Course unit title	Code
PATHOLOGY (for medical students)	**PAT02115**

Lecturer(s)	Department(s)
Coordinating: Assoc. Prof. Vaida Baltrūnienė **Others:** Lecturers from the Department of Pathology and Forensic Medicine	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**
Blended-teaching methods: lectures (including virtual), seminars and practical works (including virtual), small group discussions, and providing feedback. Independent work using the specified databases and references.	4th semester	English and Lithuanian

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

Number of ECTS credits allocated to the course unit	Total student's workload hours	Contact hours	Self-study hours
5 credits	135	66	69

Purpose of the course unit Programme competencies to be developed		
To provide the students with principles of pathology, necessary for clinical medicine. Three main competencies 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 judgment concerning 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, think critically and self-critically, be creative, take the initiative, communicate with others	Lectures, seminars (including virtual), case studies, and small group discussions. Self-study.	Continuous assessment of theoretical knowledge and problem-solving 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	Lectures, seminars (including virtual), case studies, and	Continuous assessment of theoretical knowledge and problem-solving skills

problems, to make judgments, to work with specialists of other fields.	small group discussions. Self-study.	
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 disease treatment based on pathological knowledge. To understand disease mechanisms that give rise to clinical signs and symptoms. Formulate differential diagnosis based on the knowledge gained.	Lectures provide insights into essential knowledge and focus on principles of understanding pathology findings of clinical relevance. The lectures (including recordings) are in digital format and can be viewed in the VU learning environment. During the seminars and practical works, a problem-based method is applied. The essence of this method is modeling disease diagnosis and treatment tactics. Based on this method, clinical situations (tasks) and pathology test results (pathology report) are analyzed.	Continuous assessment of theoretical knowledge and problem-solving skills: quiz in writing, solutions to didactic clinical situations. The main method of assessment Cumulative points (CP): **CP =50X%+50Y% =100%** **X –** interim control **(**test,colloquium) **Y –** 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 (including virtual), case studies, and small group discussions. Self-study.	Continuous assessment of theoretical knowledge and problem-solving 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 (including virtual), case studies, and small group discussions. Self-study.	Continuous assessment of theoretical knowledge and problem-solving skills
Ability to apply scientific principles, methods, and expertise in medical practice and research: to apply scientific principles, methods, and knowledge in medical practice and research	Lectures, seminars (including virtual), case studies, and small group discussions. Self-study.	Continuous assessment of theoretical knowledge and problem-solving 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**
4th SEMESTER									
Pathological Physiology (PP) Topics									
1. Pathophysiology of shock syndrome.	2			3			5	4	Prepare for the seminar. Read indicated literature. Review the provided video material. Be able to discuss the following topics. Review of stress response. Potential effects of prolonged and severe stress. Shock syndrome: definition, classification, and etiology of shock syndrome, differential diagnosis between different types of shock. Pathophysiology of shock: compensatory mechanisms (hemodynamic and neurohumoral changes) and stages of shock. Complications of shock: ARDS, DIC, multiorgan dysfunction syndrome. Pathogenesis of septic shock.
2. Obesity and metabolic syndrome. Pathophysiology of diabetes.				3			3	4	Prepare for the seminar. Read indicated literature. Review the provided video material. Be able to discuss the following topics. 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. Pathogenesis of type II diabetes. Insulin resistance, non-enzymatic glycation, advanced glycation end products (AGEs). Impaired glucose tolerance. The pathogenesis of long-term complications of diabetes.
3. Disorders of fluid and electrolyte balance.	2			3			5	4	Prepare for the seminar. Read indicated literature. Review the provided video material. Be able to discuss the following topics. 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. 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. Etiology and pathogenenesis of edemas: the role of impaired venous return, reduced plasma oncotic pressure, lymphatic obstruction, sodium retention, increased vascular permeability (inflammation). Pathophysiology of potassium, calcium, and magnesium imbalances.
4. Pathophysiology of acid-base balance disorders.				3			3	5	Prepare for the seminar. Read indicated literature. Review the provided video material. Be able to discuss the following topics. 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.
5. Pathophysiology of the hematopoetic and lymphoid systems.				3			3	4	Prepare for the seminar. Read indicated literature. Review the provided video material. Be able to discuss the following topics. 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,vit. B12, folate deficiency anemias, 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. Main types of acute leukemias, pathophysiology, clinical syndrome.
6. Pathophysiology of the gastrointestinal system and liver.	2			3			5	4	Prepare for the seminar. Read indicated literature. Review the provided video material. Be able to discuss the following topics.Pathophysiology of nausea and vomiting; Esophageal achalasia: etiology and pathophysiology. Gastroesophageal reflux disease: 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.

