

Selection of Physics Topics for Medical Programs in Vilnius University

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Main changes of physics subject in medical studies curricula of Vilnius University were done over the past decade starting from general reduction of physics program volume. This forced essential limitation of topics presented for different medical programs. The course of physics integrate physics and general training in IT essential for learning and clinical usage of instruments, tools and methods related to physical phenomena under consideration. Every medical physics course compose of theoretical – lectures session, laboratory experiments, computer exercises. Cumulative grade is taken after written exam taking into consideration student's success in experiments and exercises.

At present medical physics inscribed into several medical undergraduate programs: medicine, nursing, odontology, occupational therapy, physical therapy, public health, MSc program on medical biology. The physics content substantially varies for those programs. Main topics are: measurement techniques, structure of matter from the nucleus to the cell and body, physical parameters of environment, interaction of physical factors on body, physical phenomena of senses and organs, diagnostical and therapeutical application of physical factors. Selected modern medical technologies are stressed: e.g. NMR tomography, ultrasound in diagnosis and therapy, medical laser applications etc.

Physical fundamentals of human body organisation, functioning, diagnosis and treatment are being taught during the courses as well as training in computing.

Primary aims. Studies of fundamentals of physics dealing with human body organisation, functioning, diagnostic, treatment. Practical skills in measuring technique and computing.

Main objectives. Theoretical and practical knowledge of physical phenomena in medicine.

Assessment methods. Written exam for theoretical part, defence of results for each laboratory experiment and exercises.

Positive sides of the course. Cummulative presentation of medical physics fundamentals, some practical training in laboratory experiments and computing skills.

Negative sides of the course. Drastical shortage of time for theory and even more for practical work.

Here is the content of theoretical part of main medical physics course [1] for medical program:

Structure of the matter. Atom. Hydrogen atom, quantum transitions, spectra. Molecules, electronic, vibrational, rotational spectra. Biomolecules. Spectroscopy in medicine.

Optical radiation, interaction with biological objects. Lasers, applications in medicine. Safety.

Vision. Physical structure and functioning of the eye.

Sense of hearing. Sound. Structure and functioning of the ear. Sound in medicine. Audiometry. Noises. Pollution.

Breathing. Structure and physical processes of lungs. Speech. Senses of smell.

Fluids. Viscosity. Hemodynamics. Physics of heart. Measurement of blood pressure. Sedimentation.

Heat. Thermodynamics. Energy generation, flow, accumulation. Temperature measurement. Calorimetry.

Diffusion and osmosis. Membrane physics and chemistry. Membrane resting potential. Propagation of action potential. Measurement technique.

Impact of E & M fields on the body. Safety.

X- radiation. Roentgen technique in diagnosis and therapy.

Ionizing radiation. Sources, application in medicine. Safety.

32 hours for lecture course assigned only.

Students perform 6-7 laboratory experiments in mechanics, thermodynamics, electricity, optics, acoustics. Main stress is made toward measurement techniques, accuracy, safety requirements. Objects under investigation are usually of medical interest. Laboratory session not necessarily cover the same topics as lectures, in general they serve as supplement for detailed understanding of physical phenomena.

Laboratory experiments last 2 hours a week.

The part of the medical physics course consists of theoretical course in informatics and practical sessions improving computer application. In general background competence of information technologies are improved. Information technologies enables students to better perceive and interpret the material and serves as a tool for independent information survey on the subject.

3 hours per week assigned for IT in medical physics.

Medical physics course makes 6 ECTS credits available for any university student. No prerequisite is required.

Recently most medical programs undergo the quality evaluation, and modernization with respect to the implementation of Bologna process into higher education system of Lithuania. It is a pity to note the general trend to shrink physics subject in most biomedical, social, humanitarian studies programs despite noticeable decline of physics knowledge of high schools graduates when enrolling at the university.

[1] http://www.ff.vu.lt/studentams/tekstai/medicinine_fizika