National Technical University of Ukraine
"Igor Sikorsky Kyiv Polytechnic Institute"

Department
biomedical engineering

METODS AND MEANS OF DIAGNOSING HUMAN PATHOLOGY

Working program of educational discipline (Syllabus)

Requisites of the Course

Cycle of Higher Education	***First (bachelor's)***
Branch of knowledge	*16 Chemical and Bioengineering*
Specialty	*163 Biomedical Engineering*
Educational program	*Medical Engineering*
Course status	*Mandatory discipline*
Mode of study	*full-time / day / mixed / remote*
Year of study/Semester	*1st year (autumn semester)*
ECTS workload	*4 ECTS credits / 120 hours*
Testing and Assessment	*Final Test, Module Test , Homework*
Course schedule	*According to the schedule on the site http://rozklad.kpi.ua/*
Language of instruction	*English*
Information about course supervisor / teachers	***Lecturer:*** *Associate Professor of BME, Candidate of Biological Sciences Kalashnikova Larysa , e-mail – doc_hom2000@yahoo/com* ***Practical:*** *Associate Professor of BME, Candidate of Biological Sciences Kalashnikova Larysa , e-mail – doc_hom2000@yahoo/com*
Course placement	*Platform «Sikorsky» - course "***Methods and means of diagnosing human pathology** *https://do.ipo.kpi.ua*

Distribution of hours

Semester	Lectures	Practical	Laboratory	Self-study
spring semester	*28*	*26*		*66*

Curriculum of the discipline

1. Course description, goals, objectives, and learning outcomes

The main purpose of the discipline "Methods and means of diagnosing human pathology " is to form students' ability to plan instrumental diagnostic activities, apply and improve medical devices to effectively assess the condition of human organs and systems and provide sound diagnostic conclusions.

The purpose of teaching the discipline is to provide students with theoretical knowledge and the formation of practical skills in modern diagnostic methods, history and state of development of tools for instrumental assessment of functional systems and individual human organs, basic requirements for diagnostic equipment, the degree of approximation of its capabilities to medical practice. , existing and promising methods for diagnosing pathology of organs and functions of the human body. The discipline also covers issues of operation, rational use of diagnostic equipment, safety of instrumental research, design solutions used in the creation of diagnostic devices, their systems and complexes, problems of reliability of diagnostic results, the relationship of instrumental diagnostics with clinical and laboratory diagnostics.

The objectives of the discipline are:

- ✓ *identification of modern problems of instrumental diagnosis of human pathology;*
- ✓ *mastering the methods and means of research using medical equipment and computer technology to examine a person;*
- ✓ *mastering the general principles and basic methods of assessing the functional state of human organs and systems;*

- ✓ *mastering knowledge about the equipment of departments, offices of functional diagnostics;*
- ✓ *mastering the methods of measuring the main indicators of the functioning of human physiological systems and evaluating research results.*

Since the discipline is selective, its study requires knowledge of the basics of developing operational documentation.

General competencies

GC 9 *- Ability to identify, formulate, and solve engineering problems related to the interaction between living and non-living systems* ***(enhancement)***

Special (professional) competencies

PC 01 - 3K 01. Ability to apply knowledge in practical situations ***(enhancement)***

PC 02. Knowledge and understanding of the subject area and understanding of professional activities ***(enhancement)***

The program learning outcomes after studying the discipline "" Methods and means of diagnosing human pathology "" are

PLO 02 - Formulate logical conclusions and reasoned recommendations regarding the assessment, operation, and implementation of biotechnical, medical-technical, and bioengineering tools and methods. ***(enhancement)***

PLO 08. Understand theoretical and practical approaches to the creation and management of medical equipment and medical technology ***(enhancement)***

PLO 18. Understanding of fundamental-applied, medical-physical, and physico-chemical principles governing the functioning of biological objects, as well as bioengineering fundamentals of technologies and equipment for researching human body processes ***(enhancement)***

2. Prerequisites and postrequisites of the course (place in the structural and logical scheme of education according to the relevant educational program)

The academic discipline ***"Methods and Instruments for the Diagnosis of Human Pathology"*** *is interdisciplinary in nature. According to its subject matter, it integrates knowledge from other disciplines, including Biophysics**,** Human Anatomy and Physiology**,** Biomedical Mechanics**,** Recording and Processing of Biosignals and Medical Images**, and** Measuring Transducers and Sensors**.***

According to the structural and logical scheme of bachelor training, the discipline is closely related to other courses of general and professional training, in ***particular*** *Fundamentals of Medical Device Design and Engineering**,** Laboratory and Analytical Techniques**,** Modern Optoelectronic Diagnostic Devices**,** and Therapeutic Medical Equipment, as well as courses in language and practical training.*

*The practical skills and theoretical knowledge acquired during the study of this discipline can be further applied in mastering the course "Research Work on the Topic of the Qualification Thesis"**,** during pre-graduation internship in the specialty, and form the basis for the preparation of qualification (bachelor's) theses, as well as for further professional activity in the field.*

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3. Course Overview

The main sections and topics that will be considered in the process of studying the course:

Section 1. The main types and methods of diagnosis.