7. Pathophysiology of the endocrine system.				3			3	5	Prepare for the seminar. Read indicated literature. Review the provided video material. Be able to discuss the following topics. Study the provided clinical cases. 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.
8. Pathophysiology of the nervous system.	2			4			5	4	Prepare for the seminar. Read indicated literature. Review the provided video material. Be able to discuss the following topics. The mechanisms of neuronal death, focusing on ischemic/reperfusion injury, and excitotoxicity. Protein misfolding in the pathogenesis of major neurodegenerative diseases such as Alzheimer's, Parkinson's, etc. The role of prions. Cerebrovascular diseases: the pathophysiology of ischemic stroke, intracranial hemorrhages. The concept of ischemic core and penumbra zones. Cerebral amyloid angiopathy. Etiology and pathogenesis of brain edema.
Total PP hours	8			25			33	35	
4th SEMESTER									
Topics from Pathological Anatomy (PA)									
1. Cardiovascular diseases				4			3	4	Prepare for the seminar. Repeat normal histology of the cardiovascular system. Read indicated literature. Review submitted visual materials. Be able to discuss the following topics. Hypertensive heart disease. Ischemic heart disease; myocardial infarction, chronic coronary insufficiency. Heart valve defects: degenerative; rheumatism and rheumatic heart disease, infectious endocarditis. Classification of vasculitis. Giant cell (temporal) arteritis. Polyarteriitis nodosa. Henoch-Schonlein purpura. Thrombotic microangiopathies: active and chronic phase.
2. Renal pathology	2			3			3	6	Prepare for the seminar. Repeat normal histology of the kidney. Read indicated literature. Review submitted visual materials. Be able to discuss the following topics. Structural and functional aspects and clinicopathologic correlations in “medical“ kidney diseases (nephropathology). Principles and methods of renal biopsy pathology evaluation. Patterns of renal and glomerular injury. Minimal change disease. Primary and secondary focal and segmental glomerulosclerosis. Membranous glomerulopathy. Diabetic

									glomerulosclerosis, amyloidosis (see pathologic accumulations). Acute postinfectious glomerulonephritis. Rapidly progressive (crescentic) glomerulonephritis: anti-GBM disease, pauci-immune (ANCA associated), immune-complex mediated. Membranoproliferative glomerular injury. IgA nephropathy. Alport syndrome. Thin glomerular basement membrane disease. Myeloma kidney. Acute tubular necrosis. Interstitial nephritis.
3. Pulmonary pathology				3			3	4	Prepare for the seminar. Repeat normal histology of the respiratory system. Read indicated literature. Review submitted visual materials. Be able to discuss the following topics. 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. Bronchiectasis.
4. Gastrointestinal pathology (non-tumors)				3			5	3	Prepare for the seminar. Repeat normal histology of the gastrointestinal tract. Read indicated literature. Review submitted visual materials. Be able to discuss the following topics. Congenital conditions: Hirschsprung disease. Ulcerative colitis. Crohn disease. Celiac disease. Diverticulosis. Wilson disease. Hemochromatosis. Viral hepatitis (A, B, C, D, E). Alcoholic liver disease. Autoimmune hepatitis. Primary biliary cirrhosis. Cirrhosis.
5. Lymphoproliferative diseases: lymphadenopathy/lymphadenitis and lymphomas	2			3			5	5	Prepare for the seminar. Repeat normal histology of the lymph node. Read indicated literature. Review submitted visual materials. Be able to discuss the following topics. 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; and B marginal zone lymphoma (extranodal).
6. Pathology of the endocrine system				3			5	5	Prepare for the seminar. Repeat normal histology of the parathyroid gland, thyroid, and adrenal glands. Read indicated literature. Review submitted visual materials. Be able to discuss the following topics. Parathyroid gland: hyperplasia, adenoma, carcinoma. Functioning neuroendocrine tumors: gastrinoma, insulinoma, somatostatinoma, glucagonoma. Neuroendocrine tumors of the gastrointestinal tract and pancreas. Nodular and diffuse goiter. Graves disease. Thyroiditis. Thyroid tumors: adenoma, papillary carcinoma, follicular

