# MEDICAL UNIVERSITY – PLOVDIV

# FACULTY OF MEDICINE

## SYLLABUS

## IN

## DIAGNOSTIC IMAGING

**Approved by the Department Council on 02.07.2020**

**Confirmed by the Faculty Council - Protocol №5/08.07.2020**

**Diagnostic Imaging**

**Syllabus**

| Discipline | Final exam/ semester | Academic hours | | | | Academic hours in years and semesters | |
|---|---|---|---|---|---|---|---|
| | | | | | | 1st year | |
| | | Total | Lectures | Practices | ECTS | 1st sem. | 2nd sem. |
| Diagnostic Imaging | VI | 105 | 45 | 60 | 5,2 | 1/2 | 2/2 |

**DISCIPLINE**: Roentgenology and radiology

**TYPE OF DISCIPLINE ACCORDING TO THE UNIFORM STATE REQUIREMENTS:** Mandatory

**LEVEL OF QUALIFICATION**: Master

**FORMS OF TRAINING**: Lectures, practices, self-preparation

**YEAR OF TRAINING**: Regularly

**DURATION OF TRAINING**: Two semesters

**ACADEMIC HOURS**: 45 hours of lectures, 60 hours of practices

**TECHNICAL EQUIPMENT APPLIED IN THE TRAINING**: Multimedia presentations, thematically separate collections with digital and digitized images, solving practical cases

**FORMS OF EVALUATION**: Ongoing assessment, tests, seminars

**EVALUATION CRITERIA**: Average grade is formed for each semester

**ASPECTS OF EVALUATION CRITERIA**: Participation in seminars, solving tests, preparation of multimedia presentations

**SEMESTER EXAM**: Yes / entrance test, essay and interview. Variants have also been prepared for a distance online exam /

**STATE EXAM**: No

**LECTURER**: Habilitated lecturer from the department of  Diagnostic Imaging and the department of Clinical Oncology

**DEPARTMENT**: Diagnostic Imaging

## ANNOTATION

The training in Diagnostic Imaging aims to form doctors with extensive knowledge of modern methods of imaging, their informative value, their application in clinical practice, protocols for the appointment of imaging examination and selection of the most informative methods according to the required diagnosis. Students get acquainted with the imaging symptomatology of nosological units in accordance with medical standards and international requirements of the discipline, and also get acquainted with the modern diagnostic equipment.

## BASIC AIMS OF THE DISCIPLINE

The students' education includes fundamental knowledge on the physical and technical aspects of diagnostic imaging – the nature and properties of X-rays, the X-ray equipment and X-ray imaging, the nature and properties of ultrasound diagnostics, CT and MRI diagnostics. The basics of radiation protection is being studied, as well as work with contrast agents, preparation of patients for X-ray examination, methods of examination and X-ray symptomatology of diseases of the respiratory system, cardiovascular system, digestive system, urinary system, obstetrics and gynecology, mammary glands, bones and joints, neuroradiology, dental imaging.

## EXPECTED RESULTS

The medical student must:

- know the indications for the imaging examinations by nosological units, the contraindications for examination and the cases in which it is necessary to postpone the imaging examination or to replace it with an other examination;
- master the rules of radiation protection;
- know the basics of X-ray examination methods, as well as other image-diagnostic examination methods, the preparation for image-diagnostic examinations and the system for image interpretation;
- be acquainted with the radiological symptoms of the most common diseases by systems;
- acquire the following obligatory competencies - theoretical knowledge and practical skills.

How to fill document for diagnostic examination.

Description of radiography of the lung, normal and in the presence of pathology.

Preparation of the patient for X-ray and ultrasound examination of the digestive tract.

Description of the X-ray image in the normal gastrointestinal tract and in the presence of pathology.

Preparation of the patient for examination of the urinary system.

Description of examination of the urinary system in norm and pathology.

Description of examination of bones and joints in norm and pathology.

Presence of an examination of the lungs and digestive tract or a multimedia demonstration.

Presence during examinations in the ultrasound diagnostics rooms

Imaging examination methods in emergencies (pneumothorax, fractures, acute abdomen, pulmonary thrombosis).