Topic 1.1*. General classification of diagnostic methods.*

Topic 1.2*. Features of Conducting Diagnostics of Biological Objects and structures of the organism and their functional assessment.*

Section 2. Instrumental diagnostic methods

Topic 2.1 *X-ray methods of research. The principle of operation of X-ray equipment. Hardware of X-ray examination methods.*

Topic 2.2. *Magnetic resonance research method. Principle of the method. Classification of MRI equipment.*

Topic 2.3*. Radioisotope diagnostic methods. Positron Emission Tomography. Methods Based on Radiopharmaceuticals*

Topic 2.4*. The use of ultrasound in medicine. The principle of formation of ultrasonic equipment. Types of ultrasound imaging of human organs and systems. Diagnostic capabilities of ultrasound methods*

Topic 2.5. *Characteristics of methods for recording the electrical activity of organs: the physical basis of the method of cardiography. ECG recording equipment. Diagnostic capabilities of the method.*

Topic 2.6 .. *Characteristics of methods for recording the electrical activity of organs: the physical basis of the method of electroencephalography. Equipment for EEG registration. Diagnostic capabilities of the method.*

Topic 2.7. *Non-invasive cardiac diagnosis. Holter monitoring.*
Rheography, Blood pressure measurement. Physical bases of methods Hardware and diagnostic possibilities.

Topic 2.8*. Characteristics of methods for recording the electrical activity of organs: the physical basis of the method of myography. Equipment for EMG registration. Diagnostic capabilities of the method.*

Topic. 2.9. *Endoscopic research methods. Structural features and principle of operation of endoscopic equipment. Hardware of X-ray examination methods. Diagnostic possibilities of endoscopy.*

Topic. 3.0.*Thermography: the principle of the method, tooling.*

Topic. 3.1*. Optical Diagnostic Methods. COD, Diagnostics in Various Fields of Medicine.*

4. Coursebooks and teaching resources

Basic:

1. Дрозденко О.І., Паренюк Д.В. Ультразвукові технології та апарати [Електронний ресурс]: лаб. практикум: навч. посіб. для здобувачів ступеня бакалавра за освіт. програмою «Акустичні електронні системи та технології обробки акустичної інформації» спец. 171 «Електроніка» / КПІ ім. Ігоря Сікорського; уклад.: О. І Дрозденко, Д. В. Паренюк. – Електрон. текст. дані (1 файл). – Київ: КПІ ім. Ігоря Сікорського, 2024. – 44Основи біологічної фізики та медична апаратура: навчальний посібник / В. Г. Кнігавко, О. В. Зайцева, М. А. Бондаренко та ін. : за ред. проф. В. Г. Кнігавка. – Харків : ХНМУ, 2020. – 176 с
2. Ендоскопічна хірургія: навчальний посібник. В. М. Запорожан, В. О. Грубнік, Ю. В. Грубнік, А. В. Малиновський 2019.-526 с.
3. Основи реєстрації та аналізу біосигналів. Навчальний посібник / О.Г. Аврунін, В.В. Семенець, В.Г. Абакумов, З.Ю. Готра, С.М. Злепко, А.В. Кіпенський, С.В. Павлов. – Харків: ХНУРЕ, Медицина., -2019. – 400 с.
4. Основи біологічної фізики та медична апаратури. https://cloud.nvmk.org.ua/ebook/187

5. Основні принципи та можливість застосування ендоскопічного методу для діагностики захворювань внутрішніх органів : методичні рекомендації для самостійної підготовки до практичних занять здобувачів вищої медичної освіти 4-го року навчання з дисципліни за вибором «Методи візуалізації в інструментальному дослідженні захворювань внутрішніх органів» [Електронний ресурс] / укладачі М. С. Бринза, Т. В. Пересипкіна, Е. В. Карнаух. – Харків : ХНУ імені В.Н. Каразіна, 2025. – (PDF 30 с.)
6. Променева діагностика захворювань грудної клітини: навчальний посібник для студентів, за спеціальністю «Медицина», «Педіатрія», лікарів інтернів та лікарів за спеціальністю «Радіологія»/ уклад. : С.О. Мягков, Н.В. Туманська, О.Г. Нордіо – Запоріжжя : [ЗДМФУ], 2024. – 103 с
7. Фізичні основи функціонування медичного обладнання: навч. посіб. / В. Д. Дідух, Ю. А. Рудяк, О. А. Багрій-Заяць та ін. – ТНМУ, 2020– 340 с.
8. Фізичні основи функціонування медичного обладнання: навч. посіб. / В. Д. Дідух, Ю. А. Рудяк, О. А. Багрій-Заяць та ін. – ТНМУ, 2020– 340 с
9. Ядерна медицина: фізичні і хімічні основи. Бекман І.Н./навчальний посібник. Електронне видання https://stud.com.ua/135701/prirodoznavstvo/yaderna_meditsina_fizichni_ta_himichni_osnovi
10. Яковишена Л.О. Основи біологічної фізики та медична апаратура (у схемах і таблицях): навчально–методичний посібник / Людмила Олексіївна Яковишена. – Вінниця : ТОВ « », 2019. –104 с. Стор.7-15
11. Davidovits P. Physics in biology and medicine. 5-th ed. – Amsterdam: Elsevier Academic Press, 2019. – 377 p.

