteristics of uterine agents that increase uterine tone and contractility.</li> </ol> <p>Venotonics</p> |
| 2 | <p><b>Medicines used for respiratory diseases</b></p> <p>Classification of drugs affecting respiratory function.<br/> Pharmacodynamic characteristics of respiratory stimulants.<br/> Pharmacodynamics, classification, and indications for use of antitussives.<br/> Classification and pharmacodynamic characteristics of expectorants.<br/> Classification and pharmacodynamic characteristics of drugs used for bronchoconstriction.<br/> Drugs used for acute respiratory failure</p>  |
| 3 | <p><b>Drugs affecting digestive function.</b></p> <p>Drugs affecting digestive function.</p> <ol style="list-style-type: none"> <li>1. Drugs used to treat diseases of the stomach and duodenum (gastritis, peptic ulcers). Proton pump inhibitors, H<sub>2</sub>-histamine blockers. Antacids, gastroprotectors.</li> <li>2. Classification, preparations, pharmacodynamics, indications and contraindications for the use of laxatives.</li> <li>3. Classification of hepatotropic agents (hepatoprotectors). Drugs.</li> <li>4. Classification, mechanism of action, indications and contraindications of choleric agents.</li> <li>5. Pharmacodynamics, indications for use, and side effects of hepatoprotective agents.</li> <li>6. Enzyme preparations. Antienzyme drugs.</li> <li>7. Use of enveloping and adsorbing agents in medical practice.</li> <li>8. Emetics: classification, drugs, pharmacodynamics, and indications for their use</li> </ol>   |
| 4 | <p><b>Medicines affecting hematopoiesis, blood clotting, fibrinolysis, and platelet aggregation.</b></p> <p>Concept of hemocoagulation mechanisms. Classification of agents affecting blood clotting. Pharmacodynamics, comparative characteristics, indications, and contraindications for direct-acting anticoagulants. Pharmacodynamics, comparative characteristics, indications, and contraindications for indirect-acting anticoagulants. Symptoms of anticoagulant overdose and first aid.</p> <p>Classification of antiplatelet medications. Pharmacodynamics, indications for use, and their role in practical medicine, side effects and contraindications.</p> <p>Classification of medications affecting fibrinolysis. Pharmacodynamics, indications for use, and side effects of fibrinolytics. Pharmacology of medications affecting blood clotting, drugs, indications and side effects. Pharmacodynamics, indications and side effects of agents that inhibit fibrinolysis</p>  |

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| 5  | <p><b>Vitamin supplements, sodium, potassium, calcium, and magnesium supplements.</b><br/> Vitamin supplements, sodium, potassium, calcium, and magnesium supplements. Understanding the biological role of vitamins in the body and the causes of vitamin deficiency. Classification of vitamins and their preparations. The biological role and pharmacological properties of vitamins B1, B2, PP (nicotinic acid), and indications for use. Vitamins B6, B12 (cyanocobalamin), B9, C, P, A, D2 and D3, K, E (tocopherol).</p>   |
| 6  | <p><b>Hormonal Drugs - Seminar 1</b><br/> Understanding the principles of endocrine gland regulation<br/> Classification of hormonal drugs by chemical structure. Indications for the use of hormonal drugs.<br/> Mechanisms of hormonal action. Classification and biological role of hypothalamic and pituitary hormones.<br/> Pharmacodynamics and indications for the use of hypothalamic hormones.<br/> Pharmacodynamics and indications for the use of anterior pituitary hormones.<br/> Pharmacodynamics and indications for the use of posterior pituitary hormones.<br/> The biological role of thyroid hormones.<br/> Pharmacodynamics of thyroid hormone preparations, indications for their use, and side effects. Pharmacology of antithyroid drugs, indications for their use, and side effects.<br/> The biological role of insulin. Classification, pharmacodynamics, indications for use, and side effects of insulin preparations.<br/> Classification, pharmacodynamics, indications for use, and side effects of oral antidiabetic agents.</p> |
| 7  | <p><b>Hormonal Drugs - Seminar 2</b><br/> The concept of corticosteroids and their biological role. The effect of cortisol on metabolic processes. Glucocorticoids and their main pharmacological effects. The mechanism of the anti-inflammatory effect of glucocorticoids. The mechanism of the immunosuppressant and anti-shock effects of glucocorticoids. The mechanism of the antitoxic and hypothermic effects of glucocorticoids. Indications for the use of glucocorticoids. Side effects of glucocorticoids.<br/> Pharmacodynamics and indications for mineralocorticoid use.<br/> Biological role, classification of female sex hormones, pharmacodynamics, and indications for use of these hormones. Female sex hormone antagonists.<br/> Classification (drugs) and pharmacodynamics of oral and implantable contraceptives.<br/> Biological role of male sex hormones, pharmacodynamics, and indications for use of these hormones. Antiandrogen agents.<br/> Pharmacodynamics, indications for use, and side effects of anabolic steroids.</p>     |
| 9  | <p><b>Antimicrobial drugs. Seminar 1</b><br/> Classification of antimicrobial agents.<br/> Prophylactic and therapeutic use of antibiotics. Principles of rational antibiotic therapy<br/> Main problems of clinical use of chemotherapeutic agents (resistance strainsm dysbiosis).<br/> Understanding the biological phenomenon underlying the antimicrobial action of antibiotics.<br/> Classification of antibiotics by structure, spectrum, mechanism, and type of antimicrobial action.<br/> Antibacterial chemotherapeutic agents. The biological phenomenon underlying the action of antibiotics. Beta-lactam antibiotics: penicillin group, cephalosporins, carbapenems.<br/> Classification, pharmacodynamics, pharmacokinetics, indications and contraindications for use, and side effects of these agents.</p>  |
| 10 | <p><b>Antimicrobial drugs. Seminar 2</b><br/> Pharmacology of topical antibiotics</p>  |

