



Course unit title	Code
PATHOLOGY (for medical students)	PAT02115

Lecturer(s)	Department(s)
Coordinating: assoc. prof. dr. Justinas Besusparis Others: prof. dr. Arvydas Laurinavicius, prof. dr. Virginija Grabauskienė, assoc. prof. dr. Aušrinė Barakauskienė, assoc. prof. Violeta Kvedarienė, junior assist. Tomas Baltrūnas, assist. Vaida Baltrūnienė, lect. Ugnius Mickys, lect. Julius Drachneris, lect. Rūta Barbora Grinevičiūtė, lect. Artūras Barkus, junior assist. Aušra Garnelytė, assist. Augustinas Baušys, lect. Ignė Pilvelienė.	Vilnius university, Faculty of Medicine, Department of Pathology, Forensic Medicine and Pharmacology, M. K. Čiurlionio g. 21, Vilnius

Cycle	Level of the course unit	Type of the course unit
Cycle (integrated studies)		Compulsory
Mode of delivery	Period of delivery	Language of instruction
Face-to-face	4 and 5 th semesters	English

Prerequisites and corequisites	
Prerequisites: A student must have completed the following courses: human anatomy, histology, physiology, biochemistry, genetics, microbiology, immunology.	Corequisites (if any): no

Number of ECTS credits allocated to the course unit	Total student's workload hours	Contact hours	Self-study hours
10 credits	264	132	132

Purpose of the course unit Programme competences to be developed		
To provide the students with principles of pathology, necessary for clinical medicine. Three main competences are to be developed: 1) understanding the causes and mechanisms of the diseases; 2) knowledge of special organ pathology; 3) skills of diagnostic and clinical judgement in relation to pathology features of a disease.		
Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
Professional qualities: to act fairly and according to ethical obligations, apply good medical practice principles at work, be emphatic, to think critically and self-critically, be creative, take the initiative, to communicate with others	Lectures, seminars and practical tasks, analysis of clinical cases	Continuous assessment of theoretical knowledge and practical skills
Professional activities: to make an assessment within the scope of one's competence and, if necessary, ask for help, to act in new situations and adapt to them, to act independently, to solve problems, to make judgements, to work with specialists of other fields.	Lectures, seminars and practical tasks, analysis of clinical situations	Continuous assessment of theoretical knowledge and practical skills
To identify and assess pathology features and mechanisms of diseases; to understand the development of laboratory, biochemical, immunological, cytological and morphological alterations in diseased tissues of clinical importance; select relevant tests and interpret their results; evaluate diagnostic process and	Lectures provide insights into essential knowledge on the topic and focus on principles of understanding pathology findings of clinical relevance. The lectures (including recordings) are available in	Continuous assessment of theoretical knowledge and practical skills: quiz in writing, solutions to didactic clinical situations.

disease treatment on the basis of pathological knowledge.	digital format and can be viewed at the VU learning environment.	Main method of assessment <u>Cumulative points:</u> CP =10X%+30Y%+60Z% =100% X – continuous assessment during seminars and practical tasks Y – interim control (test, colloquium) Z – final control (test, examination)
Application of evidence-based medical principles, skills and knowledge: to use scientifically-based evidence in practice, to search for the relevant literature, critically assess published medical literature	Lectures, seminars and practical tasks	Continuous assessment theoretical knowledge and practical skills
Efficient use of information and information technologies in medical practice: properly and completely keep and store medical documentation, use computers, search for sources of literature, store and update information	Lectures, seminars and practical tasks	Continuous assessment theoretical knowledge and practical skills
Ability to apply scientific principles, methods and knowledge in medical practice and research: to apply scientific principles, methods and knowledge in medical practice and research	Lectures, seminars and practical tasks	Continuous assessment theoretical knowledge and practical skills