Working with contrast agents. Premedication and control of allergic conditions. Rules and behavior.

Knowledge of the basic principles of interventional diagnosis and treatment.

## LECTURES

### LECTURE № 1 - 2 hours

Physical and technical aspects of diagnostic imaging

• Obtaining, nature and properties of X-rays. X-ray tube.

• Basic radiology methods of examination - X-ray and non X-ray. Methods and principles of obtaining images in different radiological methods.

• Methods for digitization of conventional X-ray images. Digital radiography. Methods for documenting imaging studies. Image archiving and transmission systems. DICOM, PACS
• Radiation protection - basic rules of operation. Dosimetry. Quality assurance in diagnostic imaging.

**LECTURE № 2 - 2 hours**

Respiratory system

• Imaging methods for examination of the respiratory system - indications and possibilities of the methods.
• X-ray anatomy of normal chest and respiratory organs.
• General X-ray simiotics of diseases of the chest and the respiratory system. Basic terms in the description of the study. Description of normal and pathological imaging.
• Imaging diagnosis of bronchial diseases. Bronchial obstruction. Factors. Types. Radiological characteristics of the changes. Foreign bodies in the bronchi.

**LECTURE № 3 - 2 hours**

Inflammatory diseases of the lungs

• Diagnostic imaging of non-specific inflammatory diseases of the lungs. Bronchitis. Pneumonia. Bacterial, viral, incl. COVID 19 pneumonia - findings and classification.
• Diseases of the pleura - pleural effusion, pneumothorax, pleural tumors, calcifications.
• Imaging diagnosis of the parasitic diseases of the lungs - echinococcus; X-ray characteristic.

**LECTURE № 4 - 2 hours**

• Pulmonary tuberculosis. Classification. X-ray images in primary and secondary pulmonary tuberculosis.
• Pneumoconiosis-silicosis, asbestosis.
• Benign and malignant lung tumors

**LECTURE № 5 - 2 hours**

Diseases of the heart

• Imaging methods for heart examination
• Imaging anatomy of the heart and large vessels.
• Heart diseases - acquired defects, pericarditis, myocarditis, cardiomyopathy
• Pulmonary changes in heart disease.

**LECTURE № 6 - 2 hours**

Diseases of the vessels

• Imaging methods for examination of vessels.
• Interventional methods for vascular diseases.
• Vascular diseases - aortic dissection, aortic aneurysm and thrombosis, atherosclerosis, Pulmonary thrombosis.

**LECTURE № 7 - 2 hours**

Obstetrics & Gynecology diseases

• Diagnostic methods in obstetrics and gynecology. Pregnancy and choice of diagnostic methodology according to the duration of pregnancy and indications for imaging.
• Methods of examination of mammary glands. Diseases of the mammary glands.
• Imaging methods of examination of the male and female pelvis. Diagnosis of diseases of the female genitalia.

**LECTURE № 8 - 2 hours**

Diseases of the digestive system

• Imaging methods for examination of the digestive tract.
• Normal X-ray anatomy of the esophagus, stomach and duodenum.
• X-ray semiotics of diseases of the digestive tract.
• Diseases of the esophagus - atresia, achalasia, diverticula, tumors, corrosive esophagitis, varicose veins.
• Foreign bodies in the esophagus.

**LECTURE № 9 - 2 hours**

Diseases of the stomach. Acute abdomen

• Diseases of the stomach - peptic ulcer, hiatal hernia - radiological symptoms. Complications of peptic ulcer disease.
• Stomach tumors.
• Acute abdomen - etiology, differential diagnosis, diagnostic methods.

**LECTURE № 10 - 2 hours**

Diseases of the small and large intestine

• Normal X-ray anatomy and imaging methods of small and large intestines.
• Imaging diagnosis of diseases of the small and large intestines
• Inflammatory bowel diseases - appendicitis, enteritis, Crohn's.
• Tumors of the small and large intestines

**LECTURE № 11 - 2 hours**

Diseases of the hepato-biliary system

• Imaging methods and normal X-ray anatomy of the liver and bile ducts
• Diagnostic imaging of the diseases of the hepato-biliary system
• Liver diseases - diffuse liver diseases - steatosis, cirrhosis; Focal liver diseases - primary and secondary.
• Diseases of the gallbladder and bile ducts: cholelithiasis, cholecystitis, tumors.

