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**Federal State Autonomous Educational Institution of Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
RUDN University**

Institute of Medicine

educational division (faculty/institute/academy) as higher education programme developer

COURSE SYLLABUS

Pharmacology

course title

Recommended by the Didactic Council for the Education Field of:

31.05.01 General Medicine

field of studies / speciality code and title

The course instruction is implemented within the professional education programme of higher education:

General Medicine

higher education programme profile/specialisation title

2022-2023

1. COURSE GOAL(s)

The goal of the course “Pharmacology” is to equip students with the system of knowledge about the principles of drugs classification, their mechanisms of action, pharmacological effects, indications, and contraindications for use; the principles of combining drugs, the risk of adverse side effects and their prevention, rules of drugs prescription and drug rational administration.

2. REQUIREMENTS FOR LEARNING OUTCOMES

Mastering the course (module) “Pediatrics” is aimed at the development of the following competences /competences in part GPC-10.1, GPC-10.2, GPC-10.3; GPC-11.1, GPC-11.2; PC-3.4, PC-3.6.

Table 2.1. List of competences that students acquire through the course study

Competence code	Competence descriptor	Competence formation indicators (within this course)
GPC -10.	Able to solve standard tasks of professional activity using information, bibliographic resources, biomedical terminology, information and communication technologies, taking into account the basic requirements of information security	GPC-10.1. Being able to use information technology in professional activity.
		GPC-10.2 Being able to observe the information security rules in professional activity.
		GPC-10.3. Being able to use information and communication technologies, including applied software for general and special purposes in dealing with professional tasks.

GPC -11.	Able to prepare and apply scientific, research and production, design, organizational, managerial and regulatory documentation in the healthcare system	GPC-11.1. Being able to prepare scientific, research, development and production, design, organizational, management and regulatory documentation in accordance with the area of professional activity and the current requirements for their execution.
		GPC-11.2. Being able to apply scientific, research, development and production, design, organizational, management and regulatory documentation within the framework of their professional activities.
PC-3.	Able to prescribe treatment and monitor its efficacy and safety	PC-3.4. Able to evaluate the effectiveness and safety of the use of drugs, medical devices, clinical nutrition and other methods of treatment.

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course refers to the core/variable/elective* component of (B1) block of the higher educational programme curriculum.

* - Underline whatever applicable.

Within the higher education programme students also master other (modules) and / or internships that contribute to the achievement of the expected learning outcomes as results of the course study.

Table 3.1. The list of the higher education programme components/disciplines that contribute to the achievement of the expected learning outcomes as the course study results

Competence code	Competence descriptor	Previous courses/modules*
GPC-10.	Mathematics Medical informatics Biochemistry	Radiation diagnostics general surgery Medical rehabilitation Faculty surgery Occupational diseases Biostatistics Telemedicine
GPC-11.	Physics	Hygiene Public health and health care, health economics
PC-3.	Physics	General surgery

		Dermatovenereology Neurology, medical genetics, neurosurgery Faculty Surgery Occupational diseases Hospital therapy Endocrinology Outpatient therapy Hospital surgery, pediatric surgery Pediatrics Practice of a surgical profile: assistant surgeon Physician Assistant: Physician Assistant Practice of general medical profile: assistant doctor of an outpatient clinic
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4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the course “Pharmacology” is 7 credits (252 academic hours).

Table 4.1. Types of academic activities during the periods of higher education programme mastering (full-time training)*

Type of academic activities	Total academic hours	Semesters/training modules			
		5	6		
<i>Contact academic hours</i>	158	90	68		
including:					
Lectures (LC)	35	18	17		
Lab work (LW)	123	72	51		
Seminars (workshops/tutorials) (S)					
<i>Self-studies</i>	58	36	22		
<i>Evaluation and assessment (exam/passing/failing grade)</i>	36	18	18		
Course workload	academic hours_	252	144	108	
	credits	7	4	3	

* To be filled in regarding the higher education programme correspondence training mode.

