UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Medical Physics

2122-1-H4601D069-H4601D001M

Aims

Thermodynamics: 1st and 2nd principles of thermodynamics and entropy.

Biomechanics: Statics of the rigid body with applications to the human body.

Fluid mechanics: ideal fluids and real fluids

Electrostatics and electrodynamics: Electrical charges and electrical circuits.

Physics of radiation and biological effects of radiation.

Optics: mechanism of the human visual system.

Contents

The primary goal of the course is to provide students with the tools for the understanding of the complex reactions that represent the molecular basis of life, and with the fundamentals to identify the cause-effect relations of the most important chemical and physical processes for the curriculum and the work of a physician. This knowledge will form the primary basis for a rationale approach to the knowledge of medical sciences.

Detailed program

THERMODYNAMICS: - Systems and thermodynamics states - Phase transitions - Perfect gas transformations - 1st principle of thermodynamics - 2nd principle of thermodynamics and entropy - Enthalpy and free energy.

BIOMECHANICS - Moment of a force. - Balance of a body with exemplifications of Human Body. - Levers. - Mechanics of locomotion. - Statics of the body. - Young's modulus and elasticity. - Compression module. - Deflections, twists, fractures.

MECHANICS OF FLUIDS: - Stevino's Law - Principle of Archimedes - Theorem of Bernoulli – Poiseuille equation. Properties of real liquids and viscosity- Concept of hydraulic resistance . - Surface tension in liquids. - Surfactants; phenomena of adhesion and capillarity. - Laplace law.

ELECTRODINAMICS: - Interaction between electric charges. - Electrical field and electrostatic potential. - Distribution of electric charges: electric dipole and dipole layer. -Meaning of the dielectric constant. - The capacity of a capacitor. - Electrical circuits. - Laws of Ohm. - Concept of stationary current and of transient current. - Charge and discharge of a capacitor.

RADIATION PHYSICS: - Overview of the physics of the nucleus. - Radioactive decay. - Alpha, beta, gamma and nuclear reactions decay. - Emission and absorption of corpuscular and electromagnetic radiation . - X-ray. - Radiation-matter interaction. - Biological effects of radiation

OPTICS: - Spectrum of electromagnetic radiation. - Absorption of the radiation - Light and image formation - Lenses and geometrical optics - Construction of images according to geometrical optics - Eye as an optical system - Optical defects of the eye - Theory of the color perception

Prerequisites

Basic knowledges of mathematics and analysis.

Teaching form

Lectures and exercises.

During the Covid-19 emergency period, lessons will take place in a mixed mode: partial presence and asynchronous / synchronous videotaped lessons with some physical presence events.

Textbook and teaching resource

D. Scannicchio e L. Giroletti "Elementi di fisica biomedica" Edises; ISBN-13: 978-8879598873

F. Borsa e A. Lascialfari, “Principi di fisica. Per indirizzo biomedico e farmaceutico”, Edises; ISBN-13: 978-8879598163

D. C. Giancoli, “Fisica. Con fisica moderna”, CEA, ISBN-13: 978-8808186102

Semester

First semester

Assessment method

Multiple choice exercises (numerical exercises that require the application of several physical principles). Oral test on teacher evaluation.

In the Covid-19 emergency period, exams will only be online. They will be conducted using the WebEx platform and on the e-learning page of the course. A link will be sent to the students to access the exam.

Office hours

By telephone appointment (02 6448 8209) or by email (francesco.mantegazza@unimib.it).