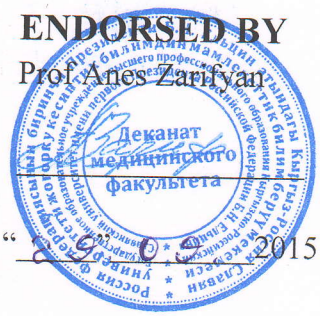
MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION,
MINISTRY OF EDUCATION AND SCIENCE OF THE KYRGYZ REPUBLIC

Government-run Educational Institution of Higher Professional Education
Kyrgyz-Russian Slavic University
School of Medicine

ENDORSED BY
Prof Anes Zarifyan



"___" _____ 2015

Physics, Mathematics

Course Outline (Module)

Assigned to the department of	Physics, Medical Informatics and Biology
Academic Curriculum	31050150_15_13GM.pli.xml 31.05.01. General Medicine
Mode of Study	**Intramural**
Total Credit Value	**_3_credit point**
Course Hours	108
including:	credit
in-class learning	90
individual work	18

Scope of Testing Semesters:
credits with assessment - 1

Course Hours Scheduling (per semester)						
Semester Academic Year	1 (1.1)		2 (1.2)		Total	
Weeks			21			
Type of Traning	AC	CO	AC	CO	AC	CO
Lectures			18	18	18	18
Lab Practical						
Practical Session			72	72	72	72
Including Interactive			4	4	4	4
Total In-class Session			90	90	90	90
Individual Work						
Face-to-face Learning			90	90	90	90
Individual Work			18	18	18	18
Total			108	108	108	108

The Course outline developed by:
Bolot K.Sadybakasov, Ph.D. in Physics & Mathematical Sci., Docent _____

Reviewers:
Nurbek J.Leenbaev, Dr.Sci. in Physics & Mathematics, Professor _____

The Course Outline
Physics, Matematics

developed in full compliance with FSES 3+:

Federal State Education Standards of Higher Professional Education for students trained for specialty 31.05.01. (The Ministry of Education and Science of the Russian Order of "09" February 2016 № 95)

in accordance with Academic Curriculum:
31.05.01. General Medicine

confirmed by KRSU Board of Academics in 29.09.2015 record № 2.

The Course Outline endorsed by Physics, Medical Informatics and Biology Department Meeting

Record of 26.08 2015 y. № 1
Valid for: 2015-2021 academic year
The Head of Department, Ph.D., associate professor Sorokin A.A.

The course outline endorsed for the following academic year

Chairman of the Educational and Methodological Board
04.09 2019y.

The course outline has been revised, considered and endorsed for implementation in 2019-2020Academic Year at the Staff Meeting of Physics, Medical Informatics and Biology Department

Record of 27.08 2019 y. № 1
The Head of Department, Ph.D., associate professor Karaeva R.R.

Chairman of the Educational and Methodological Board
23.09 2020y.

The course outline has been revised, considered and endorsed for implementation in 2020-2021 Academic Year at the Staff Meeting of Physics, Medical Informatics and Biology Department

Record of 12.09 2020y. № 3
The Head of Department, Ph.D., associate professor Karaeva R.R.

Chairman of the Educational and Methodological Board
09.09 2021y.

The course outline has been revised, considered and endorsed for implementation in 2021-2022Academic Year at the Staff Meeting of Physics, Medical Informatics and Biology Department

Record of 26.08 2021 y. № 1
The Head of Department, Ph.D., associate professor Karaeva R.R.

Chairman of the Educational and Methodological Board
__ _____ 2022y.

The course outline has been revised, considered and endorsed for implementation in 2022-2023Academic Year at the Staff Meeting of Physics, Medical Informatics and Biology Department

Record of __ _____ 2022 y. №
The Head of Department, Ph.D., associate professor Karaeva R.R.

КЫРГЫЗ РЕСПУБЛИКАСЫНЫН
ИЛИМДЕР УЛУТТУК АКАДЕМИЯСЫ
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№ 10/06-01/175 «29» декабря 2017г.

На № _____

Рецензия

на рабочую программу дисциплины «Физика, математика» (направление подготовки «Лечебное дело» для студентов-иностранцев первого курса медицинского факультета КРСУ) на английском языке

Рабочая программа по физике и математике составлена в соответствии с Федеральным государственным образовательным стандартом высшего профессионального образования по специальности «Лечебное дело», утвержденного Министерством образования и науки РФ.

Рекомендуемая рабочая программа включает: цели освоения дисциплины, ее роль в структуре ООП, взаимосвязь с другими дисциплинами, компетенции обучающегося, формируемые в результате освоения дисциплины, перечень разделов и тем.

В рабочей программе представлен большой массив оценочных средств для текущего контроля, промежуточной аттестации и итогового контроля знаний студентов.

Предложенная тематика лекций и практических занятий по курсу «Физика, математика» способствуют формированию у студентов математических, физико-технических и биофизических знаний и умений, необходимых как для обучения другим учебным дисциплинам, так и для непосредственного формирования врача.

Рабочая программа включает также темы для самостоятельной работы студентов с использованием списка основной и дополнительной литературы.

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Директор ИФТП и М НАН КР
д.ф.-м.н., профессор Н.Ж.Жеенбаев

Подпись заверяю.