5. COURSE CONTENTS

Table 5.1. Course contents and academic activities types

Course module title	Course module contents (topics)	Academic activities types
Module 1.	1. Recipe. Introduction to Pharmacology.	LC, LW

General Pharmacology	Types of prescriptions. Formulation rules in the Russian Federation. Types of dosage forms. ATC classification.	
	2. Basic principles of pharmacodynamics Mechanisms of drug action. Antagonists, agonists, partial agonists. Target molecules of drugs (receptors, enzymes, ion channels). Types of pharmacological response: expected pharmacological response, hyperreactivity, tachyphylaxis, idiosyncrasy. The relationship between pharmacokinetics and pharmacodynamics. The concept of a therapeutic index, a therapeutic range. Therapeutic drug monitoring (indications, significance, interpretation of results). Pharmacodynamic interaction of drugs.	LC, LW
	3. Basic principles of pharmacokinetics. Basic pharmacokinetic parameters and their significance. Drug bioavailability, drug absorption pathways, drug distribution volume, degree of binding to blood plasma proteins, drug metabolism, drug elimination, half-life, drug excretion routes, clearance. Factors affecting the value of pharmacokinetic parameters. Pharmacokinetic curve. Pharmacokinetic interaction of drugs.	LC, LW
Module 2. Pharmacology of drugs groups 2.1. Drugs affecting afferent and efferent innervation	1. Drugs affecting afferent innervation. Local anesthetics. Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.	LC, LW
	2. Cholinergic agents. Anticholinergics. Cholinomimetics. Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.	LC, LW
	3. Adrenomimetics and sympathomimetics Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.	LC, LW

	<p>4. Adrenolythics and sympatholytics. Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	LC, LW
<p>2.2. Drugs affecting the cardiovascular system</p>	<p>1. Diuretics Carbonic anhydrase inhibitors (acetazolamide). Osmodiuretics (mannitol). Loop diuretics (bumetamide, furosemide, ethacrynic acid, torasemide). Diuretics acting on the cortical segment of Henle's loop (hydrochlorothiazide, clopamide, chlorthalidone, metolazone, indapamide). Potassium-sparing diuretics (spironolactone, eplerenone, amiloride, triamterene). Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	LC, LW
	<p>2. Lipid-lowering agents Statins (fluvastatin, simvastatin, pravastatin, atorvastatin, rosuvastatin); fibrates (clofibrate, bezafibrate, gemfibrozil); derivatives of nicotinic acid (niacin, enduracin); bile acid sequestrants (cholestyramine, colestipol, colesevelam); an inhibitor of intestinal cholesterol absorption (ezetimibe); PCSK9 inhibitors. Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	LC, LW
	<p>3. Antihypertensive agents Ways to affect the renin-angiotensin system (RAS): pharmacology of ACE inhibitors (captopril, enalapril, perindopril, quinapril, moexipril, ramipril, fosinopril, trandolapril, spirapril, lisinopril) and angiotensin receptor blockers (valsartan, candesartan, losartan). Tactics of prescribing ACE inhibitors and angiotensin receptor blockers in hypertension and CHF. Dihydropyridine calcium antagonists: nifedipine, nimodipine, felodipine, amlodipine: pharmacology and place in the treatment of angina pectoris and hypertension. Centrally acting drugs: alpha2-adrenergic agonists (methyldopa, guanfacine,</p>	LC, LW

