INFORMATION ABOUT THE COURSE

Pathophysiology

1. Basic information

Field of studies field of medical and health sciences, discipline: medical sciences **Unit responsible for the field of studies** Faculty of Medicine Bydgoszcz University of Science and Technology **Level of studies** Uniform master's studies **Profile of studies** General academic **Form of studies** Full-time	**Studies cycle** …….. **Course code** 17-EMS-PAT-SP2 **Language** English **Obligatory** Yes

Prerequisites	Knowledge acquired during subjects: anatomy, biochemistry. Method of verification: Passing subjects defined as introductory is equivalent to meeting the prerequisites for the subject.
Introductory courses	Anatomy, Biochemistry
Coordinator	Katarzyna Dmitruk, PhD, Assoc. Prof.

Study period	**Form of assessment** **Form and hours of classes**	**ECTS credits**
Summer semester	Exam Lecture 30h Exercise 15h Seminar 15h	4.0

2. Learning outcomes

Code	**Description of learning outcomes**	**Learning outcomes reference**
Knowledge (student knows and understands):		
K1	The graduate knows and understands the participation of the inflammatory process of a specific and non-specific nature in the etiopathogenesis and course of selected disease entities	C.W23.
K2	The graduate knows and understands the etiology, mechanisms and consequences of hemodynamic disorders	C.W24.
K3	The graduate knows and understands the etiopathogenesis, clinical course and diagnostics of selected disease entities of the cardiovascular, respiratory, endocrine, genitourinary, hematopoietic, nervous and digestive systems, metabolic diseases and disorders of water-electrolyte, hormonal and acid-base metabolism	C.W27.
K4	The graduate knows and understands the participation of the oxidative process in the pathogenesis of metabolic diseases, neurodegenerative diseases and in the aging process	C.W38.

K5	The graduate knows and understands the consequences of deficiency and excess of vitamins and minerals	C.W39.
K6	The graduate knows and understands the causes and consequences of improper nutrition, including long-term insufficient and excessive food consumption and an unbalanced diet, as well as digestive and absorption disorders	C.W40.
K7	The graduate knows and understands the development, structure and functions of the human body in normal and pathological conditions	O.W1.
K8	The graduate knows and understands the symptoms and course of diseases	O.W2.
Abilities (student can do/perform):		
A1	The graduate is able to communicate in a team and share knowledge	O.U8.
A2	The graduate is able to critically evaluate the results of scientific research and appropriately justify their position	O.U9.
Social skills (the student is ready to):		
S1	The graduate is ready to formulate conclusions based on their own measurements or observations	O.K8.

3. Programme contents

No.	Programme contents	Form of studies	Learning outcomes covered by the programme content
1	Inflammation: definition, causes, stages of the inflammatory reaction, criteria for the division of inflammation: acute and chronic. Pathogenesis of inflammation: provoking factors, course of inflammation. The role of cells involved in inflammation (neutrophils, macrophages, monocytes, eosinophils, mast cells, thrombocytes, plasma cells. Inflammation mediators and their role in the inflammatory process (prostaglandins, prostacyclins, thromboxanes, leukotrienes and lipoxins; nitric oxide, histamine and kinins). Destruction of microorganisms in inflammation - oxygen-dependent and oxygen-independent. Local and systemic symptoms of inflammation and pathomechanisms of their formation. Hemodynamics of exudate formation. Differentiation of inflammatory exudate and transudate. Basics of treatment of inflammatory reactions (steroids, NSAIDs).	Lecture	K1, K2, K7, K8
2	Selected topics in immunology: Innate immunity: the immune system, major histocompatibility complex (MHC), cytokines, acute phase proteins, complement	Lecture	K1, K2, K7, K8