КЫРГЫЗ РЕСПУБЛИКАСЫНЫН
ИЛИМДЕР УЛУТТУК АКАДЕМИЯСЫ
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Рабочая программа дисциплины «Физика, математика» кафедры Физики, медицинской информатики и биологии соответствует требованиям государственного стандарта РФ и может быть рекомендована к использованию в учебном процессе.

Директор ИФТП и М НАН КР
д.ф.-м.н., профессор Н.Ж.Жеенбаев

Подпись заверяю.

ОТДЕЛ КАДРОВ

Рецензия

на рабочую программу дисциплины «Физика, математика» для студентов-иностранцев первого курса медицинского факультета КРСУ

Настоящая рабочая программа по физике и математике составлена в соответствии с Федеральным государственным образовательным стандартом высшего профессионального образования по специальности «Лечебное дело», утвержденного Министерством образования и науки РФ.

Рабочая программа включает: цели освоения дисциплины, ее роль в структуре ООП, взаимосвязь с другими дисциплинами, компетенции обучающегося, формируемые в результате освоения дисциплины, перечень разделов и тем.

В рабочей программе представлен большой массив оценочных средств для текущего контроля, промежуточной аттестации и итогового контроля знаний студентов.

Предложенная тематика лекций и практических занятий по курсу «Физика, математика» способствуют формированию у студентов математических, физико-технических и биофизических знаний и умений, необходимых как для обучения другим учебным дисциплинам, так и для непосредственного формирования врача.

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Рабочая программа дисциплины «Физика, математика» кафедры физики, медицинской информатики и биологии соответствует требованиям государственного стандарта РФ и может быть рекомендована к использованию в учебном процессе.

Н.Касмамытов,
д.ф.-м.н.,
профессор кафедры физики и микроэлектроники КРСУ

Подпись заверяю:

КАДР БӨЛҮМҮ
ОТДЕЛ КАДРОВ
ИНН 00108199710223

1. THE PURPOSE OF LEARNING	
1.1	Contribute to the mastery of mathematical apparatus necessary for solving theoretical and practical problems by medical students, the development of students' ability to self-study of mathematical literature and the ability to express the natural science and clinical problems by mathematical language.
1.2	To promote formation by medical students of the system knowledge about the physical properties and physical processes occurring in biological objects, including the human body, necessary for the development of other academic disciplines and the formation of professional medical qualities.
1.3	Formation by students logical thinking, the ability to accurately formulate the problem, the ability to isolate the main and secondary, the ability to draw conclusions based on the results of measurements.

2. DISCIPLINE AS A PART OF THE STRUCTURE OF B.E.P.	
Cycle (section) OOП:	B1.B
2.1	**Requirements for pre-training of the student:**
2.1.1	School course of physics and mathematics (Know: mathematical methods of solving problems; the basic laws of physics. Be able: to state physical and mathematical laws and theorems. Skills: solve physical and mathematical problems).
2.2	**Disciplines and practices for which the study of this discipline (module) is necessary as a prior:**
2.2.1	Chemistry and Biochemistry
2.2.2	Normal and Pathological Physiology
2.2.3	Medical Informatics
2.2.4	Probative Medicine
2.2.5	Physiotherapy

3. THE COMPETENCE OF THE LEARNER, FORMED AS A RESULT OF LEARNING (MODULE)	
BPC-7: readiness to use basic physical, chemical, mathematical and other natural science concepts and methods in solving professional problems	
To know:	
Level 1	Basic physico-chemical, mathematical and natural science concepts and laws
Level 2	Basic physico-chemical, mathematical and natural science methods
Level 3	General laws of natural science for solving professional problems
To be able:	
Level 1	Use the basic laws of natural sciences
Level 2	To apply the methods of medical-biological and mathematical analysis with the use of experimental research
Level 3	To analyze the results of experimental studies
To master:	
Level 1	Methods of application of physico-chemical, mathematical and natural science laws
Level 2	Methods of solving professional problems using experimental studies
Level 3	Methods of analysis of the results of experimental studies

As a result of the development of the discipline the student must:

3.1	**To know:**
3.1.1	The most common physical laws underlying the processes occurring in the body.
3.1.2	Physical properties of biological tissues and fluids.
3.1.3	Characteristics of physical factors (medical, climatic, industrial) that affect the body, biophysical mechanisms of such impact.
3.1.4	Physical characteristics of the information at the output of the medical device. Purpose and technical characteristics of the main types of medical equipment, safety when working with equipment.
3.1.5	Fundamentals of differential and integral calculus.
3.1.6	The theory of ordinary differential equations of the first order with separable variables.
3.1.7	Fundamentals of statistical methods in clinical and laboratory experimental studies.
3.2	**To be able:**

3.2.1	Make physical measurements and statistically process of the results of measurements; extract the necessary information from the results of observations and measurements. Analyze research results in graphical and analytical form.
3.2.2	Draw up protocols of laboratory work according to the requirements; to describe the meaning of physical quantities, using physical terminology; give a verbal description of the main physical experiments.
3.2.3	Work on laboratory equipment.
3.2.4	Find derivatives and integrals; apply differentials in approximate calculations.
3.2.5	To compose and solve differential equations on the examples of problems of physical, chemical, pharmaceutical and medico-biological content.
3.3	**To master:**
3.3.1	Problem solving skills based on the laws of mathematics..
3.3.2	Skills of the experiment (competently conduct the experiment; clearly represent the purpose of the study; possess various forms of illustrative expression of the results obtained in the experiment – the construction of graphs, polygons, histograms, tables).
3.3.3	Methods of statistical processing of medical and biological information. Assess the reliability of the data.
3.3.4	Methods of analysis of new scientific and educational literature, experimental results.