	<p>clonidine) and agonists of I1 - imidazoline receptors.</p> <p>Ganglion blockers: azamethonium bromide (penamine), benzohexonium. Features of use in hypertensive crisis. Nitrates (nitroglycerin, isosorbide dinitrate, isosorbide-5-mononitrate, molsidomine): pharmacology, place in the treatment of coronary artery disease. The main challenges of nitrate therapy (tolerance).</p>	
	<p>4. Antianginal drugs</p> <p>1) reducing myocardial oxygen demand (b-blockers);</p> <p>2) increasing the delivery of oxygen to the heart (coronary dilators of the myotropic antispasmodic and adenosine type of action);</p> <p>3) reducing myocardial oxygen demand and increasing oxygen delivery to the heart (nitrates, calcium antagonists).</p> <p>Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	<p>LC, LW</p>
	<p>5. Antiarrhythmic drugs.</p> <p>Class I antiarrhythmics (sodium channel blockers). Subclasses Ia (quinidine, novocainamide, disopyramide, aymaline), Ib (lidocaine, mexiletine, trimecaine, diphenin), Ic (etmozine, etacizin, propafenone, flecainide, alapenin) - clinical pharmacology, indications, contraindications, side effects. ECG changes while prescribing these drugs.</p> <p>Class II antiarrhythmics: Beta-blockers: nonselective (propranolol, nadolol, sotalol), selective (oxprenolol, metoprolol, atenolol, betaxolol, bisoprolol, nebivolol), drugs with their own sympathomimetic activity (oxprenolol, pindolokiol-1), drugs with alpha-1-blocking activity (labetalol, carvedilol). Beta-blockers as myocardial unloading instruments in the treatment of CHF. Clinical pharmacology, indications, contraindications, side effects. ECG changes while prescribing these drugs.</p> <p>Class III antiarrhythmics (potassium channel blockers - amiodarone, sotalol, dofetilide, ibutilide): clinical pharmacology, indications for prescription, ECG changes while prescribing these drugs.</p>	<p>LC, LW</p>

	<p>Class IV antiarrhythmics (calcium antagonists - verapamil, diltiazem): clinical pharmacology, indications, contraindications, side effects. ECG changes while prescribing these drugs.</p> <p>Additional antiarrhythmic drugs: adenosine, potassium salts.</p>	
	<p>6. Drugs to manage heart failure</p> <p>Drugs with a positive inotropic effect: cardiac glycosides (digoxin, strophanthin), non-glycoside cardiotonics (dopamine, dobutamine, amrinone, milrinone, enoximone, levosimendan). Classification of inotropic agents. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients. The dosage regimen of cardiac glycosides, depending on the state of the gastrointestinal tract, metabolic and excretion organs in the patient, the number and rhythm of heart contractions, the state of contractility and conductivity of the myocardium, the rate of development of the effect, drug interactions and factors contributing to a change in sensitivity to drugs. Diagnostics, correction and prevention of adverse reactions. Possible interactions with their combined administration and with drugs from other groups.</p>	<p>LC, LW</p>
<p>2.3. Drugs affecting hemostasis and hematopoiesis</p>	<p>1. Drugs affecting the blood coagulation system.</p> <p>Antiplatelet agents: acetylsalicylic acid, clopidogrel, ticlopidine, abciximab, anagrelide, alprostadil, lysine acetylsalicylate. Direct anticoagulants: sodium heparin, low molecular weight heparins (sodium enoxaparin, nadroparin, fraxiparin). Indirect anticoagulants: warfarin, coumarins. Fibrinolytics: streptokinase, tissue plasminogen activator (alteplase, prourokinase). Synthetic selective inhibitor of activated factor X (Xa) fondaparinux sodium, rivaroxaban, direct thrombin inhibitor dabigatran. Drugs that increase blood clotting (vitamin K and its analogs, thrombin, hemostatic sponge, fibrinogen). Fibrinolysis inhibitors (aminocaproic acid). Drugs to stop bleeding in patients with hemophilia (factor VIII cryoprecipitate, antihemophilic plasma, coagulation factor VII, coagulation factor IX). Etamsilat. Classification. Pharmacodynamics</p>	<p>LC, LW</p>