									carcinoma, medullary carcinoma, undifferentiated carcinoma. Adrenal tumors: adenoma, carcinoma, pheochromocytoma. Functioning adrenal tumors.
7. Skin diseases	2			3			5	3	Prepare for the seminar. Repeat normal histology of the skin. Read indicated literature. Review submitted visual materials. Be able to discuss the following topics. Terminology describing major microscopic skin 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.
8. Pathology of the central nervous system.				3			3	3	Prepare for the seminar. Read indicated literature. Review submitted visual materials. Be able to discuss the following topics. Brain infarction. Tumors of the brain: glial tumors (pilocytic astrocytoma, diffuse astrocytoma, anaplastic astrocytoma, glioblastoma, oligodendroglioma, anaplastic oligodendroglioma), meningioma, medulloblastoma, metastatic tumors. Molecular classification of glial tumors.
Total PA hours	8			25			33	34	
TOTAL HOURS	16			50			**66**	**69**	

Assesment strategy	**Weight**	**Assessment period**	**Assessment criteria**
The main method of assessment Cumulative points: **CP=50X%+50Y%=100%** **X -** interim control **(**test, colloquium) **Y -** final control (test, examination)	X50%	**During semester**	A total of 4 interim assessment tests (colloquia) are carried out during the 3th and 4th 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 a sound and documented reason (must be provided before the test to the pathology course administrator) prohibits a student from taking the test at the time appointed, 1 test during the course can be skipped without impacting the CP. In other cases, a missed test is estimated at zero score. Students who have taken all four colloquia and whose average colloquia scores obtained in both semesters fall within the 95th percentile in the distribution of the average colloquia scores of the entire course are exempted from the exam test; their final grade is 10 (excellent).

<table>
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<td></td>
<td>Y50%</td>
<td>At the end of the pathology course.</td>
<td>The final examination is based on a written (computer) test. The test lasts approximately 2 hours and includes 100 to 120 questions. The tests are computerized; aimed at knowledge evaluation.
When calculating the CP, the worst result from the colloquia tests taken by a student (only if all four tests are completed) is not included. The distribution of CP among medical students who took the colloquia determines the group
A group: Students with CP < 50% (49.99 or less)
B group: Students with CP ≥ 50% (50.00 or more).

Students with CP <50% have one retake opportunity. If CP remains <50% after retaking, the course must be repeated.
Final grades are determined by CP percentiles in each sample as follows:
A group: CPs are divided into 4 equal intervals, each with a width of 12.5 points.
B group: CPs are divided into 6 equal intervals, with the interval width determined by the highest CP score received during the year of study (jointly for both Lithuanian and international students).

Below is an example of final grade assignment based on different maximal CP scores.
<table>
<tr><td>Intervals for final grades, when max CP is 100 points</td><td>Intervals for final grades when max CP is 95.56 points</td><td>Final grade</td></tr>
<tr><td>A group</td><td>A group</td><td></td></tr>
<tr><td>CPp < 12.5 points</td><td>CPp < 12.5 points</td><td>1</td></tr>
<tr><td>12.5 ≤ CPp < 25</td><td>12.5 ≤ CPp < 25</td><td>2</td></tr>
<tr><td>25 ≤ CPp < 37.5</td><td>25 ≤ CPp < 37.5</td><td>3</td></tr>
<tr><td>37.5 ≤ CPp < 50</td><td>37.5 ≤ CPp <50</td><td>4</td></tr>
<tr><td>B group</td><td>B group</td><td></td></tr>
<tr><td>CPp < 58.33 points</td><td>CPp < 57.59 points</td><td>5</td></tr>
<tr><td>58.33≤ CPp <66.67</td><td>57.59≤ CPp <65.19</td><td>6</td></tr>
<tr><td>66.67 ≤ CPp < 75</td><td>65.19≤ CPp <72.78</td><td>7</td></tr>
<tr><td>75 ≤ CPp < 83.33</td><td>72.78≤ CPp <80.37</td><td>8</td></tr>
<tr><td>83.33≤ CPp < 91.67</td><td>80.37≤ CPp <87.97</td><td>9</td></tr>
<tr><td>91.67 ≤ CPp</td><td>87.97 ≤ CPp</td><td>10</td></tr>
</table>
In the case of the retake, the final grade is calculated based on the best course assessment during the primary session if the maximum CP score attained during the retake is lower.</td>
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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.	2021	Pathophysiology,7/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
Recommended portals		http://www.proteinatlas.org/learn/dictionary/normal https://www.pathologyoutlines.com/ https://peir.path.uab.edu/wiki/IPLab		