4. THE STRUCTURE AND CONTENT OF THE DISCIPLINE (MODULE)

Lesson code	Name of sections and topics /type of lesson/	Semester / Course	Hours	Competences	Literature	Interact.	Note
	Section 1. Mathematics						
1.1	Fundamentals of differential calculus. /Practical class/	2	4	BPC-7	Л1.1 Л2.1 Л2.2 Э1	0	The concepts of derivative and differential and methods of their application to solving problems, including medical and biological content are considered.
1.2	Fundamentals of integral calculus. / Practical class /	2	4	BPC-7	Л1.1 Л2.1 Л2.2 Э1	0	The concepts of integral, its properties and methods of calculations are considered
1.3	Theory of differential equations. / Practical class /	2	4	BPC-7	Л1.1 Л2.1 Л2.2 Э1	0	The basic concepts of the theory of differential.equations and first order differential equations are solved by variable separation method. On the examples of problems of medical and biological content the differential equations are solved.
1.4	Elements of probability theory. /Practical class /	2	4	BPC-7	Л1.1 Л2.1 Л2.2 Э1	0	The basic concepts and theorems of probability theory are considered. Examples of the medical and biological problems are solved.
1.5	Random variable. / Practical class /	2	4	BPC-7	Л1.1 Л2.1 Л2.2 Э1	0	Discrete and continuous random variables, their distribution laws and numerical characteristics are considered. The normal distribution law is analyzed. The calculation (on the example of problems of medical and biological content) of the probability of getting a random variable in a given interval.

1.6	Elements of mathematical statistics. / Practical class /	2	4	ВРС-7	Л1.1 Л2.1 Л2.2 Э1	0	Statistical distributions of the sample are considered, polygons and histograms are constructed. The methods of determining the average values are analyzed. The theoretical issues are analyzed and the problems of determining confidence intervals for a small sample are solved.
1.7	Elements of the theory of correlation. / Practical class /	2	4	ВРС-7	Л1.1 Л2.1 Л2.2 Э1	0	The types of dependencies between two random variables are considered. The correlation dependence is analyzed, the correlation coefficient and its properties are considered. The problems of calculating the correlation coefficient of biomedical experimental data are solved and conclusions are drawn.
1.8	Solving problems of medical and biological content in mathematics. /Ind.work/	2	7	ВРС-7	Л1.1 Л2.1 Л2.2 Э1	0	To perform the *Ind.Work* is necessary to refer to the textbook "Higher mathematics" (L 1.1) which lists all the tasks for *Ind.Work* and presented the standards of their solutions.
	Section 2. Physics (vibrations and waves, acoustics, flow and properties of liquids, biomechanics, electricity)						
2.1	Oscillations and waves. /Practical/	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	Different kinds of mechanical vibrations, resonance phenome-non and its significance in medicine, heart self-oscillating system, mechanical waves, shock waves, Doppler effect and its application in medicine are considered.

2.2	The study of oscillatory motions using kymograph. / Practical /	2	4	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	Working with kymographs, experimental obtaining of the graph of damped oscillations, the calculation of the attenuation coefficient and the logarithmic decrement of damping and statistical analysis (laboratory work.)
2.3	Acoustics. /Lecture/	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	
2.4	Flow and properties of liquids /Lecture/	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	
2.5	Determination of the surface tension coefficient of liquids by the ring separation method. / Practical /	2	3	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	Study of the phenomenon of surface tension of liquids using presentations and watching educational films. Experimental determination of the surface tension coefficient of some liquids by the method of ring separation and statistical processing of experimental data (laboratory work.)

2.6	Determination of viscosity coefficient of liquids by Stokes method. / Practical /	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	Study of regularities of processes related to internal friction of liquids through practical determination of the viscosity coefficient of the liquid by Stokes methods. The attention of students to the great importance of the coefficient of dynamic viscosity of biological fluids and its changes in the functioning of the body. Experimental determination of viscosity coefficient of some liquids and statistical processing of experimental data. (laboratory work.)

2.7	Hemodynamics. / Practical /	2	3	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	2	Analysis of biophysical patterns of blood flow through the vessels (with watching the training film non-Newtonian fluid). Discussion of the report on "Physical basis of blood pressure measurement". Analysis of the results obtained in the group of blood pressure measurements of students before and after physical activity
2.8	Elements of biomechanics. Mechanical properties of bone and blood vessel tissue. /Lecture/	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	
2.9	Electrical properties of tissues and organs. /Lecture/	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	
2.10	Biopotentials. /Lecture/	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	
2.11	External electrical fields of tissues and organs. /Lecture/	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	

2.12	Physical basis of electrocardiography. / Practical /	2	4	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	The biophysical principles of the study of electric fields of tissues and organs. The theory of Einthoven leads is considered. According to the obtained ECG on the second standard lead, the main characteristics of the ECG are calculated - the amplitude of the teeth and the duration of the teeth, segments and intervals (laboratory work.)
2.13	Calibration of thermocouple and determination of body temperature using thermocouples. / Practical /	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	Contact and thermoelectric phenomena in metals are considered (training film is demonstrated). The thermocouple is calibrated and statistical processing of experimental data is carried out, the calibration graph is constructed and the temperature of own body is determined (laboratory work.)