	<p>of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	
	<p>2. Drugs affecting the hematopoietic system. Iron preparations. Erythropoietin. Preparations containing folic acid, cyanocobalamin. Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	LC, LW
2.4. Drugs affecting the functions of the respiratory system, digestion and metabolic processes	<p>1. Drugs affecting the functions of the respiratory system Beta-2 adreno-agonists: salbutamol, fenoterol, salmeterol, formoterol. M-anticholinergics: ipratropium bromide, tiotropium bromide. Methylxanthines: theophylline, aminophylline. Mast cell membrane stabilizers (cromoglycic acid), antileukotriene drugs (zafirlukast, montelukast, zileuton). Inhalation GCS. Systemic GCS. Antitussive drugs. Mucolytics, mucoregulators, mucokinetics. Antitussive drugs of central action. Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients. The concept of the stepwise therapy for bronchial asthma, therapy of chronic obstructive pulmonary disease. Diagnostics, correction and prevention of adverse reactions. Receptor desensitization syndrome (tachyphylaxis, internalization and decreased regulation - the development of resistance to beta-adreno-agonists), methods of its correction and prevention.</p>	LC, LW
	<p>2. Drugs affecting the functions of the digestive system. Pharmacology of antacids (sodium bicarbonate, calcium carbonate, aluminum hydroxide, aluminum phosphate, magnesium oxide, magnesium hydroxide). Pharmacology of H₂-histamine receptor blockers (cimetidine, ranitidine, famotidine, nizatidine, roxatidine).</p>	LC, LW

	<p>Pharmacology of M-anticholinergics: pirenzepine.</p> <p>Pharmacology of proton pump inhibitors (omeprazole, esomeprazole, lansoprazole, pantoprazole, rabeprazole). Prescribing antisecretory agents for the treatment and prevention of gastric ulcer and duodenal ulcer.</p> <p>Pharmacology of prokinetics (metoclopramide, domperidone, trimebutin).</p> <p>Pharmacology of gastrocytoprotectors (bismuth tripotassium citrate, bismuth colloidal subcitrate, misoprostol, sucralfate).</p> <p>Prescribing antisecretory agents and prokinetics for the treatment and prevention of GERD, functional dyspepsia, NSAID gastropathy.</p> <p>Antibacterial (anti-Helicobacter) drugs in the treatment of peptic ulcer: amoxicillin, clarithromycin, tetracycline, metronidazole.</p> <p>Consensus principles "Maastricht-5" in the treatment of H. pylori infection: indications for eradication, basic therapy regimens, methods of monitoring the effectiveness of treatment.</p>	
	<p>3. Hormones of the pituitary gland, hypothalamus, pineal gland, thyroid and pancreas, hypoglycemic drugs.</p> <p>Antidiabetic drugs: insulins (ultrashort, short, intermediate, long acting), sulfonylurea derivatives (glibenclamide, gliclazide), meglitinides (repaglinide), biguanides (metformin), α-glucosidase inhibitors (acarbose), thiazolidinediones (rosiglitazone), dipeptidyl peptidase inhibitors -4 (DPP-4) (vildagliptin), GLP-1 analogues and agonists (liraglutide), amylin analogues (pramlintide acetate), gliflozins (dapagliflozin).</p> <p>Preparations of thyroid hormones and antithyroid drugs (L-thyroxine, mercaptoimidazole, thiamazole, potassium iodide).</p> <p>Preparations of pituitary and hypothalamic hormones.</p> <p>Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse drug reactions. Drug interactions. Use in special categories of patients. Principles of replacement therapy.</p>	LC, LW
	<p>4. Steroid hormones</p> <p>Sex steroids. Contraceptives. Anabolic steroids.</p>	LC, LW