	system, microbiome and its role in immunity; Acquired immunity: cells of acquired and cellular-humoral immunity and their role: T and B lymphocytes, antigen presenting cells (APC), antibodies. Normal immune response, cellular and humoral mechanisms. Immunological tolerance. Selected topics in immunopathology: Reasons for breaking immunological tolerance. Effector mechanisms of autoaggression. Transplant immunology. Allergy: type I, II, III and IV hypersensitivity. The importance of complement system, antibody-dependent cytotoxicity. Factors determining the survival of immune complexes. Effector mechanisms in immune complex reactions. Risk factors for the development of atopic diseases. The role of IgE. Anaphylactic shock.		
3	Blood and hematopoietic system diseases: 1. Red blood cell system: etiopathogenesis and symptoms of anemia. Types of anemia: post-hemorrhagic, aplastic (hypoplastic), dyserythropoietic, deficiency (iron, folic acid, vitamin B12 deficiency - Addison-Biermer disease), hemolytic. Polycythemias - etiopathogenesis, symptoms, types of polycythemia: true polycythemia, secondary polycythemia, pseudopolycythemia 2. White blood cell system: pathogenesis of leukocytosis (neutrophilia, eosinophilia, monocytosis, lymphocytosis); pathogenesis of leukopenia (neutropenia, lymphocytopenia, eosinopenia; leukemias – pathogenesis, symptoms and types: acute (lymphoblastic, myeloid) and chronic (myeloid, lymphocytic); lymphomas – pathogenesis, symptoms and types: Hodgkin's disease - non-Hodgkin's lymphomas; disorders of immunoglobulin synthesis - pathogenesis, symptoms, multiple myeloma 3. Thrombocyte system: etiopathogenesis of thrombocytopenia (thrombocytopenia) and platelet function (thrombocytopathies), etiopathogenesis of thrombocytosis (thrombocytosis), clinical picture of thrombocytopenia, thrombocytopathy and thrombocytosis. Types of thrombocytopenia: caused by reduced platelet production - congenital, acquired; caused by excessive removal of platelets from the circulation: acquired due to the action of factors immunological - autoimmune and alloimmune and others: thrombotic microangiopathies, thrombocytopenia of pregnancy, von Willebrand disease, artificial surfaces (hemodialysis, extracorporeal circulation); thrombocytopenias caused by abnormal platelet distribution: thrombocytopenia	Lecture, Exercise, Seminar	K4, K7, K8, A1, A2, S1

	associated with platelet sequestration, thrombocytopenia due to platelet dilution, thrombocytopenia of pregnancy. Types of thrombocytopathies: congenital, acquired. Types of thrombocytosis based on pathogenesis: primary, secondary. Classification of the severity of thrombocytosis according to Sutor.		
4	Hemostasis: definition, coagulation and fibrinolysis system. Laboratory diagnostics of coagulation and fibrinolysis system. Disorders of hemostasis. Pathogenesis of vascular clots (Virchow's Triad). Deep vein thrombosis - risk factors and complications. Causes and complications of embolism. Disseminated intravascular coagulation syndrome - laboratory diagnostics, multi-organ complications. Plasma, platelet, vascular and mixed hemorrhagic diathesis.	Lecture, Exercise, Seminar	K4, K7, K8, A1, A2, S1
5	Endocrine pathology: primary, secondary and tertiary hypothyroidism and hyperthyroidism of endocrine glands. Ectopic hormone secretion. 1. Hypothalamic and pituitary diseases. Diabetes insipidus. SIADH syndrome. Prolactinoma and hyperprolactinemia. Pituitary dwarfism, growth hormone receptor resistance, gigantism/acromegaly. Multihormonal pituitary insufficiency: Sheehan syndrome, Glinski-Simmonds syndrome, empty sella syndrome. Hypogonadism. Premature and delayed puberty. Primary and secondary amenorrhea. Menopause. Andropause. 2. Adrenal diseases. Hyperthyroidism and hypothyroidism. Adrenogenital syndromes. Primary hyperaldosteronism. Secondary hyperaldosteronism. Pheochromocytoma 3. Diseases of the thyroid and parathyroid glands. Subclinical and clinically overt hyperthyroidism and hypothyroidism - etiopathogenesis, symptoms. The role of the autoimmune process. Hyper- and hypometabolic crisis. Laboratory diagnosis of thyroid diseases. Primary and secondary hyperparathyroidism. Primary and secondary hypoparathyroidism. Disorders of calcium-phosphate metabolism - Causes and symptoms of hyper- and hypocalcemia and hyper- and hypophosphatemia. Pathogenesis and symptoms of tetany. Pathology of the skeletal system - osteoporosis, osteomalacia, osteodystrophy, osteopenia - definitions and etiology. 4. Diseases of the female and male gonads. Male and female hypo- and hypergonadotropic hypogonadism. Hyperandrogenism in women. Disorders of sexual differentiation (true hermaphroditism, male	Lecture, Exercise, Seminar	K4, K6, K7, K8, A1, A2, S1