2.14	Studying the effects of UHF fields on a substance. / Practical /	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	The mechanism of therapeutic action of UHF fields on the model of human tissue structures was studied. The heating curves of dielectrics and electrolytes in the UHF electric field were obtained experimentally using the UHF therapy apparatus (laboratory work.)
	Section 3. Physics (optics, ionizing radiation, quantum physics, medical electronics)						
3.1	Elements of geometric optics. / Practical /	2	3	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	The main characteristics of the centered optical system, the optical system of the eye, and its resolution , vision deficiencies and methods of their elimination are considered.

3.2	Determination of refractive index of liquids by refractometer./ Practical /	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	The phenomenon and laws of light refraction, the phenomenon of total internal reflection and its use in light guides are considered. Studied the use of optical fibers in endoscopy technology (viewed educational film). With the help of a Refractometer, the refractive indices of some liquids are determined, the statistical processing of experimental data is carried out, a graph of the dependence of the refractive index of liquids on the concentration of the solution is constructed (laboratory work.)

3.3	Determination of the wavelength of light using a diffraction grating. / Practical /	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	The phenomena of diffraction and interference of light waves and the use of these phenomena in medical and biological research (viewed educational film) Experimental determination of the wavelength of light using a diffraction grating, statistical processing of the results of the study (laboratory work)
3.4	Light polarization. / Practical /	2	3	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	Natural and polarized light, methods of obtaining polarized light, the phenomenon of double refraction and the use of polarized light in histological studies are considered (educational films are viewed)

3.5	Determination of the sugar percentage in the solution. / Practical /	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	Study of the optical scheme of the saccharimeter and experimental determination of the percentage of sugar in the solution, statistical processing of experimental data (laboratory work.)
3.6	X-Rays /Lecture/	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	
3.7	X-Rays / Practical /	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	The nature and properties of x-rays, their methods of production and types of its interaction with matter are considered. A report (in the form of a presentation with a demonstration of the film) on the use of x-rays in medicine was heard and discussed.
3.8	Radioactivity /Lecture/	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	

3.9	Basics of dosimetry. / Practical /	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	2	The main dosimetric characteristics and biological effects of radioactive radiation on the human body are considered Discussed the report "Radiation situation in Kyrgyzstan," a movie developed and filmed by students.

3.10	Quantum biophysics /Lecture/	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	
3.11	The study of the solar cell. / Practical /	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	The phenomenon and laws of photoelectric effect, the device and principle of operation of solar cells and their application in medicine are considered. The work of the selenium solar cell (laboratory work) was experimentally studied.
3.12	Determination of the optical density of solutions using a photoelectrocolorimeter. / Practical /	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	The phenomenon of interaction of light with matter, which is associated with the laws of absorption and dispersion of light; photobiological processes and spectra of photobiological action. The optical density of riboflavin was determined experimentally using photocolorimeter. Graphs of the dependence of the optical density of the solution concentration and optical density of the wavelength (laboratory work).

3.13	General and medical electronics. / Practical /	2	2	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	The concept of "sensor" is considered, in accordance with these sensors are systematized according to the principle of their action. Considered what physical phenomena are the basis of the work of a sensor and the importance of the use of sensors in medicine (viewed educational film) The work of the inductive sensor is experimentally studied. (laboratory work.)
3.14	Preparation for each practical lesson in physics. /Independed work/	2	6	ВРС-7	Л1.2 Л2.1 Л2.2 Э2	0	To perform the IW, it is necessary to refer to the textbook "Medical and biological physics" (L1.2) and draw up a protocol to the laboratory work. In the study of theoretical issues refer to the lecture notes on physics.

3.15	Execution of essays. /Individual work/	2	5	BPC-7	Л1.2 Л2.1 Л2.2 Л2.3 Л2.4 Э2	0	Work on essays provides independent work with educational and scientific literature and contains: title page, plan, text part and references. Reports of abstracts takes place in student groups in the form of a presentation, the best works will be presented at the department conference.
3.16	Passing the test with grade	2	0	BPC-7		0	

5. FUND OF ASSESSMENT TOOLS
5.1. Control questions and tasks

Questions to test the level of training “KNOW”:
- Fundamentals of differential and integral calculus
- Basic concepts of the theory of differential equations
- Basic concepts and theorems of probability theory
- Distribution laws and numerical characteristics of random variables
- Discrete and continuous distribution range. Polygon and histogram
- Point and interval estimations
- Correlation dependence. Correlation coefficient and its properties
- Error theory
- Undamped and damped free mechanical vibrations.
- Attenuation coefficient and logarithmic decrement, the relationship between them. Forced oscillations. Resonance.
- Self-oscillation.
- Doppler effect and its use for biomedical research.
- Characteristics of auditory sensation and their relationship to the physical characteristics of sound.
- Audiometry.
- Physical basis of sound research methods in the clinic.
- Ultrasound and infrasound
- Surface tension coefficient and methods of its determination.
- The phenomenon of wetting and non-wetting.
- Capillary events. Gas embolism.
- Viscous fluid flow. The basic law of viscous flow. Viscosity.
- Laminar flow and turbulent flow of liquids.
- The main indicators of hemodynamics.
- Pulse wave.
- Physical basis of blood pressure measurement.
- Mechanical properties of bone tissue.
- Mechanical properties of blood vessel tissue.
- Biopotentials. Resting potential. Action potential
- Biophysical principles of research of electric fields of tissues and organs.