	<p>Glucocorticoids. Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients. Types of glucocorticoid therapy. Negative outcomes and their prophylaxis</p>	
	<p>5. Drugs affecting immune processes. I. Cytostatics: a) alkylating agents: cyclophosphamide b) antimetabolites: azathioprine methotrexate Glucocorticoids: prednisone, etc. Drugs that inhibit the formation or action of IL-2: a) antibiotics: cyclosporine tacrolimus, rapamycin b) MAT preparations for IL-2 receptors: basiliximab, daclizumab. Antibody preparations: a) Polyclonal antibodies - anti-thymocyte immunoglobulin b) MAT to TNF-alpha - infliximabi etc. 4-aminoquinoline derivatives (chloroquine, hydroxychloroquine), D-penicillamine, Gold preparations (sodium aurothiomalate, auranofin, etc.). Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interaction. Use in special categories of patients. II. Immunostimulants. Preparations of bacterial and fungal origin, their synthetic and semi-synthetic analogs. Preparations of animal origin. Cytokines (interferons, interleukins) and stimulators of their formation in the body. Herbal preparations. Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interaction. Use in special categories of patients.</p>	<p>LC, LW</p>
	<p>6. Antiallergic drugs</p>	<p>LC, LW</p>

	<p>Types of allergic reactions. Pathogenesis of allergic and pseudo-allergic reactions. Points of application of drugs.</p> <p>Drugs for the treatment of immediate-type hypersensitivity reactions (HNT):</p> <ol style="list-style-type: none"> 1) agents that prevent the release of histamine and other mediators of allergy - glucocorticoids, cromoglycic acid (cromolyn sodium, intal); 2) antihistamines - H1-histamine blockers; 3) symptomatic agents - adrenergic agonists (adrenaline, ephedrine), myotropic bronchodilators (aminophylline). <p>Drugs for the treatment of delayed-type hypersensitivity reactions (HRT): GCS, cytostatics, NSAIDs.</p> <p>Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interaction. Use in special categories of patients.</p>	
<p>2.5. Drugs affecting the central nervous system. Medicines affecting the nociceptive system and the synthesis of pain and inflammation mediators</p>	<p>1. Drugs for anesthesia. Analgesics.</p> <p>Preparations for inhalational and intravenous anesthesia. Opioid analgesics. Non-steroidal anti-inflammatory drugs (NSAIDs).</p> <p>Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.</p>	<p>LC, LW</p>
	<p>2. Sedative drugs. Hypnotic agents. Anxiolytics. Antiepileptic drugs.</p> <p>Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.</p>	<p>LC, LW</p>
	<p>3. Antipsychotics. Antidepressants. Remedies for the treatment of mania.</p> <p>Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.</p>	<p>LC, LW</p>
	<p>4. Psychostimulants. Nootropics. Drugs for neurodegenerative diseases.</p>	<p>LC, LW</p>

	<p>Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.</p>	
<p>2.6. Antibacterial, antiviral and antifungal agents</p>	<p>1. Antibiotics (part I) The main clinically significant pathogens and infectious diseases. Mechanisms of bacterial resistance. General characteristics of antimicrobial drugs. Types of antimicrobial pharmacotherapy. Principles of rational antibiotic therapy. Classification of antibiotics and their mechanisms of action. Beta-lactam antibiotics. Pharmacology of penicillins (benzylpenicillin, amoxicillin, ampicillin, oxacillin, piperacillin). Pharmacology of cephalosporins (1st generation: cefazolin, cephalexin, cefaclor; 2nd generation: cefamandol, cefuroxime; 3rd generation: cefoperazone, cefotaxime, ceftriaxone; 4th generation: cefepime, 5th generation: ceftobiprol). Pharmacology of carbapenems (imipenem, meropenem) and monobactams (aztreonam). Non-beta-lactam antibiotics. Pharmacology of aminoglycosides (gentamicin, amikacin, tobramycin, netilmicin). Pharmacology of macrolides (erythromycin, roxithromycin, azithromycin, clarithromycin). Pharmacology of tetracyclines (tetracycline, doxycycline) and glycopeptides (vancomycin, teicoplanin). New groups of antibiotics: oxazolidinones (linezolid), lipopeptides (daptomycin), glycylcyclins (tigecycline), pleuromutilins (retapamulin).</p>	<p>LC, LW</p>
	<p>2. Non-beta lactam antibiotics and synthetic antimicrobials: Not beta-lactam antibiotics. Pharmacology of aminoglycosides (gentamicin, amikacin, tobramycin, netilmicin). Pharmacology of macrolides (erythromycin, roxithromycin, azithromycin, clarithromycin). Pharmacology of tetracyclines (tetracycline, doxycycline) and glycopeptides (vancomycin, teicoplanin). New groups of antibiotics: oxazolidinones (linezolid), lipopeptides (daptomycin),</p>	<p>LC, LW</p>