**LECTURE № 12 - 2 hours**

Diseases of the pancreas

• Imaging methods and normal radiological anatomy of the pancreas.
• Acute and chronic pancreatitis.
• Cysts and tumors of the pancreas.

**LECTURE № 13 - 2 hours**

Diseases of the urinary tract

Imaging methods of examination of the urinary tract
Normal radiological anatomy of the urinary tract
Diseases of the urinary tract - nephrolithiasis, hydronephrosis, congenital kidney abnormalities, kidney and bladder tumors. Imaging and diseases of the prostate gland.

**LECTURE № 14 - 2 hours**

Diseases of the CNS

• Imaging methods in the CNS. Brain examination.
• Ischemic and hemorrhagic strokes of the brain.
• Intracranial traumatic injuries.
• CNS tumors.
• Imaging methods for examination of the spine and spinal cord.
• Traumatic injuries to the spine and spinal cord.
• Disc herniations.

**LECTURE № 15 - 2 hours**

Bone diseases

• Imaging methods of bone examination.
• Normal X-ray anatomy of bones and joints.
• Main pathological processes in the bones: osteoporosis, osteosclerosis, osteolysis, osteonecrosis, periostosis, pathological bone remodeling.
• Traumatic injuries of the bones and the joints
• Inflammatory bone diseases.

**LECTURE № 16 - 2 hours**

Bone diseases

• Congenital dislocation of the hip joint. Hip dysplasia.
• Aseptic bone necrosis.
• Inflammatory bone diseases.
• Degenerative bone and joint diseases.
• Benign bone tumors.

• Malignant bone tumors.

## Practices

## I-st SEMESTER

### Practical № 1 – 2 hours

Introduction to Radiology

• Introduction to the specialty radiology and the structure of the department
Basic imaging methods for examination
X-ray methods: Radiography; Fluoroscopy; DSA; Computed tomography ; PET-CT.
Non- ionizing methods :Ultrasound; MRI;PET-MR.
Contrast materials for diagnostic imaging-classification. Advantages and disadvantages.
Indications and contraindications.
Radiation protection-basic rules of work.

### Practical № 2 – 2 hours

Demonstration of diagnostic imaging equipments in the bases for practical training
Structure of imaging machines.
Interaction of X-rays with matter. Obtaining X-ray images. Geometric properties of the X-ray image. Qualities of the X-ray image. Obtaining an image- analog and digital. DICOM-standart. PACS.

### Practical № 3 – 2 hours

Respiratory system

Imaging methods for examination of the respiratory system- indications and possibilities of the methods.
X-ray anatomy of normal chest and respiratory organs

General X-ray semiotics of diseases of the chest and respiratory system

Basic terms when describing a study.

Description of normal imaging and examination with pathological findings

**Practical № 4 – 2 hours**

Inflammatory Lung Diseases.

Imaging diagnosis of bronchial diseases

Impaired bronchial patency. Factors. Types. Radiological characteristics of the changes.

Foreign bodies in the bronchi.

Imaging diagnosis of non-specific inflammatory diseases of the lungs. COVID 19 pneumonia – imaging findings and classification.

Diseases of the pleura - pleural effusion, pneumothorax.

**Practical № 5 – 2 hours**

Inflammatory Lung DIseases

- Pulmonary tuberculosis. Classification. X-ray images in primary and secondary pulmonary tuberculosis
- Imaging diagnosis of parasitic diseases of the lungs - echinococcus; X-ray characteristic.

**Practical № 6 – 2 hours**

Tumors and occupational diseases of the lungs

Pneumoconiosis-silicosis, asbestosis.

Benign lung tumors

Malignant lung tumors

**Practical № 7 – 2 hours**

Respiratory system

- Summary, discussion on thesis prepared and presented by students.
- Test. Interpretation of imaging study.

## II-nd SEMESTER

**Practical № 8 – 2 hours**

Cardiovascular System

Imaging methods for examination of the heart.