- Dipole equivalent electric generator of heart.
- Electrocardiography vector. Einthoven's Theory.
- Basic electrical properties of body tissues.
- Electrical conductivity of cells and tissues at direct and alternating current
- The effect on the human body of household electric current.
- Biophysics of ventricular fibrillation. Defibrillation.
- Application of electrical current and electromagnetic fields in medicine
- The mechanism of heating dielectrics and electrolytes in the electric UHF field.
- Thermocouple and its application to medicine.
- Sensors and their application in medicine
- Diffraction and interference of light.
- Diffraction grating.
- Refraction of light. Refractometer and work with it.
- The phenomenon of total internal reflection. Fiber optics and its use in medical devices.
- Methods for obtaining polarized light
- The passage of light through the polarizer – analyzer system. Malus law.
- Rotation of the plane of oscillations of polarized light. Optically active substances.
- Optical scheme of the saccharimeter.
- Study of tissue structure in polarized light.
- X-ray radiation and its application in medicine.
- Ionizing radiation and their biological effect.
- Energy levels of biomolecules and electronic transitions in them.
- Luminescence of biological systems and its types.
- Light absorption
- Transmittance. Optical density of solutions.
- Photobiological processes and spectra of photobiological action.

Tests for the level of training “TO BE ABLE” and “TO MASTER”:
- To find derivatives of complex functions, derivatives of higher orders and use them in solving problems of medical and biological content.
- Apply differentials in approximate calculations.
- To find indefinite integrals by direct integration method, substitution method and integration by parts. To calculate definite integrals.
- To find the general and particular solution of differential equations of the first order by the method of separation of variables.
- To make and solve differential equations on the examples of problems of physical, chemical, pharmaceutical and medico-biological content.
- Solve the problem of calculating the probability of random events. Calculate the probability of getting a normally distributed random variable in a given interval. Compute probability in a normal distribution.
- Analyzing discrete and continuous distribution range. Build polygons and histograms.
- Estimate random measurement errors (small samples). To solve problems of applied nature: calculation of the true value of the measured values and their relative and absolute errors at a given confidence level, etc.
- Calculate the coefficient of linear pair correlation. Compose the equation of direct regression for the correlation: the optical density of the solution from the concentration of the substance; the volume of circulating blood from the body weight of the person; the effect of the reagent on the synthesis of the drug, etc.
- Calculate the logarithmic decrement of the attenuation of harmonic oscillations.
- Determine the viscosity coefficient of vegetable and machine oil and compare them.
- Determine the surface tension of water and soapy water and compare them.
- Determine the amplitude charateristics of the teeth (in millivolts) and the characteristics of the duration of the teeth, segments and intervals (in seconds) of the electrocardiogram.
- Plot the heating of the dielectric and electrolyte in the UHF electric field.
- Determine the refractive index of water, alcohol and sugar solutions of different concentrations.
- Determine the wavelength of red, green and purple light (in nanometers).
- Determine the optical density of the riboflavin solution and build its absorption spectrum.
- Determine the temperature of the human body using a thermocouple.
- Determine the percentage of sugar in the water solution.

5.2. Themes of course works (projects)

The discipline does not provide for the writing of the course work and the project

5.3. Evaluation Fund

REFERENCE WORK IN MATHEMATICS. List of tasks (see Annex 1)

EXAMINATION IN PHYSICS. List of questions:
- Undamped free mechanical vibrations.
- Damped free mechanical vibrations.
- Attenuation coefficient and logarithmic decrement, the relationship between them. Forced oscillations. Resonance.
- Self-oscillation.