	<p>glycylcyclines (tigecycline), pleuromutilins (retapamulin). Sulfonamides, quinolone and fluoroquinolone derivatives, 5-nitrofurantoin, imidazole derivatives. Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications. Unwanted reactions. LS interaction. Use in special categories of patients.</p>	
	<p>3. Antiviral, antifungal agents. Antifungals: amphotericin B, itraconazole, ketoconazole, clotrimazole, nystatin, polygynax, sertaconazole, fluconazole. Antivirals: anti-herpetic, anti-cytomegalovirus, anti-influenza (M2 channel blockers, neuroaminidase inhibitors), antiretroviral drugs.</p>	LC, LW
	<p>4. Anti-tuberculosis drugs. 1st line drugs, 2nd line drugs. Tuberculosis chemotherapy regimens. Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.</p>	LC, LW
	<p>5. Antiprotozoal, antisyphilitic, antihelminthic drugs Antiprotozoal: quinine, chloroquine, primaquine Antiparasitic: levamisole, mebendazole, albendazole, pyrantel, diethylcarbazine, praziquantel Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.</p>	LC, LW

* - to be filled in only for **full**-time training: LC - lectures; LW - lab work; S - seminars.

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom equipment and technology support requirements

Type of academic activities	Classroom equipment	Specialised educational / laboratory equipment, software, and materials for course study (if necessary)
Lecture	Classroom, equipped with a set of specialized furniture; whiteboard; a set of devices includes portable multimedia projector, laptop, projection screen, stable wireless Internet connection. Software: Microsoft Windows, MS Office /Office 365, MS Teams, Chrome (latest stable release), Skype	Classroom for lectures and lab works, group and individual consultations, current control and intermediate certification. A set of specialized furniture; technical devices: Optoma HD36 multimedia projector, Lenovo IdealPad330-5ikb laptop, Internet access. Wall projection screen, floorboard information marker magnetic, interactive complex for testing students.
Lab work	Classroom, equipped with a set of specialized furniture; whiteboard; a set of devices includes portable multimedia projector, laptop, projection screen, stable wireless Internet connection. Software: Microsoft Windows, MS Office /Office 365, MS Teams, Chrome (latest stable release), Skype	Classroom for lectures and lab works, group and individual consultations, current control and intermediate certification. A set of specialized furniture; technical devices: Optoma HD36 multimedia projector, HP250G7 laptop, Internet access. Wall projection screen, floorboard information marker magnetic, interactive complex for testing students.
Self-studies	Classroom, equipped with a set of specialized furniture; whiteboard; a set of devices includes portable multimedia projector, laptop, projection screen, stable wireless Internet connection. Software: Microsoft Windows, MS Office /Office 365, MS Teams, Chrome (latest stable release), Skype	Wall projection screen, magnetic floor information marker board, Optoma HD36 multimedia projector, Lenovo 15.6 laptop, centrifuge 5804, analytical scale AF225DPCT, Vortekx shaker, CryoCubeF101h freezer

7. RESOURCES RECOMMENDED FOR COURSE STUDY

Main readings:

1. Illustrated textbook / editor R.N. Alyautdin. - Moscow : GEOTAR-Media, 2020. - 312 p. - ISBN 978-5-9704-5665-1.

2. Pharmacology : textbook / D.A. Kharkevitch; Translation of Russian textbook, 12th edition, revised and improved. - 2nd edition. - M. : Geotar-Media, 2017. - 680 pages with illustrations. - ISBN 978-5-9704-3883-1.

