ACADEMIC PROGRAM FOR THE INTENSIVE BASIC MEDICINE COURSE-PHYSICS

Intensive Basic Medicine Course (Intensive BMC, Premedical Studies)
Duration of studies: 1 semester

Subject: **INTRODUCTION TO BIOPHYSICS**
Year, Semester: Intensive Basic Medicine Course
Number of teaching hours:
Lecture: 92
Seminar: 138

1st **week:**
Lecture 1-2: Introduction to modern physics. Standard of lengths, mass, time. Conversion of units. Useful mathematics. Trigonometry. Motion in one dimension, displacement, velocity, acceleration, motion diagrams.

2nd **week:**
Lecture 3-4: Freely falling objects. Vectors and their properties. Components of vectors. Displacement, velocity and acceleration in two dimensions. Motion in two dimensions. Relative velocity.

3rd **week:**
Lecture 5-6: The laws of motion. Newton's First, Second and Third Law. Application of Newton's Laws. Forces of friction.

4th **week:**
Lecture 7-8: Kinetic energy and the work-energy theorem. Gravitational potential energy. Spring potential energy. System and energy conservation. Power. Work done by varying forces.

5th **week:**
Lecture 9-10: Momentum and impulse. Conservation of momentum. Collisions. Elastic and inelastic collisions**.**
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6th **week:**
Lecture 11-12: Angular speed and angular acceleration. Rotational motion under constant angular acceleration. Centripetal acceleration. Newtonian gravitation. Kepler's laws.

7th **week:**
Lecture 13-14: Torque and the two conditions for equilibrium. The center of gravity. Rotational kinetic energy. Angular momentum.

8th **week:**
Lecture 15-16: States of matter. Deformation of solids. The Youngs's, shear and bulk modulus. Density and pressure. Variation of pressure with depth. Pressure measurements. Buoyant forces and Archimedes's principle.

9th **week:**
Lecture 17-18: Temperature and the zeroth law of thermodynamics. Thermometers and temperature scales. Thermal expansion of solids and fluids. Macroscopic description of an ideal gas. The kinetic theory of gases.

10th **week:**
Lecture 19-20: Energy in thermal processes. Heat and internal energy. Specific heat. Calorimetry. Latent heat and phase change. The first law of thermodynamics.

11th **week:**
Lecture 21-22: The second law of thermodynamics. Entropy. Refrigerators and heat pumps. Elastic potential energy. Hook's law. Simple harmonic motion. Motion of a pendulum.

12th **week:**
Lecture 23-24: Waves. Frequency, amplitude and wavelength. Interference of waves. Reflection of waves. Sound. Energy and intensity of sound waves. Shock waves, standing waves, standing waves. Doppler effect. The ear and the principles of hearing.

13th **week:**
Lecture 26-27: Properties of electric charges. Insulators and conductors. Coulomb's law. Electric field. Electric field lines. Electric flux and Gauss's law.

14th **week:**
Lecture 28-29: Electrical energy and capacitance. The parallel plate capacitor. Combinations of capacitors. Energy stored in capacitors. Capacitors with dielectric.

15th **week:**
Lecture 30-31: Electric current. Current and voltage measurements in circuits. Resistance and Ohm's law. Resistivity, temperature variation of resistance. Semiconductors and superconductors. Electrical activity of the heart. Defibrillators.

16th **week:**
Lecture 32-33: Direct current circuits. Resistors in parallel and series. Kirchhoff's rules and complex DC circuits. RC circuits. Conduction of electrical signals by neurons.

17th **week:**
Lecture 34-35: Magnetism. Magnetic field. Earth's magnetic field. Magnetic force on current carrying conductors. Torque on a current loop and electric motors. Magnetic field of a long straight wire and Ampere's law. Magnetic field between two parallel conductors. Magnetic field of loops and solenoids.

18th **week:**
Lecture 36-37: Induced emf and magnetic flux. Faraday's law of induction. Motional emf. Lenz's law. Generators. Self-inductance RL circuits.

19th week:
Lecture 38-39: Alternating current. Resistors, capacitors and inductors in AC circuits. The transformer. Properties of electromagnetic waves. The spectrum of electromagnetic waves.

20th **week:**
Lecture 40-41: The nature of light. Reflection, refraction and dispersion. Prisms. The rainbow. Huygen's principle. Total internal reflection and its medical applications.

21st **week:**
Lecture 42-43: Lenses and mirrors. Flat mirrors. Images formed by spherical mirrors. Thin lenses. Images formed by lenses. Lens aberrations. Wave optics. Conditions for interference, polarization of light. Diffraction. The camera, the simple magnifier, the compound microscope, the telescope and the eye.

23rd **week 44-45:** Quantum physics. Blackbody radiation, photoelectric effect, generation of X-ray.
Some properties of the nuclei. Binding energy. Radioactivity, the decay processes. Medical application of radioactivity.

Academic advisor: Dr. Attila Jenei, Department of Biophysics and Cell Biology
Recommended book: Serway, Vuille: College Physics (11th edition)