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|    | <p>Sulfonamides, derivatives of nitrofurans, naphthylidene, quinoxaline, 8-hydroxyquinoline, and fluoroquinolones. Sulfonamide drugs, derivatives of nitrofurans, 8-hydroxyquinoline, and quinoxaline. Fluoroquinolones. Classification, pharmacodynamics, pharmacokinetics, indications and contraindications for use, and side effects of these drugs.</p> <p>Anti-tuberculosis agents. Anti-syphilitic. Antiprotozoal, antihelminthic agents.</p> <p>Pharmacology of antimalarial agents and indications for their use.</p> <p>Characteristics of the antimicrobial action and pharmacokinetics of agents used to treat amoebic dysentery, giardiasis and amebiasis, toxoplasmosis, leishmaniasis, and trichomoniasis.</p> <p>Pharmacology of antihelminthic agents. Classification, pharmacodynamics, pharmacokinetics, indications for use, and side effects</p> |
| 10 | <p><b>Antibiotics: aminoglycosides, macrolides, tetracyclines, polypeptides, and lincosamides.</b></p> <p>Spectrum of action, mechanism, type of antimicrobial action, pharmacokinetics, indications for use, and side effects of macrolide antibiotics, tetracyclines, aminoglycosides, chloramphenicol, polymyxins, lincosamides, glycopeptides, and fusidic acid.</p> <p>Pharmacology of topical antibiotics.</p>  |
| 11 | <p><b>Antiviral agents</b></p> <p>Medicines for the treatment of acute respiratory viral infections and influenza. Mechanism of pharmacological action. Indications for use. Contraindications for use. Side effects.</p> <p>Medicines for the treatment of herpes. Mechanism of pharmacological action. Indications. Contraindications. Side effects.</p> <p>Medicines for the treatment of hepatitis C and B. Mechanism of pharmacological action. Indications for use. Contraindications for use. Side effects.</p> <p>Medicines for the treatment and prevention of HIV infection. Mechanism of pharmacological action. Indications. Contraindications. Side effects.</p>   |
| 12 | <p><b>Antifungal medications</b></p> <p>Medications used to treat topical and systemic mycoses. Mechanism of action. Indications. Contraindications. Side effects.</p>  |
| 13 | <p><b>Antitumor Agents. Seminar 1</b></p> <p>Understanding the current capabilities and perspectives of malignant tumor chemotherapy. Requirements for antitumor agents. Principles of malignant tumor chemotherapy. Side effects associated with malignant tumor chemotherapy and their prevention. Classification of antitumor agents</p>   |
| 14 | <p><b>Противоопухолевые средства.</b></p> <p>Mechanism of antitumor action, indications for use of alkaloids and antibiotics.</p> <p>Pharmacokinetics, pharmacodynamics, indications for use, and side effects of antitumor enzymes and antienzyme agents. Pharmacokinetics, pharmacodynamics, indications for use, and side effects of antitumor cytokines. Pharmacokinetics, pharmacodynamics, indications for use, and side effects of monoclonal antibodies as antitumor agents. Hormonal drugs and hormone antagonists used in tumors.</p>   |

## 6. EDUCATIONAL TECHNOLOGIES

Teaching methods include the use of multimedia, interactive approaches, to acquire theoretical knowledge and practical skills.