Topics	Contact work hours						Time and tasks of self-study		
	Lectures	Consultations	Seminars	Practice	Laboratory work	Practical training	Total contact hours	Self-study	Tasks
IV SEMESTER									
1. Introduction to pathophysiology. PF			3				3	2	What is pathophysiology? What is the rationale for studying pathophysiology? Health and disease. Medical history of pathophysiology. General pathology. General etiology. General pathogenesis. The concept of vicious circle. The cell as a unit of health and disease.
2. Introduction to Pathology. Pathologic accumulations. Amyloidosis. Cell and tissue regeneration and adaptive changes.	2		3				5	4	Role of pathology in clinical medicine. Tissue-based diagnosis, methods and principles. Amyloidosis, amyloid, detection, types. Paraproteinemias. Hyalinosis. Steatosis. Obesity. Cholesterol accumulations. Pathologic calcifications. Pigment accumulations. Hemosiderosis, local and systemic. Pathology of compensation and adaptation mechanisms. Hypertrophy. Hyperplasia. Regeneration. Atrophy. Epithelial / stromal interaction, architectural tissue rearrangements. Metaplasia. Dysplasia. Sclerosis.
3. Injury of the cell and tissue. Hemodynamic disorders.			3				3	4	Mechanism and causes of cellular injury. Reversible and irreversible cellular injury. Apoptosis. Necrosis. Types of necrosis, macroscopic and histology features. Outcomes of necrosis. Postmortem changes in the tissues. Damage of the connective tissue. Hyperemia, active and passive. Edema.

									Stasis. Infarction. Embolism. Thrombosis. Hemorrhage.
4. Mechanisms of cell injury and cell death. PF	2		3				5	4	Cell injury and adaptations. Causes and mechanisms of cell injury and death. Sequence of events in cell damage: reversible and irreversible cell injury. Cell death: apoptosis, necrosis, necroptosis, other pathways of cell death. Types of apoptosis, pro-apoptotic and anti-apoptotic proteins, diseases due to impaired regulation of apoptosis. The definition and mechanisms of autophagy. The common causes and mechanisms of cell injury and death: hypoxia, ischemia, endoplasmic reticulum stress, DNA damage, oxidative stress and etc. Ischemia-reperfusion injury. The role of mitochondrial dysfunction.
5. Inflammation. Immunopathology.	2		3				5	4	Biological significance. Acute inflammation, mechanisms, morphology. Mediators of inflammation. Types of exudate. Outcomes of acute inflammation. Factors affecting healing. Chronic inflammation. Granuloma. Granulomatous diseases. Concept of immunopathology. Mechanisms of immune tissue injury (hypersensitivity reactions).
6. Pathophysiology of inflammation. Cellular and molecular basis of inflammatory mechanisms. PF	2		3				5	5	Definition, causes and general features of inflammation. Pathophysiology of acute inflammation: local and systemic effects. Reactions of blood vessels, leukocyte recruitment, phagocytosis. Destruction of the pathogen, NET's. Leukocyte-mediated tissue injury. Mediators of inflammation: vasoactive amines, arachidonic acid metabolites, cytokines and chemokines, complement system, other mediators. Acute phase response. Pathogenesis of fever. The mechanisms of thermoregulation. Diagnostic tests and inflammatory markers. The course of inflammatory response; potential complications. Pathophysiology of chronic inflammation. Cells and mediators of chronic inflammation. The role of macrophages: classical and alternative activation.
7. Neoplasia. Principles of tumour pathology diagnosis	2		3				5	4	Definitions of neoplasia. Etiology and pathobiology of the tumours. Nomenclature of the tumors. Benign and malignant tumors. Premalignant lesions. Malignant transformation. Intratumour heterogeneity. Interaction between the host and the tumor. Anti-tumour immunity. Tumor microenvironment and progression. Predictive tissue pathology biomarkers..
8. Neoplasia. Molecular carcinogenesis. PF			3				3	5	Cancer genes. Genetic lesions in cancer: mutations and epigenetic alterations. Carcinogenesis as a multistep process. The hallmarks of cancer: self-sufficiency in growth signals, insensitivity to growth-inhibitory signals, altered cellular metabolism, evasion of apoptosis, limitless replicative potential, sustained angiogenesis, invasion and metastasis, evasion of immune surveillance. Epithelial mesenchymal transition. Carcinogenic agents. Effects of tumor on host. Paraneoplastic syndromes.