Supplementary:

1. *Біофізика. Фізичні методи аналізу та метрологія: під 663 ручник / Е. І. Личковський, В. О. Тіманюк, О. В. Чалий [та ін.];за ред. Е. І. Личковського, В. О. Тіманюка. Вінниця : Нова Книга, 2014.-464 с.*
2. *Владимиров Ю.А. Биофизика*: *Учебник*.-~~. М.: Медицина, 1983,. 272 с
3. Ємчик Л.Ф. Основи біологічної фізики і медична апаратура, Київ: Медицина, 2014. — 392 с
4. . *Єршов Ю.А. Біотехнічні системи медичного призначення: підручник.-2018.* *https://stud.com.ua/180525/tehnika/peredmova*
5. Злепко С.М., Коваль Л.Г., Гаврілова Н.М., Тимчик І.С. Медична апаратура спеціального призначення равчальний посібник. — Вінниця: ВНТУ, 2010. — 159 с.
6. . Методи променевої діагностики : навчальний посібник для студентів / уклад. Н.В. Туманська, К.С. Барська, І.П Джос – Запоріжжя : [ЗДМУ], 2016. – 92 с
7. Основи біологічної фізики і медична апаратура: Навч. посіб. / Свідрук Т.А. - К., 2017. 264с. Тиманюк В. А.
8. Радіологія: підручник / С.Ю. Кравчук: Медицина, 2019.- 296 с.
9. Рентгенологічні методи дослідження: навчальний посібник для студентів / уклад. Н. В. Туманська, К. С. Барська, С. В.Скринченко – Запоріжжя : [ЗДМУ], 2016. – 82 с

Educational content

5. Methods of mastering the discipline (educational component)

№ s/n	Subject	Program learning outcomes	The main tasks	
			Control measure	Completion Term
	Section 1. The main types and methods of diagnosis.			
1	*General classification of diagnostic methods.* ***Practikal work*** *The discussion teaches students to formulate logical conclusions and provide well-founded recommendations regarding the assessment, operation, and implementation of biotechnical, medical-technical, and bioengineering tools and methods. It also develops an understanding of theoretical and practical approaches to the design, management, and use of medical equipment and medical technology. During the discussion, fundamental and applied, medical-physical, and physico-chemical principles of the functioning of biological systems, as well as the bioengineering foundations of technologies and equipment for studying human body processes, are justified and analyzed.*	*PLO-02 PLO 08 PLO 18*	*Practical work 1*	*1st week*
2	***Features of Conducting Diagnostics of Biological Objects*** *and structures of the organism and their functional assessment.and structures of the organism and their functional assessment* ***Practikal work*** *The discussion teaches students to formulate logical conclusions and provide well-founded recommendations regarding the assessment, operation, and implementation of biotechnical, medical-technical, and bioengineering tools and methods. It also develops an understanding of theoretical and practical approaches to the design, management, and use of medical equipment and medical technology. During the discussion, fundamental and applied, medical-physical, and physico-chemical principles of the functioning of biological systems, as well as the bioengineering foundations of technologies and equipment for studying human body processes, are justified and analyzed.*	*PLO-02 PLO 08 PLO 18*	*Practical work 2*	*2nd week*
	Section 2. Instrumental diagnostic methods			
3	***X-ray methods of research****. The principle of operation of X-ray equipment. Hardware of X-ray examination methods* ***Practikal work*** *The discussion teaches students to formulate logical conclusions and provide well-founded recommendations regarding the assessment, operation, and implementation of biotechnical, medical-technical, and bioengineering tools and methods. It also develops an understanding of theoretical and practical approaches to the design, management, and use of medical equipment and medical technology. During the discussion, fundamental and applied, medical-physical, and physico-chemical principles of the functioning of biological systems, as well as the bioengineering foundations of technologies and equipment for studying human body processes, are justified and analyzed.*	*PLO-02 PLO 08 PLO 18*	*Practical work 3-4*	*3 th 4th- week*
4	***Magnetic resonance research method.*** *Principle of the method. Classification of MRI equipment* ***Practikal work*** *The discussion teaches students to formulate logical conclusions and provide well-founded recommendations regarding the assessment, operation, and implementation of biotechnical, medical-technical, and bioengineering tools and methods. It also develops an understanding of theoretical and practical approaches to the design, management, and use of medical equipment and medical technology. During the discussion, fundamental and applied, medical-physical, and physico-chemical principles of the functioning of biological systems, as well as the bioengineering foundations of technologies and equipment for studying human body processes, are justified and analyzed.*	*PLO-02 PLO 08 PLO 18*	*Practical work 5*	*5 th week*
5	***Radioisotope diagnostic methods*** *Positron Emission Tomography. Methods Based on*	*PLO-02 PLO 08*	*Practical work 6*	*6th week*

