



MORPHOLOGY 2

FIRST YEAR OF STUDIES

Year 2024/2025

HISTOLOGY AND EMBRYOLOGY

Course:

HISTOLOGY AND EMBRYOLOGY

The course is evaluated with 12 ECTS.
11 weekly teaching classes (6 theoretical classes and 5 practical classes).

LECTURERS AND ASSOCIATES:

RB	Name and surname	E-mail address	vocation
1.	Zoran Milosavljevic	zormil67@medf.kg.ac.rs	Full Professor
2.	Nemanja Jovicic	nemanjajovicic.kg@gmail.com	Associate Professor
3.	Jelena Milovanovic	jelenamilovanovic205@gmail.com	Associate Professor

COURSE STRUCTURE:

	The name of the segment	Weeks	Lectures weekly	Work in a small group per week	Teacher-leader of the module
1	CELLS AND TISSUES	5	6	5	Prof. dr Zoran Milosavljević
2	ORGANOLOGY	7	6	5	Prof. dr Nemanja Jovicic
3	EMBRYOLOGY	3	6	5	Prof. dr Zoran Milosavljević
					$\Sigma 90+75=165$

GRADING POLICY

By fulfilling the pre-examination obligations and passing the final (oral) exam, the student can achieve a maximum of 100 points. The final grade is formed based on the number of points gained in the following ways:

PRE-EXAM ACTIVITIES: Students can earn up to 30 points by regularly attending classes, taking tests, being prepared for exams, and participating in lab activities.

ORAL EXAM: A student can earn up to 70 points in this way. The oral part of the exam requires the response to 3 randomly chosen questions. If the student does not get more than 50% of the points in the oral exam, he/she can not pass the exam.

EVALUATION		MAXIMUM POINTS		
		Pre-exam activities	Exam	Σ
1	PRE-EXAMINATION	30		30
2	ORAL EXAM		70	70
Σ		30	70	100

The final grade is formed as follows:

In order to pass the final exam, the student must obtain a minimum of 51 points and must achieve more than 50% of points in both the pre-exam activities and the final oral exam.

1. To pass the pre-exam activities, the student must have more than 50% of the predicted points.
2. To pass the oral exam, the student must obtain more than 50% points.

The number of points earned	Grade
0 - 50	5
51 - 60	6
61 - 70	7
71 - 80	8
81 - 90	9
91 - 100	10

ASSESSMENT METHOD

PRE-EXAM ACTIVITIES 0-30 POINTS

ASSESSMENT IN PART OF THE PRE-EXAM ACTIVITIES

Attendance at classes, activity in labs and taking a LAB
test consisting of 9 histological slides

ORAL EXAM 0-70 POINTS

EVALUATION ORAL EXAMINATION

The exam includes 3 questions

LITERATURE:

	Textbook	Authors	Publisher	In the library
1	<u>Junqueira's Basic Histology Text and Atlas, 16e</u>	Anthony L Mesher	McGraw Hill, 2021	Yes
2	Histology	Zlatibor Andjelkovic	Galaksijanis, Niš, 2024	Yes
3	Gartner & Hiatt's Atlas and Text of Histology Eighth edition, International Edition	Leslie Gartner, Lisa Lee	LWW Lippincott Williams and Wilkins 2022	
4	Histology: A Text and Atlas: With Correlated Cell and Molecular Biology, 6th edition	Michael Ross, Wojciech Pawlina	Lippincott Williams & Wilkins, 2006	Yes
5	<u>The Developing Human : Clinically Oriented Embryology, 11th edition</u>	Keith Moore, TVN Persaud, Mark Torchia	Elsevier Health Sciences, 2018	Yes
6	<u>Workbook for practice classes in histology and embryology for medical students</u>	Goran Ranković	Unigraf X copy, Niš, 2019	Yes

All lectures are available on the website of the Faculty of Medical Sciences: <http://www.medf.kg.ac.rs/iasm/>

THE PROGRAM

CELLS AND TISSUES

TEACHING UNIT 1 (FIRST WEEK):

INTRODUCTION TO HISTOLOGY AND EMBRYOLOGY. CYTOLOGY

lectures 6 hours

Introduction to Histology and Embryology.

Microscopic methods and tissue sample preparation. Histological dyes. Histochemical and cytochemical methods. Cell membrane, transport through the cell membrane, endocytosis, transcytosis, exocytosis.