9. Hypoxemia, hypoxia. Oxidative stress. PF	2		3			5	4	Definition and classification of hypoxia: hypoxic, anemic, circulatory, histotoxic and mixed hypoxia. Main causes of hypoxemia: low oxygen pressure in inspired air, hypoventilation, increased alveolar-arterial gradient. Compensatory and adaptive mechanisms to hypoxia. The role of Hypoxia-inducible factor 1 (HIF-1). Pathological changes in various organs during chronic hypoxia. Accumulation of oxygen-derived free radicals: free radicals, reactive oxygen species (ROS). Ways of generation of free radicals. Pathologic effects of ROS: cell injury and death. Lipid peroxidation in membranes; oxidative modification of proteins, DNA lesions. Removal of free radicals. Primary, secondary and tertiary antioxidants.
10. Pathophysiology of shock syndrome. PF			3			3	3	Review of stress response. Potential effects of prolonged and severe stress. Definition, classification and etiology of shock syndrome. Pathophysiology of shock: impaired tissue oxygenation; compensatory mechanisms and stages of shock. Complications of shock: ARDS, DIC, multiorgan dysfunction syndrome.
11. Pathophysiology of peripheral blood flow. Hemostasis and thrombosis. PF			3			3	4	Hyperemia, congestion, ischemia. Factors influencing severity of ischemia. Hemostasis and thrombosis. Arterial and venous thrombosis. Hypercoagulable states: acquired and inherited. Etiology and pathogenesis of pulmonary artery thromboembolism, systemic thromboembolism. The pathogenesis of Disseminated intravascular coagulation syndrome (DIC). Anticoagulative mechanisms. Bleeding disorders due to impairment in blood vessel function, lack of coagulation factors and platelet pathology. Etiology, pathogenesis and complications of aneurysms, aortic dissection.
12. Endothelial dysfunction. Pathophysiology of atherosclerosis. PF	2		3			5	4	Endothelium as an endocrine-paracrine organ. The role of endothelium in the regulation of vascular homeostasis. Endothelial cell properties and functions: the production of extracellular matrix components, elaboration of anti-thrombotic, anti-coagulant and fibrinolytic regulators, elaboration of pro-thrombotic molecules, modulation of blood flow and vascular reactivity, regulation of inflammation and immunity, regulation of cell growth, etc. The role of NO in vascular pathology. Endothelial activation. Endothelial dysfunction: definition, causes, phenotype. Endothelial dysfunction and disease Assessment of endothelial function. Vascular wall response to injury. Types of arteriosclerosis. The pathogenesis of atherosclerosis. Understanding the response-to injury hypothesis. The role of endothelial injury, inflammation, smooth muscle cell proliferation, lipid infiltration, Stable and unstable plaques. Vulnerability of atherosclerotic plaque.
13. Heart pathology			3			3	4	Congenital heart defects: with shunt from left to right (open ductus arteriosus, atrial and ventricular septal defects); with shunt from right to left