	Radiopharmaceuticals ***Practikal work*** *The discussion teaches students to formulate logical conclusions and provide well-founded recommendations regarding the assessment, operation, and implementation of biotechnical, medical-technical, and bioengineering tools and methods. It also develops an understanding of theoretical and practical approaches to the design, management, and use of medical equipment and medical technology. During the discussion, fundamental and applied, medical-physical, and physico-chemical principles of the functioning of biological systems, as well as the bioengineering foundations of technologies and equipment for studying human body processes, are justified and analyzed.*	*PLO 18*		
6.	. ***The use of ultrasound in medicine.*** *The principle of formation of ultrasonic equipment. Types of ultrasound imaging of human organs and systems. Diagnostic capabilities of ultrasound methods* ***Practikal work*** *The discussion teaches students to formulate logical conclusions and provide well-founded recommendations regarding the assessment, operation, and implementation of biotechnical, medical-technical, and bioengineering tools and methods. It also develops an understanding of theoretical and practical approaches to the design, management, and use of medical equipment and medical technology. During the discussion, fundamental and applied, medical-physical, and physico-chemical principles of the functioning of biological systems, as well as the bioengineering foundations of technologies and equipment for studying human body processes, are justified and analyzed.*	*PLO-02* *PLO 08* *PLO 18*	*Practical work* *7-8*	*7th 8th week*
7. *8*	***Physical Principles of Electrodiagnostic Methods*** *The physical basis of the method of electroencephalography. Equipment for EEG registration. Diagnostic capabilities of the method. The physical basis of the method of myography. Equipment for EMG registration. Diagnostic capabilities of the method* ***Practikal work*** *The discussion teaches students to formulate logical conclusions and provide well-founded recommendations regarding the assessment, operation, and implementation of biotechnical, medical-technical, and bioengineering tools and methods. It also develops an understanding of theoretical and practical approaches to the design, management, and use of medical equipment and medical technology. During the discussion, fundamental and applied, medical-physical, and physico-chemical principles of the functioning of biological systems, as well as the bioengineering foundations of technologies and equipment for studying human body processes, are justified and analyzed.*	*PLO-02* *PLO 08* *PLO 18*	*Practical work* *9-10*	*9 th 10th week week*
9.	***Non-invasive cardiac diagnosis****. Holter monitoring.* *Rheography, Blood pressure measurement. Physical bases of methods Hardware and diagnostic possibilities.* ***Practikal work*** *The discussion teaches students to formulate logical conclusions and provide well-founded recommendations regarding the assessment, operation, and implementation of biotechnical, medical-technical, and bioengineering tools and methods. It also develops an understanding of theoretical and practical approaches to the design, management, and use of medical equipment and medical technology. During the discussion, fundamental and applied, medical-physical, and physico-chemical principles of the functioning of biological systems, as well as the bioengineering foundations of technologies and equipment for studying human body processes, are justified and analyzed.*	*PLO-02* *PLO 08* *PLO 18*	*Practical work 11*	*11th week*
10.	***Endoscopic research methods.*** *Structural features and principle of operation of endoscopic equipment. Hardware of X-ray examination methods. Diagnostic possibilities of endoscopy* . ***Practikal work*** *The discussion teaches students to formulate logical conclusions and provide well-founded recommendations regarding the assessment, operation, and implementation of biotechnical, medical-technical, and bioengineering tools and methods. It also develops an understanding of theoretical and practical approaches to the design, management, and use of medical equipment and medical technology. During the discussion, fundamental and applied, medical-physical, and physico-chemical principles of the functioning of biological systems, as well as the bioengineering foundations of technologies and equipment for studying human body processes, are justified and analyzed.*	*PLO-02* *PLO 08* *PLO 18*	*Practical work 12*	*12th -week*
11	. ***Thermography:*** *the principle of the method, tooling.* *Computer diagnostics: the principle of the method, tooling* ***Practikal work*** *The discussion teaches students to formulate logical conclusions and provide well-founded recommendations regarding*	*PLO-02* *PLO 08* *PLO 18*	*Practical work 13*	*13th week MKP*

	the assessment, operation, and implementation of biotechnical, medical-technical, and bioengineering tools and methods. It also develops an understanding of theoretical and practical approaches to the design, management, and use of medical equipment and medical technology. During the discussion, fundamental and applied, medical-physical, and physico-chemical principles of the functioning of biological systems, as well as the bioengineering foundations of technologies and equipment for studying human body processes, are justified and analyzed.			
12	***Optical Diagnostic Methods.*** *COD, Diagnostics in Various Fields of Medicine* ***Practikal work*** *The discussion teaches students to formulate logical conclusions and provide well-founded recommendations regarding the assessment, operation, and implementation of biotechnical, medical-technical, and bioengineering tools and methods. It also develops an understanding of theoretical and practical approaches to the design, management, and use of medical equipment and medical technology. During the discussion, fundamental and applied, medical-physical, and physico-chemical principles of the functioning of biological systems, as well as the bioengineering foundations of technologies and equipment for studying human body processes, are justified and analyzed.*	*PLO-02 PLO 08 PLO 18*		*14th week*
13	*Submission esse*			*15th week Esse*
14	*Final tests*			*Pass Final tests*