Cytology. Cytoskeleton, nucleus, cell organelles and inclusions. Proliferation, cell death.

What a student should know:

- Familiarity with the history of histology and embryology science
- Get to know the basic principles of various microscope types
- Understand the general characteristics of the structural organization of the cell and the organization of the cytoplasm
- To learn the structure of the cell membrane and transport mechanisms
- Learn the elements, structure and role of the cytoskeleton
- Learn the structure and function of cell organelles and inclusions
- Understand the connection and interaction between the building blocks of the cell
- Understand the structure of the nucleus and its components, the processes of division and the cell cycle

labs 5 hours

Introduction. Histological techniques. General cell morphology: Cell polymorphism. Nucleus polymorphism. Nucleus structure. Cytoplasmic structure: Endoplasmic reticulum, Golgi complex, mitochondrion, lysosome, centriole, cell membrane.

What a student should know:

- Familiarize yourself with basic histological techniques
- Master microscopy
- Master the morphology of the basic parts of the cell
- Master the morphology of individual cell organelles on a light microscope

TEACHING UNIT 2 (SECOND WEEK):

EPITHELIAL TISSUE

lectures 6 hours

Epithelial tissue. Basic characteristics of epithelial tissue. Epithelial cell polarization and plasmalemma specialization. Basement membrane. Intercellular junctions. Cell adhesion. Classification of epithelium. Covering and glandular epithelia.

What a student should know:

- Understand the basic terms and characteristics of epithelial tissue
- Learn the domains of the epithelial cell, cell membrane specializations, their structure and function
- Understand the formation method and structure of cell connections
- Master the classification of epithelial tissue
- Learn the structure, localization and specificities of certain types of epithelium
- Understand the division, histological structure and ultrastructural characteristics of exocrine and endocrine glands

labs 5 hours

Covering epithelium: Squamous, cuboidal, cylindrical, pseudostratified columnar and ciliated. Stratified epithelia: Squamous stratified, squamous stratified with keratinization, transitional epithelium, glandular epithelium.

What a student should know:

- Understand the appearance and characteristics of covering epithelia
- Understand the appearance and characteristics of glandular epithelia
- Master the histology of exocrine and endocrine glands

TEACHING UNIT 3 (THIRD WEEK):

CONNECTIVE TISSUE

lectures 6 hours

Connective tissue. Basic characteristics of connective tissue. Connective tissue cells and extracellular matrix. Embryonic connective tissues - mesenchyme and mucous connective tissue.

Adult connective tissues: loose, fibrous, hematopoietic, yellow and brown adipose tissue.

What a student should know:

- Get to know the general structure of connective tissues
- Learn the characteristics of the structural elements of connective tissues
- Get to know the types of connective cells, the structure of fibers and the composition of the ground substance
- Master the classification of connective tissues
- Get to know the properties of embryonic connective tissue
- Learn the types and histological properties of loose and fibrous connective tissue
- Get to know the structure and function of adipose and reticular connective tissue

labs 5 hours

Mesenchymal tissue: loose connective tissue, mucous connective tissue, tendon. Reticular connective tissue. Adipose connective tissue.

What a student should know:

Get to know the morphology of embryonic CT and CT with general properties

UNIT 4 (FOURTH WEEK):

CARTILAGE, BONE AND BLOOD

lectures 6 hours

Cartilage and bone tissue. Structure and classification of the cartilage. Chondrocytes and cartilage matrix. Bone: structure of cortical and spongy bone tissue, lamellar and immature bone. Bone tissue cells and extracellular matrix. **Blood and hematopoiesis.** Structure of the bone marrow. Hematopoietic microenvironment. Stem cells and hematopoiesis. Red and fatty bone marrow. Erythrocytes, leukocytes, platelets. Life cycle of blood cells.

What a student should know:

- Get to know the types, role and location of cartilage in the body
- Learn the common characteristics as well as the basis of the structure of individual types of cartilage
- Understand the structure of immature and mature bones
- To learn the types of cells, the basic morphological unit and the roles of bone
- Master the development of bone tissue
- Understand the bone remodeling process
- Understand the way blood elements are formed
- Learn stages of development and cellular characteristics of individual cells of blood lines
- Master the composition of the blood

labs 5 hours

Cartilage: hyaline, elastic, fibrous. Bone tissue: Bone and decalcified bone. Osteogenesis - endosomal and endochondral. Hematopoiesis - bone marrow, fatty bone marrow. Blood elements: Blood smear. Leukocyte formula.