								(transposition of main arteries, Fallot tetrad); obstructive (aortic coarctation, pulmonary venous atresia, common arterial trunk). Heart valve defects: degenerative; rheumatism and rheumatic heart disease, infectious endocarditis. Hypertensive heart disease. Ischemic heart disease; myocardial infarction, chronic coronary insufficiency.	
14. Pulmonary pathology	2		3				5	4	Lung tumors, histological types. Interstitial pneumonia and pneumonitis (sarcoidosis, usual interstitial pneumonia, non-specific interstitial pneumonia, desquamative pneumonia). Adult respiratory distress syndrome. Bronchitis, chronic. Pulmonary tuberculosis. Bronchoectasis.
15. The Female Genital Tract pathology. Pathology of Pregnancy and Breast.			3				3	4	Cervical cancer. HPV infection. Cervical intraepithelial neoplasia. PAP test, Bethesda categories. Prevention of cervical cancer. Endometriosis. Adenomyosis. Endometrial hyperplasia. Endometrial carcinoma. Myometrial tumors. Ovarian cysts and tumours. Fibrocystic changes. Proliferative disease with and without atypia. Breast carcinoma: ductal / lobular in situ carcinoma, ductal / lobular invasive. Stromal and fibroepithelial tumors.
V SEMESTER									
16. Pathophysiology of systemic blood flow. PF	2		3				5	5	Types and causes of hypertension. The pathogenesis of essential hypertension: changes in blood vessel tone, increased vascular resistance, increased blood volume. Complications of hypertension. Heart failure. The concepts of cardiac output, preload, afterload, ejection fraction. Causes and pathogenesis of systolic and diastolic heart failure. Neurohumoral activation as one of the key mechanisms underlying the progression of heart failure. The role of increased sympathetic nervous system and RAAS activation, elevated production of ANP, BNP and cytokines. Pathophysiology and types of myocardial hypertrophy: eccentric and concentric. Causes and pathogenesis of acute and chronic heart failure. Pathophysiology-based heart failure treatment. The pathophysiology of primary and secondary pulmonary hypertension. Cardiomyopathies. Inflammatory cardiomyopathy.
17. Obesity and metabolic syndrome. Pathophysiology of diabetes. PF			3				3	4	The etiology and pathogenesis of obesity. Neurohumoral regulation of energy balance and body weight. Brain-gut axis: the role of leptin, insulin, ghrelin, PYY, GLP-1, cholecystokinin. The role of adipokines. Comorbidities of obesity. The role of visceral obesity in the pathogenesis of essential hypertension, coronary heart disease, stroke, cancer, non-alcoholic fatty liver disease and type II diabetes. Metabolic syndrome. The role of microbiome in the pathogenesis of obesity. Classification of diabetes mellitus. Secondary diabetes. Pathogenesis of diabetes. Obesity and insulin resistance. Impaired glucose tolerance. Acute

								complications of diabetes: hypoglycemia, diabetic ketoacidosis, hyperosmolar hyperglycemic nonketotic coma. Long-term complications of diabetes: micro-and macroangiopathy, neuropathy, infections, cataract. The pathogenesis of long-term complications: the role of advanced-glycation products (AGE), protein kinase C activation, and disturbances in polyol pathways.	
18. Disorders of fluid and electrolyte balance. PF	2		3				5	4	The regulation of body fluid homeostasis: regulation of extracellular fluid volume and plasma osmolality. The concept of plasma tonicity. Negative and positive fluid balance. Causes, pathogenesis and complications of dehydration and hyperhydration. The etiology and pathogenesis of hypo and hypernatremias. The consequences of rapid changes in sodium levels. The etiology and pathogenesis of the inappropriate antidiuretic hormone secretion syndrome (SIADH) and diabetes insipidus. Causes of edema: impaired venous return, arteriolar dilation, reduced plasma oncotic pressure, lymphatic obstruction, sodium retention, inflammation. Pathophysiology of electrolyte imbalance: potassium, calcium, magnesium.
19. Pathophysiology of acid-base balance disorders. PF			3				3	5	Maintenance of constant serum pH. Buffering systems: bicarbonate-carbonic acid buffer, phosphate buffer, protein buffer. Respiratory and renal regulation of acid-base balance. The pathophysiology of acid-base balance disorders. Causes and effects of acidosis and alkalosis. Respiratory and metabolic acidosis. The concept of anion gap. Respiratory and metabolic alkalosis. Chloride responsive and chloride resistant metabolic alkalosis. Compensation for acid-base disorders. Mixed acid-base balance disorders. Arterial blood gas analysis parameter (pH, pCO ₂ , HCO ₃ ⁻) interpretation.
20. Vasculitis and thrombotic microangiopathies			3				3	4	Classification of vasculitis. Giant cell (temporal) arteriitis. Kawasaki syndrome. Polyarteritis nodosa. ANCA vasculitis. Microscopic polyangiitis. Wegener's granulomatosis. Churg-Strauss syndrome. Leukocytoclastic vasculitis. Cryoglobulinemic vasculitis. Henoch-Schonlein purpura. Pulmonary syndromes. Thrombotic microangiopathies. Antiphospholipid antibody syndrome. Progressive systemic sclerosis. Hemolytic uremic syndrome. Thrombotic thrombocytopenic purpura. Pathology of atherosclerosis. Aortic aneurysms.
21. Pathophysiology of the hematopoietic and lymphoid system. PF			3				3	4	Red cell disorders. Classification of anemias according to the underlying mechanism, reticulocyte index and red cell morphology. Anemia of blood loss, etiology, pathogenesis, compensatory mechanisms. Hemolytic anemias, their types. Anemia of diminished erythropoiesis, its etiology and pathogenesis. Iron deficiency anemia, anemia of chronic inflammation, aplastic anemia. Pathophysiologic classification of polycythemia. White cell disorders.

