Odesa National Medical University
Department of Biophysics, Informatics and Medical Equipment

Course Syllabus

Medical devices

Amount	90 hours, 3 credits
Semester, year of study	2 semester, 1 year
Day, time and place	The time and place (lecture auditory, classroom, etc.) where lessons are held on are appointed in accordance with the approved schedule of lessons.
Teacher (-s)	Prof. Godlevsky L.S., PhD, MD, chief of the department, associate prof. Mandel O.V., senior teacher Marchenko S.V.
Phone (contact)	(048) 717-89-16; (048) 712-31-02
E-mail	medphys@onmedu.edu.ua
Working place	Department of Biophysics, informatics and medical devices. Olgiyevska str., 4.
Consultations	*Off-line consultations*: Thursday from 15:00 till 17:00; Saturday from 9:00 till 12:00 *On-consultations:* Consultations are performed by prior agreement with the teacher.

COMMUNICATION

Communication with graduate students will be carried out through face-to-face meetings. In the transition to distance learning, contact with graduate students will be carried out using e-mail and programs: Microsoft Teams, Moodle, Telegram, and Viber.

COURSE ABSTRACT

The subject of discipline study:

The subject of study of the selective discipline "Medical Equipment" are

- computer equipment,
- software for personal computers,
- technologies for the provision of medical and diagnostic services,

- Physical principles of operation of the main classes of modern medical equipment and methods of processing medical and biological information.

Course prerequisites and post-requisites (Place of the discipline in the educational program):

The discipline "Medical Devices" is based on the study by students of the following educational disciplines: medical and biological physics, higher mathematics, medical biology, morphological disciplines, integrates with these disciplines and forms the ability to apply knowledge in the process of further education and professional activities.

The purpose of the course:

The purpose of the selective discipline "Medical Equipment" is the formation of skills to apply the title of medical equipment in further training and professional activities, as well as to process medical and biological information using modern techniques.

- ***Objectives of the discipline:***
- providing applicants for the degree of Doctor of Philosophy with knowledge of modern diagnostic and therapeutic technologies and trends in their development;
- providing applicants for the degree of Doctor of Philosophy with the skills to use the main classes of technical means of collecting information and influencing the human body for therapeutic purposes;
- providing applicants for the degree of Doctor of Philosophy with knowledge on methods of searching, storing, processing and transmitting medical and biological data, mastering the basic principles of formalization and algorithmization of diagnostic tasks.

Expected results

According to the results of the study of the discipline, graduate students must **know:**

- the main technical groups and classes of modern medical and diagnostic equipment used in Ukraine and abroad:
- current trends and prospects for the development of medical instrument making;
- the procedure for working with typical modern devices and devices:
- the principle of operation and structure of modern medical equipment by areas of application;
- biophysical foundations that underlie the work of modern medical devices for diagnostic and therapeutic purposes:
- rules of technical quality of functional safety when working with the main classes of medical and diagnostic equipment;

- basics of metrological control of measuring instruments for medical purposes;

have to get skills:

- work on bioelectric signal registration devices - electrocardiography, electromyography, electroencephalography;
- observe safety rules when using medical devices;
- work with computerized medical devices and determine the main diagnostic characteristics of the information received;
- perform the necessary methodological actions to prepare the patient for the diagnostic or therapeutic procedure following the methodological rules of work on the relevant medical apparatus;
- use the instructions and descriptions of self-mastering the rules of operation of medical devices;

COURSE DESCRIPTION

Forms and methods of education

The course will be presented in the form of lectures (16 hours) and practical classes (28 hours), the organization of independent work of graduate students (46 hours), and a total of 90 hours (3 credits).

The study of the discipline should be implemented based on problem presentation, heuristic, research, and interactive (project method).

Content of the academic discipline:

Topic 1. General classification of medical equipment.
Topic 2. Diagnostic medical equipment.
Topic 3. Computer systems for processing biomedical data.
Topic 4. Therapeutic medical equipment.
Topic 5. Devices of life support systems.

Recommended literature:

The main one:

1. Biomedical Devices: Design, Prototyping, and Manufacturing / Tuğrul Özel, Paolo Jorge Bártolo, Elisabetta Ceretti, Joaquim De Ciurana Gay, Ciro Angel Rodriguez, Jorge Vicente Lopes Da Silva — Copyright © 2017 by John Wiley & Sons, Inc. All rights reserved, — ISBN:9781118478929
2. Design of Biomedical Devices and Systems, 4th edition / By Paul H. King, Richard C. Fries, Arthur T. Johnson — Copyright Year 2019 by CRC Press — 542 Pages, 85 B/W Illustrations — ISBN 9781138723061

3. Medical Devices and Instrumentation. Editor-in-Chief John G. Webster (USA, 2020) Second Edition Vol. 5. Available at: **The Encyclopedia of Medical Devices and Instrumentation** is available online at http://www.mrw.interscience.wiley.com/emdi
Also, posted at Department Informational Site.