6. Self-study

Independent study includes: *preparation for lectures and practical classes; completion and defense of an essay; preparation for modular assessment; preparation for the final credit, etc.*

No.	***Types of Independent Study Activities***	***Number of Independent Study Hours***
1	*Review of lecture material and study of topics assigned for independent work*	*16*
2	*Preparation for practical classes*	*24*
3	*Preparation for the modular assessment*	*10*
4	*Completion of an essay (term paper)*	*12*
5	*Preparation for the final credit (pass/fail test)*	*8*
	Total	***66***

Distribution of Student Independent Work Hours by Topic

No.	Titles of Topics and Issues for Independent Study (with References)	Number of Hours (Independent Study)
1	General classification of diagnostic methods. **List of issues for independent study**: features of classification of medical equipment in different countries of the world [3–5].	2
2	Features of diagnostics of biological objects and structures of the human body and their functional assessment. **List of issues for independent study:** features of biological structures as complex systems; concept of electrodes and sensors; measurement errors [3–5, 11].	4
3	Radiological research methods. Principle of operation of X-ray equipment. Hardware support of X-ray diagnostic methods. **List of issues for independent study:** hardware support of methods and their comparative characteristics [3–5, 7–9].	2
4	Magnetic resonance imaging (MRI). Principle of the method. Classification of MRI equipment. **List of issues for independent study:** hardware support of methods and their comparative characteristics [7–8, 10].	4
5	Radioisotope diagnostic methods. **List of issues for independent study:** hardware support of methods and their comparative characteristics [3–5, 9–10].	4

No.	Titles of Topics and Issues for Independent Study (with References)	Number of Hours (Independent Study)
6	Application of ultrasound in medicine. Principle of formation of ultrasonic equipment. Types of ultrasound visualization of human organs and systems. Diagnostic capabilities of ultrasound methods. **List of issues for independent study:** hardware support of methods and their comparative characteristics [1, 3–5].	4
7	Methods for recording electrical activity of organs: physical basis of cardiography. ECG recording equipment. Diagnostic capabilities of the method. **List of issues for independent study:** hardware support of methods and their comparative characteristics [3–5].	4
8	Characteristics of methods for recording electrical activity of organs: physical basis of myography. EMG recording equipment. Diagnostic capabilities of the method. **List of issues for independent study:** hardware support of methods and their comparative characteristics [7–8, 10].	4
9	Non-invasive cardiac diagnostics. Holter monitoring. Rheography. Blood pressure measurement. Physical principles, hardware support and diagnostic capabilities. **List of issues for independent study:** hardware support of methods and their comparative characteristics [3–5].	4
10	Thermography: principle of the method, hardware support. **List of issues for independent study:** hardware support of methods and their comparative characteristics [3–5, 10].	4
11	Endoscopic research methods. Design features and principle of operation of endoscopic equipment. Hardware support of endoscopic methods. Diagnostic capabilities of endoscopy. Optical diagnostic methods. Computer optical diagnostics (COD) in various fields of medicine. **List of issues for independent study:** hardware support of methods and their comparative characteristics [2, 7–8, 10].	4
12	Modular assessment (test).	8
13	Essay (individual assignment).	10
14	Final assessment (credit).	8
	Total	66

6.2. Preparation for Classroom Activities

Preparation for classroom activities is carried out according to the course plan, using the references provided on the MOODLE platform, and by completing the control tests available on MOODLE. Students are also encouraged to choose a topic for their research paper and prepare a 5–7 minute presentation.

6.3.Module Control Work (MCW)

Ten hours of independent work (IWS) are allocated for preparation for the Module Control Work.

6.3. Research Esse

*One of the main types of semester assessment in the "**Methods and means of diagnosing human pathology** " course is the research paper. The research esse must be completed in accordance with the requirements and submitted by the deadline specified by the instructor. The final submission deadline is the 12th week of the semester.*

The main purpose of the research paper is to analyze literary sources and independently systematize theoretical material. A student may write a research paper only on a topic approved by the instructor.

A research esse is a type of written work on a specific topic, with information collected from various sources, including less known and current literature on the subject.

The research esse serves as a form of assessment of the student's knowledge on the topics of the course.

Abstract - a type of written work, a statement on a particular topic, information for which is collected from various sources using current literature on the topic. The abstract is a form of testing the student's knowledge on the topics of the course. Abstract is an independent educational and scientific research of a student, which is performed on a specific topic, which is carried out outside the educational process

The main purpose of homework is to solve a practical problem using the material learned in lectures and independently, and practical skills acquired in practical classes. The student can write homework only on the subject agreed with the teacher.

Approximate subject of reports:

1. *Comparison of radiological methods*
2. *Features of computed tomography*
3. *Diagnostic value of the ECG method*
4. *Methods of measuring blood pressure*
5. *Ultrasound diagnostics*
6. *Modes and diagnostic capabilities of echocardiography*
7. *Methods for diagnosing pathology of the respiratory system*
8. *Diagnosis of pathology of the central nervous system*
9. *Methods for diagnosing renal pathology*
10. *Equipment and physical principles of endoscopy*
11. *Fundamentals of the electroneuromyography method*
12. *Biophysical foundations of rheography*
13. *Positron emission tomography (PET) method*
14. *Comparative characteristics of nuclear diagnostic methods*
15. *Features of design and types of ultrasound transducers*
16. *Advanced methods of ultrasound visualization*

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The abstract is performed in accordance with the requirements, within the period specified by the teacher.