- Nature of sound. Physical characteristics of sound.
- Characteristics of auditory sensation and their relationship to the physical characteristics of sound.
- Weber – Fechner Law.
- Audiometry. Hearing threshold and pain threshold.
- Physical basis of sound research methods in the clinic.
- Ultrasound. The effect of ultrasound on biotissue, the phenomenon of cavitation.
- Application of ultrasound in medicine.
- Infrasound and its effect on the human body.
- Mechanism of surface tension forces of liquids.
- Surface tension coefficient and methods of its determination.
- Derivation of the formula for determining the surface tension coefficient by the method of detachment of the ring.
- The phenomenon of wetting and non-wetting.
- Capillary events. Gas embolism.
- Viscous fluid flow. The basic law of viscous flow.
- Coefficient of viscosity and methods of its determination. Derivation of the Stokes formula.
- Laminar flow of liquids. Pause Formula.
- Turbulent fluid flow. Reynolds number.
- The main indicators of hemodynamics: a) linear and volumetric blood flow rate; b) blood pressure.
- Hemodynamic resistance (TPVR).
- Pulse wave. The equation of the pulse wave. Moens Formula.
- Physical basis of blood pressure measurement.
- Deformation and its types.
- The main characteristics of deformation. Hooke's law for elastic deformation.
- Mechanical properties of bone tissue.
- The average curve of deformation of compact bone.
- Mechanical properties of blood vessel tissue.
- Derivation of the Lame equation.
- Biopotentials. Types of biopotentials (diffuse, membrane and phase).
- Resting potential. The Goldman Equation.
- Action potential. Hodgkin-Huxley Equation.
- Graph of the action potential of the nerve cell axon.
- Scheme of nerve impulse propagation (depolarization and repolarization). The velocity of the nerve impulse.
- Biophysical principles of research of electric fields of tissues and organs.
- The equivalent electrical generator cells.
- - The potential of the electric field generated by the dipole and the dipole.
- The concept of multipole.
- Dipole equivalent electric generator of heart.
- Vector electrocardiography. Einthoven's Theory.
- Electrical conductivity of cells and tissues at constant current.
- Ohm's law for living tissue.
- The electrical conductivity of cells and tissue by the alternating current.
- Impedance. The equivalent electrical circuit of the tissues of the body.
- The effect on the human body of household electric current.
- Biophysics of ventricular fibrillation. Defibrillation.
- Application of direct current in medicine (galvanization and electrophoresis).
- The use of AC in medicine (diametre, darsonvalization, surgical diathermy, Deuteronomy).
- The mechanism of heating dielectrics and electrolytes in the electric UHF field.
- Medical applications of high frequency currents and electromagnetic fields (darsonvalization, surgical diametre, inductometer, UHF – therapy, microwave therapy).
- Contact potential difference.
- The mechanism of thermo-EMF. The formula of thermo-EMF.
- Thermocouple and its application to medicine.
- The calibration of thermocouples and the calibration graph. Determination of body temperature using a thermocouple.
- Sensors and their classification on the principle of action.
- Parametric sensors and the principle of their operation.
- Generator sensors and the principle of their operation.
- Diffraction and interference of light.
- Diffraction grating. The derivation of the diffraction grating.
- Laws of reflection and refraction of light.
- Absolute and relative refractive indices.
- Refraction of light. Refractometer and its purpose.
- The phenomenon of total internal reflection.
- Fiber optics and its use in medical devices.
- Natural and polarized light.
- Polarization of light at reflection and refraction at the boundary of two dielectrics. Brewster's Law.
- Polarization of light at double refraction.

- Nicola prism, the course of the rays in Nicola prism.
- The passage of light through the polarizer – analyzer system. Malus law.
- Rotation of the plane of oscillations of polarized light. Optically active substances.
- Optical scheme of the saccharimeter.
- Study of tissue structure in polarized light.
- The phenomenon of photoelectric effect. Laws of photoelectric effect.
- The device and the principle of operation of the vacuum and selenium solar cells.
- Nature and basic properties of x-rays.
- The device and the principle of operation of the x-ray tube.
- Brake x-rays and its spectrum.
- Characteristic x-ray radiation and its spectrum.
- Interaction of x-ray radiation with matter (coherent scattering).
- - Interaction of x-ray radiation with the substance (photoelectric effect).
- Interaction of x-ray radiation with the substance (incoherent scattering or Compton effect).
- Application of x-rays in medicine.
- The basic law of radioactive decay.
- The half-life of radioactive nuclei. Activity.
- Penetrating and ionizing ability of radioactive radiation.
- Dosimetry of ionizing radiation (amount of radiation, radiation dose, dose rate, exposure dose).
- Biological dose of ionizing radiation. Protection against ionizing radiation.
- Biological effect of radioactive radiation on the human body.
- Energy levels of biomolecules.
- Electronic transitions in biological molecules (explain the scheme).
- Luminescence of biological systems and its types.
- The absorption of light by biosystems. Booger's law (derivation).
- The law of Lambert-Bouguer-Ber (derivation).
- Transmittance. Optical density of solutions.
- Photobiological processes and spectra of photobiological action.
- Evaluation of measurement errors of physical quantities.

LABORATORY WORK IN PHYSICS. List of laboratory works:
- The study of oscillatory motions using kymograph
- Determination of the surface tension of liquids
- Determination of the viscosity coefficient of the liquid
- Study of the action of ultra-high-frequency (UHF) electric field on the substance
- Physical basis of electrocardiography
- Calibration of thermocouple and determination of body temperature
- Determination of the refractive index of liquids using a Refractometer
- Determination of the percentage of sugar in the solution
- Determination of the wavelength of light using a diffraction grating
- Study of the solar cell
- Determination of the optical density of solutions using a photoelectrocolorimeter
- Study of some medical sensors

TEST. List of test questions for laboratory work in physics (see Annex 2)
TEST. List of test questions for the general course (see Annex 3)

ABSTRACT. List of abstract works:
- Physical basis of biomechanics.
- Peculiarities of hemodynamics of the newborn.
- Passive and active transport of substances through the membrane.
- Biopotentials and their classification.
- Physical basis of sound research methods in the clinic.
- Ultrasound is its application in medicine.
- Physical basis of hemodynamics.
- Mechanical and electrical methods of blood circulation.
- Low-frequency and high-frequency currents, their use in medicine.
- Impulse currents and their use in medicine.
- Physical bases of high-frequency methods of videolecture.
- Polarization of biological tissues.
- Impedance of biological tissues.
- Physical basis of electrocardiography.
- Saccharimetry and its application in medicine.
- Optical quantum generators and their application in medicine.
- Physical basis of holography and its application in medicine.
- Ultra-weak glow and their use in medicine.
- Radioactivity. The effect of radiation on humans.