Additional:

1. Intermediate Physics for Medicine and Biology / Russell K. Hobbie (Author), Bradley J. Roth. — 5th ed. — Springer Science+Business Media, 2015. — ISBN-13: 978-3319126814, ISBN-10: 3319126814
2. Compendium of Biophysics / Andrey B. Rubin First © 2017 Scrivener Publishing LLC ISBN:9781119160250 |Online ISBN:9781119160281 |DOI:10.1002/9781119160281
3. Biophysics: An Introduction / Roland Glaser. Springer-Verlag Berlin Heidelberg, 2012. ISBN 978-3-642-25212-9
4. Physics in Biology and Medicine - 5th Edition / Paul Davidovits. Academic Press, 2018. ISBN: 9780128137178
5. Membrane Structural Biology With Biochemical and Biophysical Foundations 2nd Edition / Mary Luckey, San Francisco State University, 2014 ISBN: 9781107030633
6. Biophysics: Tools and Techniques / Betty Karasek. East West Books, 2017. ISBN-13: 978-1632385444. ISBN-10: 1632385449

Informational Resources:

1. http://amphu.org (Medical Physics in Ukraine)
2. http://uamedphys.blogspot.com (Books on Medical Physics)
3. http://iopscience.iop.org/0031-9155 (Journal “Physics in Medicine and Biology”)
4. www.mednavigator.net (Medical Browsing System)
5. https://physicsworld.com/c/medical-physics (Informational resources for medical and biological physics)
6. http://iomp.org (International Physics Society)
7. https://aapm.org/default.asp (North America Medical Physics Association)
8. https://aapm.onlinelibrary.wiley.com/journal/24734209 (Journal «Medical Physics»)
9. https://efomp.org (European Federation of Medical Physics).

EVALUATION:

Methods of current control: Evaluation of the success of studying each topic of the discipline is performed according to a traditional 4-point scale.

The current academic performance is calculated as the average current score, i.e., the arithmetic average of all grades received by the graduate student on a traditional scale, rounded to 2 (two) decimal places, for example, 4.75.
Assessment of current discipline control:

The value of the grade "**excellent**": the graduate student shows special creative abilities, knows how to acquire knowledge independently, finds and processes the necessary information without the help of a teacher, and knows how to use the acquired knowledge and skills to make decisions in non-standard situations, convincingly argues answers, independently reveals his gifts and inclinations.

The meaning of the grade "**good**": the graduate student has a good command of the studied material, applies it in practice, solves exercises and problems in familiar situations, and independently corrects the mistakes made, the number of which is insignificant.

The value of the assessment is "**satisfactory**": the graduate student reproduces a significant part of the theoretical material and demonstrates knowledge and understanding of the main provisions; with the help of the teacher, he can analyze the educational material, correct errors, among which there are a significant number of significant ones.

The value of the assessment is "**unsatisfactory**": the graduate student has mastered the material at the level of individual fragments, which constitute a small part of the educational material.

Only graduate students with no academic debt and an average score for the current educational activity of at least 3.00 are admitted to the final certification.

Forms and methods of final control:

Differential assessment is the final control of knowledge in the academic discipline:

The average score for the discipline is translated into a traditional evaluation of the discipline on a 4-point scale and is considered as the ratio of this arithmetic

average to the percentage of assimilation of the required amount of knowledge in the given subject.

A graduate student (seeker) is admitted to the final examination (differential credit) only if there is no academic debt and the average score for the current educational activity is not less than 3.00.

The grade for the discipline is the arithmetic average of two components:

1) average current score as the arithmetic average of all current grades;
2) traditional assessment for differential credit.

The average score for discipline	The relation obtained by the graduate student the average score for the discipline to the maximum possible value of this indicator	Score with disciplines on a 4-point scale (traditional assessment)
4,45 – 5,0	185-200	5
3,75 – 4,44	151-184	4
3,0 – 3,74	120-150	3

Independent work of graduate students (self-preparing).

The independent work of graduate students, which is provided by the lesson's topic and the classroom work, is evaluated during the current control of the topic in the corresponding lesson. The last lesson checks the mastery of topics presented only for independent work.

COURSE POLICY ("rules of the game")

Policy on deadlines and rescheduling: if the student of higher education was absent from classes for any reason, then the practice is carried out within the deadlines set by the teacher, following the Regulation on the organization of the educational process at ONMedU https://onmedu.edu.ua/wp-content/uploads/2020/01/osvitnij-proces.pdf. All tasks provided by the program must be completed within the deadlines set by the teacher.

Academic Virtue Policy:

The policy of the educational component is based on the principles of academic virtue (link to the regulations on the university website: https://onmedu.edu.ua/wp-content/uploads/2020/07/polozhennja-pro-dobrochesnist.pdf. It is determined by the requirements that the teacher presents to the applicant when studying the educational component:

♦ independent performance of educational tasks, tasks of current and final control of learning results (for persons with special educational needs, this requirement is applied taking into account their individual needs and capabilities);

♦ links to sources of information in the case of using ideas, developments, statements, and information.

Attendance and Tardiness Policy: Attendance and work in classroom classes (lectures and seminar classes) are mandatory for obtaining a satisfactory grade. A graduate student is allowed to be late for no more than 10 minutes.
Mobile devices: you can use mobile devices in class with the teacher's permission.

Behavior in the audience: While in the audience, the following are important: respect for colleagues; tolerance for others; receptivity and impartiality; the ability to disagree with an opinion, but respect the personality of the opponent (during discussions); thorough argumentation of one's opinion; compliance with the ethics of academic relationships.