Work structure:

The title page *is followed by a detailed plan (content) of the abstract, which should highlight the introduction, sections of the main content (main topics studied), their subdivisions (if necessary), conclusion, list of sources used. The table of contents on the right indicates the page numbers at the beginning of each question. Each section begins on a new page.*

Contents *- a page of work, which contains the title and page numbers of all sections, subsections and paragraphs; the headings of the table of contents must exactly repeat the headings in the text and are placed one below the other (list of symbols if necessary).*

Introduction *- substantiates the relevance of the topic, its practical significance; the object, subject, purpose and tasks of research are defined; the methods by which it was carried out are considered; reveals the structure of the work, its main content. The review should be systematized by the analysis of theoretical, methodical and practical novelty, significance, advantages and disadvantages of works.*

Sections and subsections of the main part - the analyzed and systematized material is presented in accordance with the content in the form of separate sections and subsections (chapters and paragraphs); each section covers an independent issue, and the subsection a separate part of this issue; the main idea, and also theses of each division is noted; the theory of the question and the experience of practical work are revealed.

Conclusions *- the result of the work, presented in the form of separate concise provisions that meet the objectives; there are not only positives and shortcomings, but also specific recommendations for their elimination;*

List of used literature (5-10) - reflects the amount of sources used and the degree of study of the research topic; contains a bibliographic description of the sources used by the student while working on the topic.

Appendices *- are not a mandatory element and are not included in the main limit of the amount of work, but increase the level of confidence in the results of work, indicate their reliability; contain supporting material in the form of samples of questionnaires, tests, tables of supporting digital data, diagrams, graphs, maps, illustrated material, etc.*

The total amount of the abstract depending on the chosen topic can vary from 20 to 25 pages of the main text (in agreement with the teacher). The volume of the abstract is determined by the student's ability to briefly and at the same time comprehensively explain and analyze scientific information resources

Mandatory requirement: clear reference to sources of information. All figures, facts, opinions of scientists, quotations, formulas should have a reference in the form of [2] (the number means the number of the source in the bibliography at the end of the creative work. The list of used sources (at least 10 sources) taken from the Internet, you need, as for ordinary literature, specify the author, the title of the article, and then provide the address of the site on the Internet.

The abstract *is evaluated by the following criteria: logic of the plan; completeness and depth of disclosure of*

the topic; correct formulation of conclusions and conclusions; design; substantiation of the student's own opinion on this issue in the form of a conclusion.
Deadline for submission of abstracts for review: 11-12th week of study. Mandatory oral presentation for 3-5 minutes on the chosen topic.

***The abstract** is not tested for plagiarism, but must meet the requirements of academic integrity. In case of academic dishonesty, the work is canceled and not checked.*

7. Attendance policy

Attending classes

Attendance at lectures is optional. Attending practical classes is desirable. All works and activities are aimed at the students' compliance with the assessment rating requirements. A significant part of a student rating is formed through active participation in activities in practical classes. Therefore, skipping a practical class does not allow a student to get points in the semester rating. General assessment takes place according to a scheme of the agreed grading system. Expected learning outcomes, control measures and deadlines are announced to students in the first practical class.

Control measures missed

Missed control measures (defense of practical work) can be worked out during the next classes, (provided that the task is scheduled for the current lesson), or in consultations.

Skipped express tests/ quizzes cannot be completed.

Skipped Module Test can be worked out in consultations.

Violation of deadlines, penalty points and rewarding points

Incentive Points	Criterion	Points
1	Improvement of practical work, active participation in practical classes	1 point (per practical work)
2	Completion of online courses on topics approved by instructors	3 points
3	Writing abstracts on the topics of the course	3 points
4	Preparation of a scientific paper for participation in student research competitions	5 points
5	Participation in international or national events/competitions, or winning a prize in a university competition related to the course	10 points
6	Writing a scientific article on the topics of the course	10 points

** if the control measure was missed for a good reason (illness, which is confirmed by a certificate of the established sample) - penalty points are not accrued.*

Academic integrity

The policy and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Read more: https://kpi.ua/code.

Norms of ethical behavior

Normative principles of behavior of students and employees, defined in sections 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Read more: https://kpi.ua/code.

Procedure for appealing the results of control measures

Students have the opportunity to raise any issue related to the control procedure and expect it to be addressed according to predefined procedures.

The student has the right to appeal the results of the control measure according to the approved provision on appeals in the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" (approved by the order №NON/128/2021 from 20.05.2021) - https://osvita.kpi.ua/index.php/node/182

Inclusive education

*The course " **Methods and means of diagnosing human pathology** "can be taught to the most of students with special educational needs.*

Distance learning

Distance learning takes place through the Sikorsky Distance learning Platform «Sikorsky».