								Differential leukocyte count, types and causes of leukocytosis. Causes and pathogenesis of leukopenia. Neoplastic white cell proliferation, classification. Acute leukemias, pathophysiology, general symptoms.	
22. Leukaemias and lymphomas	2		3				5	6	Enlarged lymph node: clinical and pathology algorithm of diagnosis. Histological patterns and differential diagnostics of reactive lymphadenopathy. Hodgkin's and non-Hodgkin's lymphomas in Lithuania and the World (WHO classification). Hodgkin's lymphoma. The most common B non-Hodgkin lymphomas: Diffuse large B cell lymphoma; B Follicular lymphoma; B mantle cell lymphoma; B small lymphocytic lymphoma/leukemia; B marginal zone lymphoma (extranodal).
23. Pathophysiology of the gastrointestinal system and liver. PF	2		3				5	4	Pathophysiology of nausea and vomiting; Esophageal achalasia: etiology and pathophysiology. Gastroesophageal reflux disease (Barrett esophagus): etiology, pathophysiology. Gastric cancer: etiology; pathophysiology. Peptic ulcers: etiology; pathophysiology; complications. Dumping syndrome: etiology; pathophysiology. Jaundice: classification; etiology; pathophysiology. Viral hepatitis (A, B, C, D): etiology; pathophysiology; serology markers. Liver cirrhosis: etiology; pathophysiology; complications (portal hypertension; hepatic encephalopathy; liver insufficiency; hepatorenal syndrome; hepatopulmonary syndrome. Acute and chronic pancreatitis: etiology; pathophysiology. Gut microbiome, its role in health and disease.
24. Liver pathology			3				3	3	Wilson disease. Hepatorenal syndrome. Portal hypertension syndrome. Alfa-1 antitrypsin deficiency. Autoimmune hepatitis. Hemochromatosis. Viral hepatitis (A, B, C, D, E). Toxin-induced liver disease. Circulatory disorders. Liver tumors. Primary biliary cirrhosis. Alcoholic liver disease. Hepatic failure. Cirrhosis. Homeostasis disorders.
25. Gastrointestinal pathology			3				5	5	Esophagitis. Barrett esophagus. Esophageal tumors. Congenital esophageal abnormalities. Gastritis. Gastric polyps. Helicobacter pylori infection. Acute gastric ulcers. Gastric adenocarcinoma. Neuroendocrine tumors. Pancreatic adenocarcinoma. Ischemic bowel disease. Infectious enterocolitis. Achalasia. Malabsorption syndromes. Acute appendicitis. Tumors of the appendix. Peritoneum pseudomyxoma. Diverticular disease of the colon. Pseudomembranous colitis. Gastrointestinal lymphomas. Adenomatous lesions of colon. Colorectal cancer. Ulcerative colitis. Crohn disease. Hirschprung disease. Mallory-Weiss syndrome. Celiac disease. Whipple disease.
26. Renal pathology			3				3	5	Structural and functional aspects and clinico-pathologic correlations in