	pseudohermaphroditism, female pseudohermaphroditism). Gonadal dysgenesis (Turner syndrome, Klinefelter syndrome). 5. Other endocrine disorders. Diseases of the diffuse endocrine system: insulinoma, glucagonoma, somatostatinoma, gastrinoma, VIP-secreting tumor, neuroendocrine tumors developing outside the pancreas; Multiglandular syndromes - multiple endocrine neoplasia syndrome types 1 and 2 6. Neuroendocrine axes of the stress response. Selye's stress theory. Cannon's reaction. General adaptation syndrome (GAS). Inhibition of pain impulsation in the stress response (the role of endorphins and vasopressin).		
6	1. Coronary heart disease. Pathogenesis of myocardial ischemia. Clinical forms of coronary heart disease. Risk factors for acute coronary syndromes (ACS). Myocardial infarction. Markers of cardiomyocyte necrosis. Localization and evolution of infarction in the ECG recording. Acute and chronic complications of myocardial infarction. 2. Rhythm and conduction disorders. Tachyarrhythmias. Reentry phenomenon. Bradyarrhythmias. Conduction blocks. Pre-excitation syndromes. 3. Heart failure. Pathogenesis of systolic and diastolic failure. Acute and chronic failure. Compensatory and adaptive mechanisms of the heart muscle to changes. Left ventricular, right ventricular and biventricular heart failure – causes and clinical symptoms. Biomarkers of heart failure. 4. Shock: essence and types - oligovolemic, distributive, cardiogenic shock. Phases of shock. Neuroendocrine mechanisms responsible for hemodynamic changes in shock. The phenomenon of circulatory centralization and "autotransfusion". Metabolic and electrolyte changes in shock. Multi-organ complications in shock. Theories of the irreversibility of the late phase of shock. Septic, anaphylactic, neurogenic shock. 5. Arterial hypertension. Definition and classification of arterial hypertension. Pathogenesis of primary hypertension. Secondary hypertension accompanying endocrine diseases, kidneys, sleep breathing disorders (OSA). Monogenic hypertension. Acute and chronic complications of arterial hypertension. 6. Dyslipidemia. Metabolism of plasma lipoproteins. Primary and secondary hyperlipoproteinemias.	Lecture, Exercise, Seminar	K3, K4, K5, K7, K8, A1, A2, S1

	Antiatherogenic effect of high-density lipoproteins (HDL). Factors modifying lipoprotein function. 7. Atherosclerosis: Risk factors for atherosclerosis, clinical forms of atherosclerosis, complications. Atherosclerotic plaque: structure, stages of formation, location, types. Endothelial dysfunction.		
7	Respiratory pathology Respiratory, circulatory, blood-derived, cytotoxic hypoxia. Adaptive mechanisms to hypoxia at the organ and cellular level. Cyanosis. Dyspnea. Basic spirometric parameters and their interpretation (restriction, obstruction, reversible obstruction). Respiratory failure. Ventilation, diffusion and perfusion disorders - causes. Acute respiratory distress syndrome (ARDS). Pulmonary edema, pneumothorax, pulmonary hypertension. Sleep apnea: (1) central (CBS) and (2) peripheral (OSA) - pathogenesis, cardiovascular complications. Obstructive lung diseases: bronchial asthma - acute and chronic obstruction, the role of the inflammatory process. Bronchial hyperreactivity. Chronic obstructive pulmonary disease (COPD) - changes in the airways leading to obstruction. The role of inflammatory cells in the pathogenesis of COPD.	Lecture, Exercise, Seminar	K4, K7, K8, A1, A2, S1
8	Pathophysiology of the kidneys Pathogenesis of acute kidney injury (AKI) - prerenal, renal and extrarenal causes. Chronic kidney diseases - etiopathogenesis, factors accelerating the progression of kidney diseases. Clinical and biochemical symptoms of kidney diseases. Uremic toxins. Proteinuria - causes, types. Primary glomerulonephritis - immunopathology.	Lecture, Exercise, Seminar	K3, K4, K7, K8, A1, A2, S1
9	1. Water and electrolyte imbalance: Neurohormonal mechanisms of water and electrolyte regulation. Water balance of the body. Iso-, hypo- and hypertonic dehydration and overhydration. General mechanisms of edema formation. Pathophysiology of edema accompanying heart failure and liver and kidney diseases. Nephrotic and nephritic syndrome. Causes and symptoms of hyper- and hyponatremia. Causes and symptoms of hyper- and hypopotassemia. The effect of electrolyte imbalance on circulatory system function. 2. Acid-base imbalance: Acidosis and alkalosis - definition, metabolic and respiratory causes. Uncompensated, partially compensated and completely compensated changes.	Lecture, Exercise, Seminar	K4, K7, K8, A1, A2, S1