What a student should know:

- To learn the histological characteristics of supporting connective tissues
- Master the morphology of formed blood elements

UNIT 5 (FIFTH WEEK):

MUSCLE AND NERVOUS TISSUE

lectures 6 hours

Muscle tissue. Microscopic structure of skeletal, cardiac and smooth muscle cells. Structure of myofibrils and myofilaments. Sarcoplasmic reticulum and the T-tubule system. Structural basis of contraction. Neuromuscular junction and muscle spindle. Nervous tissue. Neuron structure - morphofunctional types, perikaryon, dendrites and axon. Synapse - structure and types, structural basis of neurotransmission. Glial cells - types, structural and functional characteristics. Nerve fibers and peripheral nerve endings.

What a student should know:

- Understand the basis of the structure of nervous tissue
- Learn the types of cells that make up tissue
- Master the cytological characteristics of nerve tissue cells
- Become familiar with the role of individual cell populations

labs 5 hours

Muscle tissue: Smooth, skeletal, cardiac
Nervous tissue: Nerve cell, Nissl's substance, nerve fibers, myelin sheath. Sensitive corpuscle.

What a student should know:

- Understand the histological characteristics of certain types of muscle tissue, similarities and differences
- Get to know the structure of nerve cells and peripheral nerves
- Master the recognition of sensitive corpuscles

- Learn the types and structure of nerve endings and corpuscles
- Get to know the histological classification of muscle tissue
- Learn the role, location and basic function of certain types of muscles
- Learn the cytological characteristics of muscle cells
- Understand the way muscle tissue is organized
- Master the types of innervation and the specifics of the innervation of certain types of muscle tissue

ORGANOLOGY

UNIT 6 (SIXTH WEEK):

CIRCULATORY AND LYMPHATIC SYSTEM

lectures 6 hours

Circulatory system: Fundamentals of structural organization of cardiovascular system. Heart. Structure of blood vessels. Elastic and muscular arteries, microcirculation (arterioles, capillaries, venules). Veins. Endothelium. Lymphatic vessels.

Lymphatic system. Antigens, epitopes, antibodies, MHC complex. Lymphocytes and antigen-presenting cells. Primary and secondary lymphatic organs. Thymus, spleen, lymph node, tonsils. Lymphatic tissue of mucous membranes (lymphatic tissue of the digestive tract and respiratory tract).

What a student should know:

- Master the general characteristics of the circulatory system
- Familiarize yourself with the structure of the heart and blood vessels
- Learn the details of the structure of the heart
- Master the elements of the structure of arterial, venous blood vessels and capillaries
- Learn the histological characteristics of the lymphatic vessels
- Familiarize yourself with the basics of the composition and role of the lymphatic system
- Learn the details of the structure of the lymphatic organs
- Understand the role of the lymphatic organs

labs 5 hours

Heart. Blood vessels: elastic and muscular arteries. Continuous, fenestrated and sinusoidal capillaries.

Lymphatic organs: Folliculus lymphaticus solitarius, nodus lymphaticus, tonsils, spleen, thymus - histological organization and cytological analysis.

What a student should know:

- Learn the histological structure of the heart and blood vessels
- Master the recognition of individual types of arterial and veins
- Learn the histological characteristics of lymphatic organs
- Master the appearance of lymphocytes and plasma cells
- Understand the differences in the histological structure of lymphatic organs

UNIT 7 (SEVENTH WEEK):

DIGESTIVE SYSTEM 1

lectures 6 hours

Digestive tract: General characteristics of the structure of the digestive tract and regional specificities. Oral cavity, tongue, tooth. Esophagus, stomach, small and large intestine. Cytological features and characteristics of epithelial cells. Stem cells and epithelial regeneration. Endocrine cells of the gastrointestinal tract.