X-ray anatomy of the heart.

Heart diseases- acquired valvular lesions, pericarditis, myocarditis, cardiomyopathy.

Pulmonary changes in heart diseases.

**Practical № 9 – 2 hours**

Cardiovascular system

Imaging methods for vessels

- Interventional methods for vascular diseases.
- Vascular diseases - aortic dissection, aortic aneurysm and thrombosis, atherosclerosis, Pulmonary embolism.

**Practical № 10 – 2 hours**

Diagnostic imaging in obstetrics and gynecology

Diagnostic imaging in obstetrics and gynecology.Pregnancy diagnosis and monitoring of pregnancy according to its term.Indications for diagnostic imaging.

Diagnostic imaging of the mammary glands

Diseases of mammary glands. Ca glandulae mammae

Diagnostic imaging of diseases of the female pelvis

**Practical № 11– 2 hours**

Diagnostic imaging of Gastrointestinal tract

Imaging in dentistry

Imaging methods for examination of the digestive tract.

Normal X-ray anatomy of the esophagus, stomach and duodenum.

X-ray semiotics of diseases of the digestive tract.

Diseases of the esophagus - atresia, achalasia, diverticula, tumors, corrosive esophagitis, varicose veins.
Foreign bodies in the esophagus

**Practical № 12– 2 hours**

Diagnostic imaging of disease of the stomach, small and large intestines.Acute abdomen.

Diagnostic imaging of diseases of the stomach- ulcer and its complications, hiatal hernia - imaging signs.
Gastric tumors.
Acute abdomen– etiology, differential diagnosis, imaging methods
Diagnostic imaging of diseases of the small intestines and large intestine: normal anatomy and pathological conditions
Inflammatory bowel diseases - appendicitis, enteritis, Chronic ulcerative colities, Crohn's disease
Tumors of the colon

**Practical № 13– 2 hours**

Diagnostic imaging of diseases of hepatobiliary system

Imaging modalities for diagnostics and normal X-ray anatomy of the liver and biliary system.
Diagnostic imaging of diseases of the hepatobiliary system.
Liver diseases: Diffuse liver diseases – steatosis, cirrhosis .Focal liver lesions- benign and malignant tumors –primary and secondary.
Diseases of gallbladder and biliary system: cholelithiasis and cholecystitis.

**Practical № 14– 2 hours**

Diseases of the pancreas

Imaging methods and normal X-ray anatomy of the pancreas.
Acute and chronic pancreatitis
Cysts and tumors of the pancreas.

**Practical № 15– 2 hours**

Disease of the urinary tract

Imaging methods for diagnostics of the urinary tract

Normal X-ray anatomy of the organs of the urinary tract.

Diseases of the urinary tract -nephrolithiasis, hydronephrosis,congenital kidney abnormalities, tumors of the kidneys and urinary bladder - renal cell carcinoma,transitional cell carcinoma, renal cysts.

**Practical № 16– 2 hours**

Neuroradiology

Imaging methods in the CNS. Brain examination.

Ischemic and hemorrhagic strokes of the brain.

Intracranial traumatic injuries.

CNS tumors.

**Practical № 17– 2 hours**

Neuroradiology

Imaging methods for examination of the spine and spinal cord.

- Traumatic injuries to the spine and spinal cord.
- Disc herniations.

**Practical № 18– 2 hours**

Diagnostic imaging of the bones

Imaging methods for examination of the bones

X- ray anatomy of bones and joints

Bone pathologies: osteoporosis, osteosclerosis, osteolysis, osteonecrosis, periostosis, pathological bone remodeling and deformity.

**Practical № 19– 2 hours**

Bone diseases

• Traumatic injuries of bones and joints

• Congenital dislocation of the hip joint. Hip dysplasia.

• Aseptic bone necrosis.

• Inflammatory bone diseases.

**Practical № 20– 2 hours**

Degenerative bone and joint diseases

Benign bone tumors

Malignant bone tumors

**Practical № 21– 2 hours**

Polytrauma-image-diagnostic algorithm.

CT image of traumatic injuries of parenchymal abdominal organs.