10	1. Pathophysiology of the digestive system: Reflux disease. Gastric and duodenal ulcers - the role of protective and aggressive factors (NSAIDs, Helicobacter pylori). Functional dyspepsia. Nonspecific inflammatory bowel diseases - pathogenesis, characteristics, differentiation. Pathogenesis of diarrhea. Malabsorption syndrome. Acute and chronic pancreatitis - etiopathogenesis, symptoms 2. Pathophysiology of the liver: Clinical and laboratory symptoms of liver diseases. Jaundice - metabolism of bile pigments, causes of jaundice and differentiation. Hepatitis - HBV and HCV infection, diagnostic role of immunological markers. Liver cirrhosis. Pathogenesis and consequences of portal hypertension. Fatty liver. Nonalcoholic fatty liver disease. Alcoholic liver disease. Autoimmune liver diseases. Congenital liver diseases.	Lecture	K4, K7, K8
11	Eating disorders. Endogenous regulation of energy balance. Obesity. Endocrine function of adipose tissue. Metabolic syndrome. Insulin resistance. Malnutrition. Anorexia nervosa. Bulimia.	Lecture	K4, K7, K8
12	Diabetes Mechanisms regulating insulin secretion. Incretin effect. Influence of insulin on carbohydrate, lipid and protein metabolism. Metabolic disorders in diabetes: glucotoxicity, non-enzymatic glycation of proteins, overproduction of sorbitol. Atherogenic lipid profile. Criteria for diagnosis and classification of diabetes. Pathogenesis of type 1 diabetes. Pathogenesis of type 2 diabetes. Gestational diabetes. Chronic complications of diabetes: diabetic microangiopathy and macroangiopathy, diabetic neuropathy, diabetic foot syndrome. Acute complications of diabetes: diabetic ketoacidotic, hyperosmolar and lactate coma. Hypoglycemia.	Lecture, Exercise, Seminar	K4, K7, K8, A1, A2, S1
13	Vitamins and minerals – impact on the body. Consequences of deficiency and excess of vitamins and minerals.	Seminar, Exercise	K6, A1, A2
14	Pathophysiology of selected diseases of the nervous system: multiple sclerosis, parkinsonism, Alzheimer's disease, myasthenia gravis, transient ischemic attack, stroke (ischemic, hemorrhagic, venous), epidural, subdural, subarachnoid hemorrhage (aneurysms, arteriovenous malformations), cerebral edema: vasogenic, cytotoxic (intracellular), interstitial, osmotic.	Lecture	K4, K7, K8
15	Senescence: types of pathology in old age and the consequences of aging in selected systems and organs.	Lecture	K4, K5, K7, K8

16	Pathogenesis, phases and classification of fever. Pyrogens. Hyperthermia: heat syncope, heat exhaustion, heat stroke, sunstroke. Hypothermia - phases, functional changes of the organism in hypothermia.	Lecture	K3, K4, K8

4. Methods of verifying and assessing the learning outcomes achieved by the student

Form of studies		
Lecture	**Methods of studies form:**	
	Lecture	
	Methods of verification:	**Involvement:**
	Written exam	70%
	Colloquium	30%
	Conditions for passing the course:	
	Detailed conditions for passing the course and admission to the exam are specified in the internal regulations, which are made available to each student and discussed during the first classes. The condition for passing the lectures is to obtain at least a satisfactory grade in the written exam. Students who have obtained at least a satisfactory grade in all colloquia may take the exam. The final theoretical exam takes the form of a single-choice test consisting of 60 closed questions. Each question contains four possible answers - with 1 vertractor and 3 distractors (no negative points for an incorrect answer).	
Exercise	**Methods of studies form:**	
	Laboratory exercise	
	Methods of verification:	**Involvement:**
	Colloquium	30%
	Presentation	10%
	Written exam	60%
	Conditions for passing the course:	
	Detailed conditions for passing the subject and admission to the exam are specified in the internal regulations, which are made available to each student and discussed during the first classes. Three tests will be held during the semester (30 test questions scored on a scale of 0/1 point for each incorrect/correct answer) from individual thematic blocks, from topics discussed during lectures, classes and given to students in the form of issues to be developed. Students who obtain grades of at least satisfactory from all tests will take the exam. The final theoretical exam takes the form of a single-choice test consisting of 60 closed questions. Each question contains four possible answers - with 1 vertractor and 3 distractors (no negative points for an incorrect answer).	
Seminar	**Methods of studies form:**	
	Discussion, Project, Group work	
	Methods of verification:	**Involvement:**

	Observation	20%
	Discussion	20%
	Presentation	60%
	Conditions for passing the course:	
	Preparing a multimedia presentation on a topic assigned by the lecturer.	

Learning outcomes	**Methods of verification**				
	Written exam	**Colloquium**	**Presentation**	**Discussion**	**Observation**
K1	X	X			x
K2	X	X			X
K3	X	X			X
K4	X	X	X		X
K5	X				X
K6	X				X
K7	X	X	X		X
K8	X	x	X	X	X
A1			X	X	X
A2			X	X	X
S1			x	x	X

5. Student workload – balance of hours and ECTS credits

Students activity		**Student workload Number of hours**
Classes conducted with the direct participation of an academic teacher or other persons conducting classes	Lecture	30
	Exercise	15
	Seminar	15
Individual student's work	Preparing for classes	5
	Preparing a multimedia presentation	5
	Studying literature	10
	Preparing for a test	10
	Preparing for an exam	15
Total student workload		105

ECTS	4

One (teaching) hour is 45 minutes.

6. Literature

The list of required and recommended literature will be provided by the lecturer at the first meeting.