									<p>“medical“ kidney diseases. Principles and methods of renal biopsy pathology evaluation. Patterns of renal and glomerular injury. Minimal change disease and the concept of podocytopathies. Focal and segmental glomerulosclerosis, primary and secondary. Membranous glomerulopathy. Diabetic glomerulosclerosis. Amyloidosis. Paraprotein deposition. Acute postinfectious (diffuse endocapillary proliferative) glomerulonephritis, Rapidly progressive (crescentic and/or necrotising) glomerulonephritis: anti-GBM, ANCA, immune-complex mediated. Membranoproliferative glomerular injury: Immune complex-mediated, cryoglobulinemic, dense deposit disease, C3-glomerulonephritis, immunoglobulin light chain deposition, glomerular involvement in thrombotic angiopathies. Mesangioproliferative glomerular injury: IgA nephropathy. Henoch-Schoenlein purpura. Lupus nephritis. Amyloid AL, light chain nephropathy, immunotactoid glomerulopathy, myeloma kidney, tubulopathies. Alport syndrome, thin glomerular basement membrane disease, Fabry disease, nephronophthisis/medullary cystic disease, polycystic kidney disease. Acute tubular necrosis, renal oxalosis, myeloma kidney, interstitial nephritis, analgesic nephropathy, reflux nephropathy.</p>
27. Pathophysiology of the endocrine system. PF			3				3	5	<p>Common traits of endocrine disease etiology and pathogenesis. Control of endocrine gland activity. Pathophysiology of hypothalamic-pituitary axis. Etiology and pathogenesis of pituitary gland diseases: hypopituitarism, pituitary gigantism, acromegaly, Cushing disease. Etiology and pathogenesis of hyperprolactinemia. Adrenocortical hyperfunction: hypercortisolism, primary and secondary aldosteronism, adrenogenital syndromes. Adrenocortical insufficiency: etiology and pathogenesis of Addison disease. Thyroid disorders: goiter, hyperthyroidism, hypothyroidism. Etiology and pathogenesis of parathyroid glands: hyper and hypothyroidism.</p>
28. Pathology of the endocrine system	2		3				5	4	<p>Parathyroid gland: hyperplasia, adenoma, carcinoma. Functioning neuroendocrine tumors: gastrinoma, insulinoma, somatostatinoma, glucagonoma. Neuroendocrine tumours of gastrointestinal tract and pancreas. Nodular and diffuse goiter. Graves disease. Thyroiditis. Thyroid tumours: adenoma, papillary carcinoma, follicular carcinoma, medullary carcinoma, undifferentiated carcinoma. Adrenal tumours: adenoma, carcinoma, pheochromocytoma. Functioning adrenal tumours.</p>
29. Pathophysiology of the nervous system. PF	2		3				5	3	<p>The pathophysiology of neurodegenerative diseases. The concept of proteinopathies. The role of misfolded protein aggregation, mitochondrial dysfunction, oxidative stress in the</p>

								pathogenesis of neurodegenerative diseases (Alzheimer disease, frontotemporal dementia, Parkinson's disease, Huntington disease, amyotrophic lateral sclerosis, prion diseases). Cerebrovascular diseases: the pathophysiology of ischemic stroke, intracranial hemorrhages. Cerebral amyloid angiopathy. Etiology and pathogenesis of brain edema. Diseases of myelin. The pathogenesis of multiple sclerosis, acute disseminated encephalomyelitis,	
30. Pathology of central nervous system.			3				3	4	Brain infarction. Tumors of the brain: glial tumors (pilocytic astrocitoma, diffuse astrocitoma, anaplastic astrocitoma, glioblastoma, oligodendrogloma, anaplastic oligodendrogloma), meningioma, meduloblastoma, metastatic tumors. Molecular classification of glial tumors.
31. Urological pathology	2		3				5	4	Urothelial tumors. Testicular tumors: germinogenic tumors: seminoma, yolk sack tumor, embrionic carcinoma, choriocarcinoma. Prostatic adenocarcinoma. Renal cell carcinoma: clear cell, papillary, chromophobe. Renal oncocytoma and papillary adenoma.
32. Skin diseases	2		3				5	4	Skin histology and terminology describing major microscopic changes. General principles of inflammatory dermatoses: psoriasis. Infectious dermatoses: verrucae (warts). General principles of blistering (bullous) disorders: pemphigus vulgaris. Melanocytic tumors: ABCDE criteria system, melanocytic nevi, melanomas. Malignant neoplasms of the epidermis: basal cell carcinoma, squamous cell carcinoma. Cutaneous T lymphoma (mycosis fungoides).
33. Colloquia		4							
Total hours	32		100				132	132	