Additional readings:

1. Basic and Clinical Pharmacology / B. Katzung, S. Masters. - 11th ed. ; Книга на английском языке. - New York : McGraw-Hill, 2009. - 1218 p. : il. - (LANGE Basic Science). - ISBN 978-007-127118-9 : 4318.03.

2. Clinical Pharmacology / P.N. Bennett, M.J. Brown. - 10th ed. ; Книга на английском языке. - Edinburgh : Churchill Livingstone, 2008. - 694 p. : il. - ISBN 978-0-443-10245-5 : 2048.65.

3. Tutorial Guide to Pharmacokinetics: учебное пособие / С.К. Зырянов, О.И. Бутранова, М.Б. Кубаева. – Москва: РУДН, 2022. – 134 с.: ил. ISBN 978-5-209-10837-5

4. Tutorial Guide to Pharmacodynamics [Текст] = Пособие по фармакологии : Учебное пособие / S.K. Zyryanov, O.I. Butranova. - Книга на английском языке. - М. : PFUR, 2019. - 56 с. : ил.

Internet sources

Electronic libraries with access for RUDN students:

1. Electronic libraries with access for RUDN students – ЭБС РУДН: <http://lib.rudn.ru:8080/MegaPro/Web>

2. Online University library: <http://www.biblioclub.ru>

3. IQlib: <http://www.iqlib.ru>

4. НЭБ Elibrary: <http://elibrary.ru>

5. Science Direct: <http://www.sciencedirect.com>

6. EBSCO: <http://search.ebscohost.com>

7. Oxford University Press: <http://www3.oup.co.uk/jnls>

8. Sage Publications: <http://online.sagepub.com>

9. Springer/Kluwer: <http://www.springerlink.com>

10. Taylor & Francis: <http://www.informaworld.com>

11. Web of Science: <http://www.isiknowledge.com>

12. Консультант студента <http://www.studmedlib.ru>

13. Университетская информационная система РОССИЯ: <http://www.cir.ru/index.jsp>

14. Учебный портал РУДН: <http://web-local.rudn.ru/>

Data bases

1.U.S. National Library of Medicine National Institutes of Health: <http://www.ncbi.nlm.nih.gov/pubmed/>

2. ACS Publications: Data base / American Chemical Society. - Database in English. - Washington : ACS Publications, 2013. - Access mode: <http://pubs.acs.org/>

3. RSC Journals: Data base / Royal Society of Chemistry. - Database in English. - London : RSC Publishing, 2013. - Access mode: <http://pubs.rsc.org/>

4. Springer Link: Data base / Springer Science+Business Media. - Database in English. - Berlin: Springer Science+Business Media, 2013. - Access mode: <http://link.springer.com/>.

*Training toolkit for self- studies to master the course *:*

1. The set of lectures on the course “Pharmacology”

* The training toolkit for self- studies to master the course is placed on the course page in the university telecommunication training and information system under the set procedure.

8. ASSESSMENT TOOLKIT AND GRADING SYSTEM* FOR EVALUATION OF STUDENTS’ COMPETENCES LEVEL UPON COURSE COMPLETION

The assessment toolkit and the grading system* to evaluate the competences formation level (GPC-10.1, GPC-10.2, GPC-10.3; GPC-11.1, GPC-11.2; PC-3.4, PC-3.6) upon the course study completion are specified in the Appendix to the course syllabus.

* The assessment toolkit and the grading system are formed on the basis of the requirements of the relevant local normative act of RUDN University (regulations / order).

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