What a student should know:

- Familiarize yourself with the general structure plan of the digestive tube
- Master the histological structures of the oral cavity
- Learn the structure of the mucous membrane of the oral cavity
- Master the histological characteristics of the tongue
- Learn the histological structure of the lips
- Learn the parts of the teeth
- Master the histological structures of the esophagus
- Learn the details of the structure of the stomach, duodenum, jejunum, ileum, colon, appendix and rectum
- Master the types of cells present in these organs and their role

labs 5 hours

Lip, tongue, tooth, esophagus, cardia, fundus ventriculi, glandulae gastrica propria, pylorus duodenum, jejunum, ileum, colon, appendix.

What a student should know:

- Understand the general structure of the digestive tube and the characteristics of the esophagus
- Master the microscopic characteristics of the basic elements of the oral cavity
- Learn the details of the structure of the papillae of the tongue
- Master the histological characteristics of dentin, pulp and enamel
- Master the morphology of the parts of the stomach, similarities and differences
- Learn the important features of the parts of the intestinal wall
- Learn the characteristics of individual segments of the intestine, similarities and differences

UNIT 8 (EIGHTH WEEK):

DIGESTIVE SYSTEM 2

lectures 6 hours

Salivary glands. The function of saliva. Acini and excretory ducts of salivary glands. Classification of the salivary glands. Innervation and vascularization.

Liver, biliary tract, pancreas: General histological structure of the liver. Lobulation and zonal organization. Vascularization of the liver. Cytological characteristics of hepatocytes, Kupffer and perisinusoidal cells. Structure of the bile ducts. Microscopic structure of the gallbladder. Histological organization of the exocrine and endocrine part of the pancreas. Cytological characteristics of pancreaticocytes. Structure of the islet of Langerhans and characteristics of insulocytes.

What a student should know:

- Master the histological characteristics of salivary glands
- Familiarize yourself with the glands associated to the digestive tract
- Learn the histological structure of the liver and gallbladder

labs 5 hours

Salivary glands - serous, mucous and mixed. Pancreas - exocrine. Liver-structural organization, microcirculation, bile ducts, hepatocytes, Kupffer cells. Gallbladder.

What a student should know:

- Learn the histological structure of salivary glands
- Master the histological structure of the liver, gallbladder and pancreas
- Understand the cytological characteristics of hepatocytes, pancreaticocytes and insulocytes

- Master the details of the structure of the exocrine and endocrine pancreas

UNIT 9 (NINTH WEEK):

RESPIRATORY AND URINARY SYSTEM

lectures 6 hours

Respiratory system: Nasal cavity and sinuses. Microscopic structure of the larynx and trachea. Lungs: bronchopulmonary segments, bronchi, bronchioles and respiratory units. Cytological characteristics of bronchial epithelium and alveolar cells. Structure of the respiratory membrane. Pulmonary circulation. Pleura.

Urinary system: Histological organization of the kidney - cortex and medulla. Structure of nephron and collecting tubules. Juxtaglomerular apparatus. Vascularization and innervation. Excretory canalicular system, ureter and urinary bladder. Urethra.

What a student should know:

- Understand the basis of the composition of the respiratory system
- Master the histological structure of the nasal cavity, larynx and trachea
- Understand the distribution of individual elements of lung tissue
- Learn the details of the histological structure of the airways and alveoli
- Master the cytological characteristics and the role of the most important cells present in the respiratory system
- Get to know the basis of the structure of the urinary system
- Learn kidney architecture
- Master the structure and function of the nephron
- Understand the structure and function of the urinary tract and bladder

labs 5 hours

Epiglottis, trachea. Lungs: bronchi, bronchioles, alveoli. Kidney: Microcirculation; Renal corpuscle. glomerulus; Juxtaglomerular apparatus. Ureter, urinary bladder.

What a student should know:

- Master the general structure of the respiratory tract
- Understand the composition of the alveoli
- Learn the lobular architectonics of the kidney and the structure of the nephron
- Master the histological characteristics of the structure of the wall of the urinary tract

UNIT 10 (TENTH WEEK):

REPRODUCTIVE SYSTEM

lectures 6 hours

Male reproductive system: Histological organization of the testes. Seminiferous epithelium. Sertoli cells. Interstitium and Leydig cells. Blood-testicular barrier. Tubuli recti and rete testis. Ductuli efferents and ductus epididymis. Ductus deferens. Accessory glands and histological characteristics of the penis.

