SYLLABUS

SUBJECT … MEDICAL AND MEASURING EQUIPMENTS

TEACHER … DR IRENEUSZ STEFANIUK ……

COURSE DESCRIPTION
Course is divided into two parts. First consist of lectures during which students recognizing basis of construction and principle of operation of medical equipment: USG, tomograph X-ray, MR, and applications of laser in medicine. Second part are laboratory classes in which students are realizing in practice the theoretical knowledge from the first part.

LEARNING OUTCOMES
To give students an understanding of the concept of engineering and principle of operation the selected type of equipment. Moreover recognizing influence of physical factor at received results which have considerable influence on correct diagnosis.

GRADING POLICY
Student should write an individual homework during the semester and pass the examination after the semester.

TIMETABLE
Principle and production of X-Rays. Engineering and principle of operation X-Ray tube. Properties of X-Ray mapping :geometrical correlation, projection, contrast, noise, static, digital artifact, radiation attenuation, principles of fluoroscopic techniques.
Creation X-Ray tomograms, configuration with X-ray tube, computer, images reconstruction, tomograms quality. Tomography's generations, Digital detectors, system's evolution – improvement to detections quality. Digital radiography, reconstructions and image visualization. Radiation exposure.
Principle and production of ultrasonics. USG wave propagation. Creation ultrasonics image, generation, ultrasonics convertors, echo imaging, attenuation, acoustic shadow, digital artifact. Sort of presentation: amplitudes (A-Mode), luminosity (B-Mode), M presentation, images using Doppler effect, mapping quality assessment. Sort of transducers. 3D systems. Allowable intensity of ultrasonics waves in tissues.
Physical foundations of magnetic resonance, nucleus spin, electron spin. Energy level dispersion, resonant transition energy. Longitudinal and transverse relaxation. Shape of resonant line, signal detection. Spectrometer EPR and NMR, principle of operation and detection methods.
Creation X-Ray tomograms, rules of receiving NMR images, measuring sequences with changeable magnetic field gradient, repetition time, echo time.
Engineering and principle of operation LASER. Population inversion, induced and spontaneous emission, types of resonators. Types of lasers: gas, liquid, color lasers, lasers on solid state material and semiconductor lasers. Laser beam characteristics, monochromatic, coherence, laser beam energetic parameters. Radiation influence with matter.
applications of laser in diagnostics and medical therapy.
Different imaging technique in medicine, scintigraphy, thermography, impedance tomography, PET emission tomography, topography EEG.
LABORATORY:

1. Detection of internal structures based on tomograms using java applets (MR- relaxation times).
2. Analysis radiological images and improvement to quality using MammoViewer application (creation digital RTG images, quality assessment maps, images processing)
3. Measurement of EPR spectrum and analysis received signal - hyperfine interaction (nucleus spin) and fine
4. Testing properties of laser radiation

TEXTBOOK AND REQUIRED MATERIALS

Basic

A. Z. Hrynkiewicz E. Rokita, Fizyczne metody diagnostyki medycznej i terapii. PWN 2000.
A. Przelaskowski, „Miary jakości" w „Multimedia - Algorytmy i Standardy kompresji" pod redakcją W. Skarbka, Akademicka Oficyna Wydawnicza PLJ, pp. 111-142
J. Stankowski, A. Graja, Wstęp do elektroniki kwantowej, WKŁ 1972
B. Ziętek, Optoelektronika, Wydawnictwo UMK, Toruń 2004.
Anna Wróblewska, Opis programu MammoViewer

Additional

M. Krzemińska-Pakuła, Metody obrazowe w diagnostyce układu krążenia, PZWL, 1991.
P. Sprawls, Physical Principles of Medical Imaging, Aspen Publ., 1987.
C-N. Chen, D. I. Hoult, Biomedical Magnetic Resonance Technology, Adam Hilger, 1989.