- Physical basis of dosimetry.
- Physical basis of magnetic therapy.
- Sensors and their application in medicine.
- Optical vision defects and ways to eliminate them.
- Biophysics of color perception.
- Biophysics of hearing.
- Chemiluminescence of biological systems.
- Spectrophotometry of biological fluids.
- Nuclear magnetic resonance and its application in medicine.
- Medical electronic systems.
- Modern methods of osteosynthesis
- Features of blood circulation of the fetus and newborn baby.
- Thermography
- Biologically active points.
- Radiological methods of diagnosis of maxillofacial area
- Physical and mechanical properties of composite materials.
- Pathogenic effect of radioactive radiation on humans.
- Age features of the structure of the eye and its appendages.
- The equivalent electrical circuit of the tissues of the organisms.
- Tensometry and determination of Poisson's ratio of dental materials.

The kinetics of the curing process of the sealing compositions by an ultrasonic method.

- Application of ultrasound in dentistry.
- Coefficient of linear and volumetric expansion.
- Chemiluminometric and their importance in medicine.
- Biomechatronics is an artificial hand.
- Nanotechnology in medicine
- Nanotechnology in Oncology
- Nanotechnology in dentistry
- Radiation situation in Kyrgyzstan.
- Shape memory effect.
- Physiotherapy in Pediatrics

5.4. A list of the types of assessment tools

Control work in mathematics
Control work in physics
Laboratory work
Test
Abstract

SCALE GRADING OF THE CONTROL WORK IN MATHEMATICS (midterm control) (see Annex 4)
INSTRUCTIONS for the assessment in %:
- Solution of differential equation -0-25%;
- Solution of the probability problem-0-25%;
- Solving the problem of calculating the numerical characteristics of a random variable and determining the probability that it will take a value less than a fixed number -0-25%;
- Solution to the problem of calculating the correlation coefficient-0-25%
All control work is estimated at 0-100%

SCALE GRADING OF CONTROL WORK IN PHYSICS (interim control) (see Annex 7)
INSTRUCTIONS for the assessment in %:
- The answer to the first task -0-35%
- Answer to the second task -0-35%
- Confidence interval for the arithmetic mean is calculated - 0-30%
All control work is estimated at 0-100%

SCALE OF EVALUATION of laboratory work in physics (midterm control) (see Annex 5)
INSTRUCTIONS for the assessment in %:
- Oral interview - 0-30 %
- Test (20 questions, each correct answer is estimated at 1 %) - 0-20 %
- Preparation of reports (protocols) of laboratory work -0-50 %
The report on laboratory work is estimated at 0-100%

SCALE OF EVALUATION of abstract work (midterm control)
INSTRUCTIONS for the assessment in %:
The abstract reveals the content of the problem, its relevance and practical significance - 0-40 %
Submitted on time, taking into account all requirements for the content and design of the work - 0-30 %
The student can justify their judgments, owns the conceptual apparatus of the topic, the defense of the abstract was held in the group in the form of a presentation – 0-30 %

The abstract is estimated at 0-100%

SCALE OF ASSESSMENT of an ORAL test (interim control – "to KNOW") %.
The following criteria are taken into account when assessing the oral responses to the test of the level of training “to KNOW”:
General physical laws, processes occurring in the body;
the basic physical properties of biological tissues;
characteristics of external factors acting on the body;
purpose and characteristics of medical devices;
fundamentals of differential and integral calculus;
theory of first order differential equations;
fundamentals of statistical methods;
- the degree of disclosure of the content of the material 0-50%
- presentation of the material (literacy, accuracy of terminology and symbols, logical sequence of presentation 0-25%
- formation and stability of the skills used in the answer 0-25%
The oral survey is estimated at 0-100%

SCALE OF ASSESSMENT OF ANALYTICAL AND PRACTICAL TASKS
interim control – a "TO BE ABLE” and “OWN”)
The following criteria are taken into account when assessing the answers to the test of the level of training “TO BE ABLE” and “OWN”:
make physical measurements and statistically process the results of measurements and draw appropriate conclusions;
methods of registration of protocols of laboratory works;
methods of work on laboratory equipment;
the method of finding derivatives and integrals;
methods of modeling medical and biological processes using the theory of differential equations;
- the degree of knowledge of the mathematical apparatus in solving problems 0-30%
- the degree of knowledge of the physical experiment and the methods of statistical processing of experimental data 0-30%
- preparation of reports (protocols) of laboratory works 0-40%