For independent preparation for practical classes and exams, students are provided access to full-text textbooks and articles from electronic databases:

## 7. ASSESSMENT TOOLKIT

The assessment toolkit ensures verification of the intended learning outcomes achievement (competency-based rubrics) using current, midterm and interim assessment of the course.

The link between developed competencies and their assessment is presented in the following table:

| Competency | Achievement rubrics | Assessment activity (Syl 1)   | Assessment activity (Syl 2) |
|------------|---------------------|-------------------------------|-----------------------------|
| ОПК-7      | 3-ОПК-7             | PFE, Cq-8, Cq-13, Кл-7, Кл-13 | Ex, Cq-7, T-15, Кл-7, Кл-15 |
|            | У-ОПК-7             | PFE, Cq-8, Cq-13, Кл-7, Кл-13 | Ex, Cq-7, T-15, Кл-7, Кл-15 |
|            | В-ОПК-7             |                               | Ex, T-15, Кл-7              |

### Educational achievement rubrics scales

The scale of each assessment activity varies from 0 to the maximum established point, inclusive. The final assessment of the course is performed on a 100-point scale and represents the sum of the points earned by the student in the section assessments, framework of current and interim assessment.

Sections and interim assessments are considered passed when the student achieves a minimum score equal to 60% of the maximum. The final grade is assigned only upon passing all sections and the interim assessment.

The final grade is assigned in accordance with the following scale:

| Total score | Rating on a 4-point scale   | Pass/fail examination | ECTS assessment |
|-------------|-----------------------------|-----------------------|-----------------|
| 90-100      | 5 – « <i>excellent</i> »    | « <i>pass</i> »       | A               |
| 85-89       | 4 – « <i>good</i> »         |                       | B               |
| 75-84       |                             |                       | C               |
| 70-74       |                             |                       | D               |
| 65-69       | 3 – « <i>satisfactory</i> » |                       | E               |
| 60-64       |                             | F                     |                 |
| below 60    | 2 – « <i>fail</i> »         | « <i>fail</i> »       |                 |

An “excellent” grade indicates a deep and solid mastery of the program material by a student who presents their answers consistently, clearly, and logically, is able to closely link theory with practice, and uses materials from monographic literature in their answers.

A “good” grade corresponds to a student’s solid knowledge of the material, who presents their answers competently and to the point, without any significant inaccuracies.

A “satisfactory” grade corresponds to the basic level of mastery of the material by the student, in which the main material has been mastered, but its details have not been assimilated, the answers contain inaccuracies, insufficiently correct wording and logical inconsistencies.

A grade “pass” corresponds to at least a basic level of mastery of the program material, in which the student possesses the necessary knowledge, skills, and abilities, and is able to apply theoretical principles to solve typical practical problems.

A grade “fail” is given to a student who lacks a significant understanding of the curriculum material, makes significant errors in their answers, or fails all required assignments. These students are generally unable to continue their studies without additional classes.

## **8. ACADEMIC COURSE EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT**

### **CORE READING:**

1. ЭИ К42 Pharmacology : учебник, Kharkevitch D.A., Москва: ГЭОТАР-Медиа, 2023
2. ЭИ X 21 Фармакология : , Харкевич Д.А., Москва: ГЭОТАР-Медиа, 2022

### **FURTHER READING:**

1. ЭИ P56 Pharmacology. Illustrated textbook : учебник, Alyautdin R.N., Москва: ГЭОТАР-Медиа, 2020
2. ЭИ B29 Тестовые задания по фармакологии : учебное пособие, Венгеровский А.И., Плотникова Т.М., Ваизова О.Е., Москва: ГЭОТАР-Медиа, 2020

### **SOFTWARE:**

No special softwares is required

### **LMS AND ONLINE RESOURCES**

1. Pharmacology (<https://online.mephi.ru/course/view.php?id=1008>)

<https://online.mephi.ru/>

<http://library.mephi.ru/>

## **9. LOGISTICAL SUPPORT**

1. Интерактивная доска SMART SBM 685 (64-405)
2. МЫШЬ, клавиатура (64-405)
3. Персональный компьютер: Моноблок Lenovo V540-24IWL All-In-One 23,8" i3-8145U 8Gb 256GB\_SSD\_M.2 Intel (64-405)
4. Проектор SMART P109 (64-405)

## **10. EDUCATIONAL AND METHODOLOGICAL RECOMMENDATIONS FOR STUDENTS**

Recommendations for preparing for seminars.