Assessment strategy	Weight (%)	Assessment period	Assessment criteria																						
<p>Main method of assessment</p> <p>Cumulative points: $CP = 10X\% + 30Y\% + 60Z\% = 100\%$</p> <p>X – continuous assessment of active participation during seminars and practical tasks</p> <p>Y – stage control (test, colloquium)</p> <p>Z – final control (test, examination)</p>	X10%	During seminars	<p>Continuous assessment of active participation during seminars. The participation in the seminars is obligatory. One is eligible to take Pathology exam if at least 80% of the seminars during both semesters have been attended. During each seminar interactive questions are provided as open questions or MCQs. The questions have to be answered during the seminar in a particular time limit. In case of a positive response to the question 1 point is given, otherwise - zero points are gained. The percentage of positive responses is calculated throughout both semesters and summarized as the student activity score (X) and comprises 10% of the Cumulative Points.</p> <p>A total of 4 interim assessment tests (colloquia) are carried out during the 4th and 5th semesters. The tests are aimed at knowledge and skills evaluation, obtained during the practical classes and by self-study. A percentage of correct answers is calculated. The tests are provided only once and at the appointed time. If sound and documented reason (must be provided before the test) prohibits a student to take the test at the time appointed, 1 test during the course can be skipped without impact to the cumulative score. In other cases, a missed test is estimated at zero score. The credits for the 4th semester are accomplished if a student has accumulated at least 50% of X score and collected sum of at least 70% from the 2 Y tests taken. Students who achieved average of X and Y tests at 92% at the end of both semesters are awarded 10 final score without taking the examination (Z) test.</p> <p>Final examination is based on a written (computer) test. The test lasts approximately 2 hours and up to 120 questions in total. The tests are computerized, aimed at knowledge and skills evaluation.</p> <p>Final grade is calculated from the CP based on following the intervals:</p> <table border="1"> <thead> <tr> <th>Cummulative points, %</th> <th>Final grade</th> </tr> </thead> <tbody> <tr><td>>10.00</td><td>1</td></tr> <tr><td>>20.00</td><td>2</td></tr> <tr><td>>30.00</td><td>3</td></tr> <tr><td>>40.00</td><td>4</td></tr> <tr><td>>50.00</td><td>5</td></tr> <tr><td>>60.00</td><td>6</td></tr> <tr><td>>65.00</td><td>7</td></tr> <tr><td>>75.00</td><td>8</td></tr> <tr><td>>85.00</td><td>9</td></tr> <tr><td>>90.00</td><td>10</td></tr> </tbody> </table>	Cummulative points, %	Final grade	>10.00	1	>20.00	2	>30.00	3	>40.00	4	>50.00	5	>60.00	6	>65.00	7	>75.00	8	>85.00	9	>90.00	10
	Cummulative points, %	Final grade																							
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Y30%	During semester																								
Z60%	At the end of pathology course.																								

Author	Year of publication	Title	No of periodical or vol. of publication	Publication place and publisher or Internet link
Required reading				
Vinay Kumar Abul Abbas Jon Aster	2020	Robbins Pathology		Elsevier, 10th edition and other editions: https://www.clinicalkey.com/#!/browse/book/3-s2.0-C20160040871?indexOverride=GLOBAL
Recommended reading				
Copstead L-EC, Banasik JL.	2018	Pathophysiology,6/E		Saunders/Elsevier
Gary D. Hammer, Stephen J. McPhee	2020	Pathophysiology of Disease: An Introduction to Clinical Medicine, 8e		https://accessmedicine.mhmedical.com/book.aspx?bookID=2468
Stevens A, Lowe J, Scott I.	2009	Core Pathology,3/E,		Morsby/Elsevier