6. EDUCATIONAL-METHODICAL AND INFORMATION SUPPORT OF DISCIPLINE (MODULE)			
6.1. Recommended literature			
6.1.1. Main literature			
	Authors, composers	**Title**	**Publisher, year**
L1.1	Irving P. Herman	Physics of the Human Body	Springer, 2006
L1.2	A.Gelig et all	Mathematics for medical students	SPbU, 2005
L1.3	Sorokin A., etc.	Higher Mathematics. Textbook	KRSU, 2013
L1.4	Sologubova T., etc.	Medical and Biological Physics. Textbook.	KRSU, 2010
6.1.2. Additional literature			
	Authors, composers	**Title**	**Publisher, year**
L2.1	Лещенко В.Г., Ильич Г.К.	Медицинская и биологическая физика: Учебное пособие	Москва "ИНФРА-М" 2012
L2.2	Ремизов А.Н., Максина А.Г., Потапенко А.Я.	Медицинская и биологическая физика: Учебник	М.: Дрофа 2008
L2.3	Павлушков И.В.	Основы высшей математики и математической статистики (имеется на кафедре)	ГЭОТАР-Медиа 2012
L2.4	Самойлов О.В.	Медицинская биофизика	Изд-во СпецЛит 2013
6.2. List of resources of information and telecommunication network "Internet"			
E1	Medical literature (mathematics)		http://www.medbook.net.ru/27.shtml
E2	Medical literature (physics)		http://www.medbook.net.ru/28.shtml
6.3. List of information and educational technologies			
6.3.1 Competence-oriented educational technologies			

6.3.1.1	To organize the study of the discipline, traditional educational technologies are used, focused on the communication of knowledge and methods of action transferred to students in a ready form. Lecture material is provided to students using multimedia equipment. Traditional educational technologies include: explanatory and illustrative lectures; explanatory and explanatory practical classes.
6.3.1.2	Innovative educational technologies, classes in an interactive form, which form a system of thinking and the ability to generate ideas in solving various situational problems. Innovative educational technologies include two reports, the control of which is made in the form of independent work in the classroom.
6.3.1.3	Information educational technologies – independent use of computer equipment and Internet resources for practical tasks and independent work.
6.3.2 List of information reference systems and software	
6.3.2.1	1. Mathematics in Medical Science - http://www.medbook.net.ru/27.shtml
6.3.2.2	2. Books on Math in Medicine - https://www.lecturio.com/curriculum#sub_all
6.3.2.3	3. Scientific electronic library - http://elibrary.ru/defaultx.asp
6.3.2.4	4. The website of the library of KRSU (http://lib.krsu.edu.kg)
6.3.2.5	5. Republican Medical Information Center (http://rmic.med.kg/ru)

7. THE LOGISTICS OF THE DISCIPLINE (MODULE)	
7.1	Theoretical classes are held in lecture halls with 150 seats.
7.2	Practical classes are held in three classrooms with 14 seats each
7.3	Multimedia complex (laptop, projector).
7.4	Multimedia and slate.
7.5	Laboratory equipment: electrocardiograph machine, UHF-therapy, refractometer, kymograph, thermocouple, diffraction grating, saccharimeter, sound generator, an inductive sensor, a sound level meter, device for determination of surface tension by the method of separation ring, the equipment to determine the coefficient of viscosity of liquids by the method of Stokes light meter.

8. METHODICAL INSTRUCTIONS FOR STUDENTS FOR THE DEVELOPMENT OF THE DISCIPLINE (MODULE)

The process chart is in ANNEX 6

Guidelines for independent extracurricular work of students to study the theoretical foundations of the discipline "physics, mathematics".

The study of the theoretical part of the discipline is designed not only to deepen and consolidate the knowledge gained in the classroom, but also to promote the development of students' creative skills, initiative and organization of their free time.
Independent work of the student in the study of the discipline includes:
- reading the recommended literature and mastering the theoretical material of the discipline;
- familiarity with Internet sources;
- preparation for various forms of control (control work, test);
- work on the creation of a protocol for laboratory work

Planning the time required to study the discipline, students are better to carry out the entire semester, while providing for regular repetition of the material.
The material outlined in the lectures should be regularly studied and supplemented with information from other sources of literature presented not only in the discipline program, but also in periodicals.
When studying the discipline it is necessary for each topic to read the recommended literature and make a brief summary of the main provisions, terms, information that require memorization and are fundamental to this topic, for the development of subsequent topics of the course. To expand knowledge of the discipline, it is recommended to use Internet resources; conduct searches in various systems and use the materials of sites recommended by the teacher.

CONTROL WORK
In preparation for the decision of the control work is necessary:
- to work out the relevant pages of textbooks;
- use lecture notes or notes from practical material;
- solve as much as possible the problems at home on relevant topics.

LABORATORY WORK
In preparation for the laboratory work it is necessary to:
- to work out the theoretical material from the textbooks;

- conduct a test of self-knowledge;
- prepare a protocol for laboratory work;
- perform laboratory work and submit a report including mathematical processing of experimental data and their analysis

TEST
In preparation for the tests, it is necessary to work out the lecture material and the relevant pages of textbooks (it is also desirable to read additional literature); solve all the necessary practical tasks; perform all the necessary laboratory work

ESSAY
Work on the essay is done by students individually, on their own with the aim of consolidating and deepening of theoretical knowledge. The topic of the abstract and the proposed work plan is discussed with the teacher, then the student independently selects, analyzes and structures the material. The approximate volume of the abstract – 10-15 sheets of printed text, welcome the use of diagrams, drawings, tables, complementing the main material. The work should contain the purpose, objectives of the study, generalized conclusions on the problem. In the structure of the abstract there is a title page, designed according to the requirements, table of contents, introduction, main part, final, list of used literature and Internet resources. The abstract should be submitted to the teacher for review within the specified time, after correcting the material comments (if any), the student can proceed to presentation at the appointed time.
A sample of the title page of the essay is presented in Annex 8