The plan for practical classes, their topics, recommended readings, and the purpose and objectives of the course are communicated by the instructor during introductory classes or in the curriculum for the given course. Practical classes help students gain a deeper understanding of the course material and acquire skills in creative work with scientific literature.

Before you begin studying the topic, you need to familiarize yourself with the main questions of the practical lesson plan and the list of recommended literature.

When preparing for a practical lesson, you should first review lecture notes, textbook sections, and teaching aids to gain a general understanding of the topic's place and significance in the course being studied. Then, consult additional literature and take notes on the recommended sources.

In the process of studying the recommended material, it is necessary to understand the structure of the topic being studied, identify the main points, follow their logic and thereby delve into the essence of the problem being studied.

It is necessary to keep records of the material being studied in the form of notes, which, along with visual memory, also includes motor memory and allows for the accumulation of an individual fund of auxiliary materials for the rapid repetition of what has been read, for the mobilization of accumulated knowledge.

Basic note-taking forms: outline (simple and detailed), excerpts, and abstracts. During preparation, it is important to compare sources, consider the material being studied, develop an action plan, and carefully consider your oral presentation.

Recommendations for preparing for the test.

Test – 10-15-20-25 points. Each question – 1 (2) point.

TOPICS: Specified in each specific section

Answer requirements: A clear, detailed answer (2 points/question) or a choice of the correct answer to the test question (1 point/question).

Recommendations for preparing for a test/exam

Response requirements and evaluation criteria:

An "excellent" grade of 45-50 points on a test/exam is awarded for: a correct, complete, and logically constructed answer; the ability to use specialized terminology; the ability to illustrate theoretical principles with practical material.

A "good" grade of 35–44 points on the exam is awarded for: a correct, complete, and logically constructed answer with minor errors or inaccuracies; the ability to use specialized terminology, but incomplete conclusions or generalizations are made.

A "satisfactory" grade of 30–34 points on the exam is given for: a schematic, incomplete answer; inability to use special terms or ignorance of them; with one serious error;

An "unsatisfactory" grade of <30 points on the exam is given for: answering all questions on the ticket with serious errors; inability to use specialized terminology; inability to give examples of the practical use of scientific knowledge.

Admission to the exam in a discipline is granted based on a score of over 30 points.

A student can earn between 30 and 50 points per semester.

The minimum score for an exam answer is 30, the maximum is 50.

## **11. EDUCATIONAL AND METHODOLOGICAL RECOMMENDATIONS FOR TEACHERS**

Grading and criteria for tests, extended quizzes, homework, and the final test:

1 - Tests are graded according to the following formula: 1 point for every 1 correct answer. A student who has not started the test receives -1 point.

2 - Extended quizzes are graded according to the following formula: complete answer - 2 points, incomplete answer - 1 point, no answer - 0 points, student who has not started the test -2 points.

3 - Homework must be completed by all students to be admitted to the final assessment. Late submissions will result in a deduction of -1 point from the final score.

#### 4) Credit/Exam Grading Criteria

To be allowed to the exam, a student must:

1. Complete all homework assignments according to the course syllabus.
2. Successfully participate in seminars (oral quizzes, case studies, and Round Table presentations), receiving a grade of at least "satisfactory."
3. Successfully complete the tests and oral interview, scoring at least 15 points for each section of the semester.
4. Score at least 30 points out of 50 on the final test (to be admitted to the oral exam).

5. To pass the exam, a student must to answer :

To be admitted to the exam, a student must:

- a) Complete all homework assignments according to the course syllabus.
- b) Successfully participate in seminars (oral quizzes, case studies, and Round Table presentations), receiving a grade of at least "satisfactory."
- c) Successfully complete the tests and oral interview, scoring at least 15 points for each section of the semester.
- d) Score at least 30 points out of 50 on the final test (to be admitted to the oral exam).

6. To pass the exam, a student must:

- a) Obtain admission to the exam (see above).
- b) Attend the exam according to the schedule.
- c) Bring only a pen and paper! Cell phones, computers, notebooks, and textbooks are prohibited.
- d) A minimum of 30 points out of 50 is required for the exam.

7. The Pharmacology Biology exam contains 5 questions:

- 3 questions on general or specific pharmacology (10 points each)
- 2 situational problems with prescription writing (10 points each)

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