Distance learning through additional online courses on certain topics is allowed subject to agreement with students. If a small number of students wish to take an online course on a specific topic, studying the material with such courses is allowed, but students must complete all the tasks provided in the discipline.

The list of courses is offered by the teacher after the students have expressed a desire (because the bank of available courses is updated almost every month).

The student provides a document confirming the completion of the distance course (in the case of a full course) or provides practical tasks from the distance course and subject to an oral interview with the teacher on the topics can receive grades for control measures provided for the studied topics (express control / test tasks, practical work).

Performance of practical works is carried out during independent work of students in a remote mode (with a possibility of consultation with the teacher through e-mail, social networks).

Teaching in a foreign language

Teaching in English is carried out only for foreign students.

At the request of students, it is allowed to study the material with the help of English-language online courses on topics that correspond to the topics of specific classes.

8. Monitoring and grading policy

8.1.Grading system (current control):

Home work	Homework	%	Weight points	Number	Total
1.	Express control works	45	15	3	45
2.	Active work on a practical classes	20	4	5	20
4.	Module Test (MT)	20	20	1	20
5.	Home control work	15	15	1	15
6	Final Test[1]	85	85	1	85
	Всього				100

8.2. Practical Class Performance. Evaluation Criteria

Weight per answer – 4 points Number of assessed answers – 5

Maximum total score – 4 × 5 = 20 points

Grade	Description of Performance	Points per Answer
Excellent	Answers are complete and correct (at least 90% of the required information)	4
Very Good	Answers are sufficiently complete (at least 80% of the required information)	3
Good	Answers are fairly complete (at least 70% of the required information)	2
Satisfactory	Answers are incomplete (at least 60% of the required information)	1
Unsatisfactory	Answers are missing or incorrect (less than 60% of the required information)	0

8.3. Modular Assessment. Evaluation Criteria

Total weight of the modular assessment – 20 points

Grade	Description of Performance	Score (points)
Excellent	Answers are complete and correct (at least 90% of the required information)	18–20
Very Good	Answers are sufficiently complete (at least 80% of the required information)	14–17

[1] Taken into account in the amount of the rating together with the grade for CGW in case the student has not scored 60 points per semester or he wants to improve his grade.

Grade	*Description of Performance*	*Score (points)*
Good	*Answers are fairly complete (at least 75% of the required information)*	*10–13*
Satisfactory	*Answers are incomplete (at least 60% of the required information)*	*6–9*
Unsatisfactory	*Answers are missing or incorrect (less than 60% of the required information)*	*0-5*

8.4. Research Esse

Weight – 15 points

The research paper is assessed according to the following criteria: logical structure of the plan; completeness and depth of topic coverage; accuracy of conclusion formulation; formatting; justification of the student's own opinion on the topic in the form of a conclusion; mastery of the topic (defense of the research paper). ***The defense of the research esse is mandatory.***

Assessment Criteria for the Research Paper

Grade Description	Points
"Excellent" The research paper is submitted and defended on time; all main requirements are fully met (at least 90%); the student is well oriented in the topic.	13–15 points
"Good": the main requirements for the research paper are met with some comments (at least 75%); the student demonstrates a good understanding of the topic. Or: the research paper is submitted after the deadline; the main requirements for the research paper are fully met (at least 90%); the student demonstrates a good understanding of the topic.	10–12 points
"Satisfactory" Not all main requirements are met (at least 60%); the student is generally oriented in the topic.	7–9 points
"Unsatisfactory" Main requirements are not met, or the student is not oriented in the topic.	0-6 points

In the final practical class of the course, students will add their rewarding points, if there are any, to the performance score, and /or subtract their penalty points if there are any, from the performance score, and in case it is in total higher than 60 points, they may either get their Pass or take the Final Test to improve their grade. If the grade for the Final Test is higher than the final performance grade, the student receives the grade based on the results of this Test. If the grade for the Test is lower, the final performance grade is cancelled and the student receives a grade based on the results of the Test.

Students whose final performance grade is 30-60 points have to take the Final Test in order to complete the course.

Students whose score is below 30 did not meet the requirements of the course and are not allowed to take the Final Test.

9.Calendar control *(CC) is performed twice a semester as monitoring of the current state of compliance with syllabus requirements.*

The purpose of calendar control is to improve the quality of student learning and monitor the implementation of the schedule of the educational process by students.

Criterion			*The first CC*	*The second CC*
Deadline of calendar controls			*8th week*	*14th week*
Conditions for obtaining a positive calendar control	*Current grade*		*≥15 балів*	*≥ 25 балів*
	Execution of practical work	*№№1-4*	+	+
		№№5-8	-	+
	Express control works /quizzes	*At least 4 of any lectures*	+	-
		At least 8 of any	-	+

		lectures		
	Module Test	*Estimated MCW*	-	+
	Home control work	*Estimated HCW*		+

In the case of a plagiarism or an academic poor quality during training the control measure is not credited.