Female reproductive system: Histological organization of the ovary. Cyclic maturation of follicles. Corpus luteum. Histological organization of the fallopian tubes. Uterus: endometrium, cyclic changes, myometrium and perimetrium. Histological structure of the cervix, vagina and external genital organs. Mammary gland.

What a student should know:

- Understand the composition of the female reproductive system
- Learn the histological structure of parts of the female reproductive system
- Adopt the functional connection of the organs of the female reproductive system
- Understand the composition of the male reproductive system
- To learn the histological structure of parts of the male reproductive system
- Learn the structure of spermatozoa

labs 5 hours

Male reproductive system: Testis, epididymis, ductus deferens, seminal vesicle, prostate, penis. Female reproductive system: Ovary, uterine tube, uterus, vagina - histological organization and cytological analysis.

What a student should know:

- Master the micromorphology of the male reproductive system
- Learn the details of the structure of the testis and its excretory ducts
- Get to know the structure and function of the glands associated to the male reproductive system
- Master the micromorphology of parts of the female reproductive system
- Learn the structure of the ovaries
- Master the structure of a woman's reproductive canals
- Understand the menstrual changes of the endometrium

UNIT 11 (ELEVENTH WEEK):

NERVOUS SYSTEM AND SENSES

lectures 6 hours

Nervous system: Basics of nervous system organization. Histological characteristics of the cerebral and cerebellar cortex. Meninges. Choroid plexus and cerebrospinal fluid. Structural basis of the blood-brain barrier. Spinal cord. Peripheral and autonomic nervous system.

Special senses: Structure of sensory organs. Histological organization of the eye and accessory organs. Histological characteristics of the outer, middle and inner ear.

What a student should know:

- Learn the basic principles of the structure of the nervous system
- To learn the laminar structure of cerebrum and cerebellum and spinal cord
- Master the structure and function of the meninges

labs 5 hours

Nervous system: Cerebrum, cerebellum, spinal cord.

Eye: cornea, retina, eyelid. Ear - ductus cochlearis, organ of Corti

What a student should know:

- Get to know the laminar structure of the basic elements of the CNS
- Understand the general structure of the eye
- Learn the histological structure of certain parts of the eyeball
- Adopt the general characteristics and structure of the organ of Corti

- Learn the elements of the peripheral nervous system
- Understand the role of the autonomic nervous system
- Learn the parts of the eye
- Master the histological and cytological structure of the layers of the eyeball
- Learn the roles and structure of the accessory organs of the eye
- To learn parts of the ear
- Master the structure of the outer, middle and inner ear
- Understand the functioning of the organ of Corti and sense of balance

UNIT 12 (Twelfth Week):

ENDOCRINE SYSTEM AND INTEGUMENTARY SYSTEM

lectures 6 hours

Endocrine system: Histological and cytological organization of the pituitary gland, pineal gland, thyroid and parathyroid glands, adrenal glands. Diffuse endocrine system.

Skin: Epidermis structure and cell types. Cytological characteristics of the keratinization process. Dermo-epidermal junction. Dermis and hypodermis. Pilosebaceous apparatus. Sweat glands. Nail. Mammary gland.

What a student should know:

- Know the composition of the endocrine system
- Master the details of the structure of individual endocrine glands
- Learn the cytological characteristics of endocrine cells
- Understand the interaction between endocrine organs
- Master the basic roles and target tissues of individual hormonal products
- Understand the roles of skin and its derivatives
- Learn the laminar structure of the skin
- Master the cytological characteristics of skin cells
- Learn the types and structure of the skin appendages
- Get to know the role and structure of the breast

labs 5 hours

Endocrine glands: Pituitary gland, pineal gland, thyroid gland, parathyroid gland, adrenal gland, endocrine pancreas - histological organization and cytological analysis. Skin: Epidermis, dermis, hypodermis; hair, sebaceous and sweat glands. Nail; Mammary gland.

What a student should know:

- Adopt the common characteristics of the structure of the endocrine glands
- Master the characteristics of the morphology of individual endocrine glands
- Master the structure of the skin, skin appendages and mammary gland

UNIT 13 (WEEK THIRTEEN):

EMBRYOLOGY

GENERAL EMBRYOLOGY

lectures 6 hours

General Embryology: Fertilization, cleavage of the fertilized egg, morula, blastocyst and implantation. Preembryonic and early embryonic period of development. The fetal period of development. Placenta and fetal membranes.