Overview of emergencies - BTE, aortic dissection, pneumothorax, pneumoperitoneum, ileus, emergencies in neurology and neurosurgery - strokes, intracranial trauma.

**Practical № 22– 2 hours**

• Summary of basic terms in diagnostic imaging.

• Description of normal imaging and examination with pathological findings in various organs and systems.

**Conspectus**

1. X-ray tube - basic components. X-ray image - obtaining, essence, qualities.
2. Digital X-ray images - obtaining. Methods for archiving and transmitting images. DICOM. PACS.
3. Principles of computed tomography - modern development
4. Principles of ultrasound examination - application

5. Principles of magnetic resonance imaging – concept of sequence
6. Contrast tools for diagnostic imaging - classification. Advantages and disadvantages.
7. Invasive X-ray methods. Interventional radiology
8. Radiation protection of staff and patients.
9. Imaging methods for examination of the respiratory system
10. X-ray diagnosis of airway diseases
11. Nonspecific inflammatory diseases of the lungs
12. Diseases of the pleura
13. Pulmonary tuberculosis. Classification. X-ray images in primary and secondary pulmonary tuberculosis
14. Lung cancer - diagnosis and staging with imaging methods.
15. Benign lung tumors. Echinococcus of the lungs
16. Occupational diseases of the lungs - silicosis
17. Imaging methods for examination of the mediastinum. Tumors of the mediastinum
18. Methods for imaging of the heart, coronary vessels, large and peripheral vessels
19. Normal X-ray anatomy of the cardiovascular shadow
20. Imaging diagnosis of acquired heart defects
21. Diseases of the myocardium
22. Imaging diagnosis of pericardial diseases
23. Imaging in diseases of the aorta and peripheral vessels.
24. Imaging methods for examination of the esophagus and stomach. Normal X-ray anatomy of the esophagus and stomach
25. Diseases of the esophagus - diverticula, strictures, tumors, varicose veins
26. Imaging diagnosis of peptic ulcer of the stomach and duodenum. Complications.
27. Hiatal hernia. Benign and malignant tumors of the stomach
28. Imaging methods for examination of the small and large intestines. Carcinoma of the colon
29. Imaging methods for examination of the liver. Diffuse liver diseases.
30. Focal diseases of the liver - primary and secondary tumors
31. Imaging methods for examination of the biliary system. Diseases of the gallbladder and bile ducts.
32. Imaging diagnosis of the pancreas. Diffuse and focal diseases. Pancreatic cancer.
33. Imaging methods for examination of the urinary system
34. Normal X-ray anatomy of the urinary system. Varieties and anomalies.
35. Urolithiasis. Hydronephrosis.
36. Tumors of the kidneys, ureters and bladder. Tumors of the prostate gland .
37. Imaging methods in obstetrics and gynecology.
38. Imaging diagnosis of the mammary gland. Benign and malignant diseases of the breast.
39. Imaging methods for examination of the musculoskeletal system.
40. X-ray images of the main pathological processes in the bones
41. Traumatic diseases of the bones and joints - fractures, fissures, dislocations, dislocation fractures, subluxations
42. Osteomyelitis - acute, chronic. Atypical forms. Bone and joint tuberculosis.
43. Benign bone tumors - osteoma, osteoid-osteoma, osteoblastoma
44. Benign bone tumors - chondroma, osteochondroma. hemangiomas, osteoclastoma
45. Malignant bone tumors - osteosarcoma
46. Malignant bone tumors - Ewing's sarcoma. Myeloma. Chondrosarcoma
47. Inflammatory and degenerative-dystrophic diseases of the joints and spine
48. Aseptic osteonecrosis - Perthes' disease.

49. Imaging methods for examination of the central nervous system
50. Brain tumors.
51. Imaging diagnosis in ischemic stroke.
52. Imaging diagnosis of intracranial hemorrhages.
53. Pulmonary thromboembolism - modern imaging methods for diagnosis
54. Aortic aneurysm and dissection
55. Examination methods and X-ray images in acute abdomen - differential diagnostic plan. Perforation of a luminal abdominal organ. Ileus
56. Posttraumatic patient

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