Semester certification of students

Mandatory requirements for the admission to the Final Test		*Criterion*
1	*Current grade*	*RD ≥ 35*
2	*All practical works are completed*	*More than 5 points*
	Obtaining a positive assessment for the esse	*More than 7 points*
3	*Writing at least 2 control test*	*More than 15 points*

10.1. Assessment Criteria for Final Theoretical Questions (5 questions)

Grade	**Description**	**Score Range**
Excellent	The answer is correct and complete (at least 90% of the required information)	75–85 points
Very Good	Minor inaccuracies in the answer (at least 80% of the required information)	65–74 points
Good	Minor inaccuracies in the answer (at least 80% of the required information)	55–64 points
Satisfactory	The answer contains shortcomings and certain errors (at least 60% of the required information)	45–54 points
Sufficient	The answer contains shortcomings and certain errors (at least 60% of the required information)	35–44 points
Unsatisfactory	The answer is absent or does not meet the requirements for a "Satisfactory" grade	0-34 points

10.2. Assessment Criteria for a Final Theoretical Question (Weighting factor – 17)

Grade	**Description**	**Score Range**
Excellent	Answers are complete and correct (at least 90% of the required information)	15–17 points
Good	Answers are sufficiently complete (at least 75% of the required information)	12–14 points
Very Good	Minor inaccuracies in the answer (at least 80% of the required information)	9–11 points
Satisfactory	The answer contains shortcomings and certain errors (at least 60% of the required information)	6–8 points
Sufficient	Incomplete answers (at least 60% of the required information)	3–5 points
Unsatisfactory	Answers are absent or incorrect (less than 60% of the required information)	0-3 points

The results are announced to each student individually, either in person or remotely (by e-mail). The results are also recorded in the "Electronic Campus" system.

Optional conditions for admission to the examination:

1. *Active participation in practical classes.*
2. *Positive results of the first and second assessments.*
3. *Attendance of lecture classes.*

10.3.The final performance score or the results of the Final Test are adopted by university grading system as follows:

Number points	*Assessment on the university scale*
100-95	*Excellent*
94-85	*Very good*
84-75	*Good*
74-65	*Satisfactory*
64-60	*Sufficient Enough*

Less 60	*Unsatisfactory*
The course requirements are not met	*Not allowed*

11.Additional information on the course (educational component)

The list of questions for preparation for modular control work, and also for preparation for credit is given in appendix 1.

Distance learning through additional online courses on certain topics is allowed subject to agreement with students. If a small number of students wish to take an online course on a specific topic, studying the material with such courses is allowed, but students must complete all the tasks provided in the discipline.

The list of courses is offered by the teacher after the students have expressed a desire (because the bank of available courses is updated almost every month).

The student provides a document confirming the completion of the distance course (in the case of a full course) or provides practical tasks from the distance course and subject to an oral interview with the teacher on the topics can receive grades for control measures provided for the studied topics (express control / quizzes, practical work).

Work program of the course (syllabus) is developed by:

Larisa Kalashnikova ;*PhD, Associate Professor of BME, PhD in Biological Sciences,*

Approved by *the Department of Biomedical Engineering (Minutes No. 16 dated June 21, 2024)*

Approved by *the Methodical Commission of the Faculty of Biomedical Engineering (Minutes No. 9 dated June 26, 2024)*

Appendix 1 to the syllabus of the course

*" **Methods and means of diagnosing human pathology** "*

The list of questions for preparation for the Module Test,

And also for preparation for the Final test

1. Comparative characteristics of radiological research methods
2. Rheography, the essence of the method, use to assess blood circulation.
3. Cardiography, the essence of the method, diagnostic value
4. Holter monitoring, its significance for diagnosis.
5. How is Korotkov's blood pressure measured? What values of pressure thus turn out
6. Health, WHO definitions and others.
7. Illness, differences from the norm, state of health.
8. MRI: the essence of the method, diagnostic principle
9. Classification of equipment for MRI
10. Physical foundations of MRI
11. Types of MRI technologies
12. Contrasts for MRI method
13. Ultrasonic contrast agents
14. Diagnostic value of radiological research methods
15. Classification of methods of X-ray examination
16. The principle of the method of thermography
17. The principle of the MRI method
18. Physical foundations of electromyography
19. Diagnostic value of myography
20. Fundamentals of electroencephalography.
21. Methods of electroencephalography. Survey equipment
22. Types of ultrasonic sensors and their medical application
23. Physical bases of ultrasonic dopplerographic research
24. Physical bases of ultrasonic two-dimensional examination
25. Types of ultrasound examination
26. The principle of operation of the endoscope.
27. Classification of endoscopic techniques
28. The structure of the endoscope.
29. Basics of thermography.
30. Diagnostic significance of thermography
31. Types of electrodes for electroencephalography and their features
32. The essence of the method of oculography and its role in encephalographic examination
33. Optical computer diagnostics - the essence of the method and medical application
34. Electromyography, the essence of the method, block diagram of the apparatus for myography
35. Diagnostic possibilities of endoscopy.
36. Artifacts of ultrasound research
37. What is a problem patient

38. Classification of ultrasonic devices
39. Classification of radioisotope research methods
40. The principle of the method of scintiography