What a student should know:

- Learn periods in human development
- Master the basic processes during development
- Master gametogenesis and the stages of the fertilization process
- Learn the stages of development during the pre-embryonic and embryonic period
- Understand the processes of differentiation and formation of important embryonic structures
- To learn the way of formation, structure and function of extraembryonic structures
- Understand the processes involved in the embryonic and fetal periods

labs 5 hours

Umbilical cord. Placenta.

What a student should know:

- Understand the stages of embryonic development
- Master the basics of the structure of the umbilical cord and the placenta

UNIT 14 (FOURTEENTH WEEK):

SPECIAL EMBRYOLOGY 1

lectures 6 hours

Special Embryology 1: Development of the cardiovascular system. Development of the nervous system. Development of the eye. Embryology of the ear. Development of the face and pharyngeal system. Development of the lymphatic system.

What a student should know:

- Learn the stages and basic details of the development of the cardiovascular system
- Understand the stages and basic details of the development of the nervous system and senses
- Learn the stages and basic details of the development of the face and pharyngeal system
- Learn the stages and basic details of the development of the lymphatic system

labs 5 hours

Stages of morphogenesis and organ system development schemes 1 (SIMBRIO demonstration)

What a student should know:

- Get acquainted with the structural characteristics of individual organ systems during their development

UNIT 15 (FIFTEENTH WEEK):

SPECIAL EMBRYOLOGY 2

lectures 6 hours

Special Embryology 2: Development of the endocrine system. Embryology of the respiratory system. Development of the digestive system. Development of the urinary system. Embryology of the male and female reproductive system.

What a student should know:

- Learn the stages and basic details of endocrine system development
- Learn the stages and basic details of the development of the respiratory system
- Learn the stages and basic details of the development of the digestive system
- Learn the stages and basic details of the development of the urinary system
- Learn the stages and basic details of the development of the male and female reproductive system

labs 5 hours

Morphogenesis stages and organ system development schemes 2 (SIMBRIO demonstration)

What a student should know:

- Get acquainted with the structural characteristics of individual organ systems during their development

LECTURE SCHEDULE

**INSTITUTE FOR EMERGENCY MEDICAL
ASSISTANCE**

TUESDAY

10:30 - 15:00

SCHEDULE OF LABS

THURSDAY	
ROOM (V31)	ROOM (V32)
08:00 - 11:45 IV group	11:45 - 15:30 Group V
11:45 - 15:30 I group	15:30 - 19:15 VI group
15:30 - 19:15 II group	
FRIDAY	
ROOM (V31)	ROOM (V32)
08:00 - 11:45 III group	08:00 - 11:45 VII group

Week	Type	Unit name	Lecturer
1	Theoretical	Introduction to histology and embryology. Cytology	Prof. dr Zoran Milosavljević
	Practical	Introduction to histology and embryology. Cytology	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic
2	Theoretical	Epithelial tissue	Prof. dr Nemanja Jovičić
	Practical	Epithelial tissue	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic
3	Theoretical	Connective tissue	Prof. dr Zoran Milosavljević
	Practical	Connective tissue	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic
4	Theoretical	Cartilage, bone and blood	Prof. dr Jelena Milovanovic
	Practical	Cartilage, bone and blood	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic
5	Theoretical	Muscle and nerve tissue	Prof. dr Zoran Milosavljević
	Practical	Muscle and nerve tissue	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic
6	Theoretical	Circulatory and lymphatic system	Prof. dr Nemanja Jovičić
	Practical	Circulatory and lymphatic system	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic
7	Theoretical	Digestive system 1	Prof. dr Zoran Milosavljević

Week	Type	Unit name	Lecturer
	Practical	Digestive system 1	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic
8	Theoretical	Digestive system 2	Prof. dr Nemanja Jovičić
	Practical	Digestive system 2	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic
9	Theoretical	Respiratory system and urinary system	Prof. dr Zoran Milosavljević
	Practical	Respiratory system and urinary system	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic
10	Theoretical	Reproductive system	Prof. dr Nemanja Jovičić
	Practical	Reproductive system	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic
11	Theoretical	Nervous system and senses	Prof. dr Zoran Milosavljević
	Practical	Nervous system and senses	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic
12	Theoretical	Endocrine system and integumentary system	Prof. dr Nemanja Jovičić
	Practical	Endocrine system and integumentary system	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic
13	Theoretical	General embryology	Prof. dr Zoran Milosavljević
	Practical	General embryology	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic

Week	Type	Unit name	Lecturer
14	Theoretical	Special embryology 1	Prof. dr Nemanja Jovičić
	Practical	Special embryology 1	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic
15	Theoretical	Special embryology 2	Prof. dr Jelena Milovanovic
	Practical	Special embryology 2	Prof. dr Zoran Milosavljević Prof. dr Nemanja Jovičić Prof. dr Jelena Milovanovic
EXAM			

ORAL EXAMINATION COMMISSION:

1. Prof. dr Zoran Milosavljević
2. Prof. dr Nemanja Jovičić
3. Prof. dr Jelena Milovanovic

EXAM QUESTIONS

CYTOLOGY AND HISTOLOGY

1. Cell membranes and specializations
2. Structure of the nucleus (matrix, envelope, chromatin, nucleolus)
3. Mitochondria
4. Endoplasmic reticulum and ribosomes
5. Golgi complex
6. Lysosomes, multivesicular bodies and peroxisomes
7. Centriole and centrosome
8. Cytoskeleton and cell motility
9. Cilia and flagella
10. Endocytosis and exocytosis
11. General characteristics of epithelial tissues and divisions
12. Polarization of epithelial cells, cell junctions and basement membrane
13. Simple epithelia (structure and distribution)
14. Pseudostratified epithelia (structure and distribution)
15. Epithelium of transitional type (structure and distribution)
16. Stratified epithelia (structure and distribution)
17. Glandular epithelia (characteristics, divisions and secretion mechanisms)
18. General characteristics of connective tissue structure
19. Embryonic connective tissues (mesenchyme and mucous tissue)
20. Loose connective tissue (cells and matrix)
21. Fibroblast (collagen biosynthesis and fibrillogenesis)
22. Cells of loose connective tissue (macrophage, mast cell, plasma cell).
23. Fibrous connective tissue (regular and irregular)
24. Fat tissue
25. Reticular tissue
26. General characteristics of cartilage cells and matrix
27. Hyaline cartilage
28. Elastic and fibrous cartilage
29. Chondrogenesis, regressive changes and cartilage regeneration
30. Bone - basic characteristics and structure of the matrix
31. Bone tissue cells
32. Osteogenesis
33. Histological characteristics of bone marrow
34. Cytological characteristics of hematopoiesis
35. Erythrocyte and erythropoiesis
36. Granulocytes and granulocytopoiesis
37. Monocytes and monocytopenesis

38. Lymphocytes and lymphocytopoiesis
39. Platelets and thrombocytopoiesis
40. Mononuclear phagocytic system
41. Histological characteristics of smooth muscle
42. Structure of skeletal muscle cells (myofibrils, sarcoplasmic reticulum and T tubules)
43. Motor plate (neuromuscular synapse) and muscle spindle
44. Structure of cardiac muscle cells
45. Characteristics and modalities of nervous tissue structure
46. Neuron structure (body, dendrites and axons)
47. Morphofunctional types of neurons
48. Neuroglia
49. Synapses: morphology and types. Structural basis of neurotransmission
50. Periaxon sheath (myelinated and unmyelinated). Axonal transport
51. Sensory and motor nerve endings

ORGANOLOGY

1. General characteristics of the structure of the cardiovascular system
2. Histological organization of the heart, conduction system
3. Histological organization of arteries
4. Microcirculation - arterioles, capillaries, venules
5. Endothelial cells: characteristics and types
6. Histological structure of veins
7. Lymphatic vessel system. Lymph capillaries
8. Histological characteristics of the oral cavity. Types of mucosa
9. Structure of the tongue - papillae. Gustatory corpuscle
10. Histological characteristics of teeth
11. Histological structure of the oesophagus
12. Histological structure of the stomach
13. Duodenum - histological structure
14. Jejunum – histological structure
15. Ileum – histological structure
16. Cells of the intestinal epithelium
17. Lymphatic tissue of the digestive tract
18. Histological structure of the colon
19. Histological structure of the appendix
20. Liver lobulation and zonal organization
21. Vascularization and microcirculation of the liver
22. Cytological characteristics of liver cells
23. Histological structure of bile ducts and gallbladder
24. Histological structure and division of salivary glands
25. Histological structure of the exocrine pancreas
26. Histological structure of the endocrine pancreas
27. Histological structure of the nasal cavity and sinuses
28. Histological structure of the larynx - vocal cords
29. Structure of the trachea - cellular composition of the epithelium
30. Bronchial tree (structure of bronchi and bronchioles - cellular composition of the epithelium)
31. Terminal bronchioles, respiratory bronchioles, alveolar ducts and saccules. Pulmonary lobule and acinus
32. Cytological organization of alveoli and respiratory barrier

33. General histological structure of the kidney. Cortex and medulla
34. Nephron morphology and types
35. Cytological organization of the renal corpuscle
36. Cytological organization of the tubular part of the nephron and collecting ducts.
Juxtaglomerular apparatus of the kidney
37. Ureter - histological structure
38. Urinary bladder - histological structure
39. Structure of the urethra
40. General histological characteristics of endocrine glands
41. Structure and cellular composition of the adenohypophysis
42. Structure of the neurohypophysis
43. The pineal gland (cells and structure)
44. Thyroid gland (cells and structure)
45. Parathyroid gland (cells and structure)
46. Histological organization of the cortex of the adrenal gland
47. Histological organization of the medulla of the adrenal gland
48. General histological organization of the lymphatic system. Lymphatic follicle
49. Thymus - structure and cellular composition
50. Lymph node - general histological structure and cellular composition
51. Structure of the white pulp of the spleen
52. Structural organization of the red pulp of the spleen (venous sinusoids). Vascularization of the spleen.
53. Histological structure of the tonsils
54. Principles of nervous system organization. Meninges.
55. Spinal cord – histological structure and cells.
56. Histological structure and cells of the cerebellum.
57. Histological structure and cells of the cerebrum.
58. Histological structure of the external ear.
59. Cavum tympani and tympanic membrane
60. Utriculus, sacculus and semicircular canals (macula and crista ampularis) – histological structure and cells.
61. Eyelid, conjunctiva and lacrimal glands - histological structure and cellular composition
62. Cornea and sclera - histological structure and cells.
63. Uvea - histological structure and cells of different segments.
64. Retina - histological structure and cells.
65. Macula lutea and fovea centralis of the retina and the structure of the optic nerve.
66. Ovary - histological structure. Ovogenesis and folliculogenesis.
67. De Graafian follicle and corpus luteum.
68. Uterine tube.
69. Uterus – histological organization.
70. Structure of the endometrium and the menstrual cycle.
71. Vagina – histological structure.
72. Testis and spermatogenesis
73. Tubuli recti and rete testis, ductuli efferentes and ductus epididymidis.
74. Sertoli cells. Interstitium and Leydig cells.
75. Ductus deferens and vesica seminalis.
76. Prostate - histological structure.
77. Penis – histological structure.
78. Epidermis - histological organization (keratinocytes and keratinization).
79. Dermis and hypodermis

80. Sebaceous and sweat glands - histological structure.
81. Histological structure of hair and nails.
82. Mammary gland - histological organization.
83. Cochlea and organ of Corti - histological structure and cells

EMBRYOLOGY

1. Gametogenesis
2. Fertilization and zygote
3. The pre-embryonic period of the development. Cleavage, implantation and blastocyst formation
4. Gastrulation and neurulation
5. Embryonic period of development
6. Somite formation
7. Bending of the embryo
8. The fetal membranes - chorion and amnion
9. Yolk sac and allantois
10. Placenta: structure and function
11. Umbilical cord
12. Fetal circulation
13. Head and neck development
14. Development of the respiratory system
15. Development of the oral cavity
16. Development of esophagus and stomach
17. Development of the small and large intestine
18. Liver development
19. Development of the pancreas and salivary glands
20. Development of the urinary system
21. Development of the male reproductive system
22. Development of the female reproductive system
23. Development of the heart
24. Development of the pituitary gland and pineal gland
25. Development of the thyroid gland
26. Development of the adrenal gland
27. Development of the nervous system
28. Development of the cerebrum
29. Development of the cerebellum
30. Eye development
31. Development of the outer and middle ear
32. Development of the inner ear