INTRODUCTION TO BIOPHYSICS
SCHEDULE
15.09 – 06.10 2023

	DATE	Topic
1	15.09.	INTRODUCTION
2	15.09	***Description of Motion: Kinematics in One and Two Dimensions*** 1. To understand the concept of frames of reference and relative velocity 2. To employ concepts of average velocity, instantaneous velocity and acceleration to solve problems 3. To learn how to use graphs to find quested unknowns 4. Motion at a constant acceleration. Falling Objects 5. To distinguish vectors and scalars 6. To learn how to add and subtract vectors-graphical methods 7. To learn how to find the components of vectors and add vectors by components 8. To introduce students to vectors and the use of sine and cosine for a triangle when resolving components 9. Projectile motion
3	18.09	***Dynamics: Newton's Law of motion in Straight Line:*** 1. To understand Newton's 1st law. 2. To understand Newton's 2nd law. 3. To understand the relationship between applied force, net force, acceleration, and mass for 1-dimensional motion. 4. To understand Newton's 3rd law. 5. The normal force. 6. To gain practice drawing free-body diagrams. 7. To introduce contact forces: the normal force and the force due to friction

4	18.09	***ELEMENTS OF KINEMATICS AND DYNAMICS OF CIRCULAR AND ROTATIONAL MOTION*** 1. To understand relations between linear and angular velocity, relations between period and frequency 2. Centripetal acceleration and the centripetal force 3. Torque – the definition and practice – some aspects of equilibrium
5	19.09	***WORK, POWER AND ENERGY*** 1. To explore the definition of work and learn how to find the work done by a force on an object 2. Gravitational potential energy 3. Conservation and conversion of energy 4. Work-energy principle
		10-15 min short quiz
6	20.09	***WORK, POWER AND ENERGY-CONTINUED. ELEMENTS OF ELASTICITY AND FRACTURE*** 1. Power 2. Elastic potential energy 3. Elasticity - mechanical properties of solids: concepts of stress, strain, Hooke's law and Young's modulus 4. Energy Conservation with Dissipative Forces
7	25.09	***OSCILLATIONS*** 1. To learn the basic terminology and relationships among the main characteristics of simple harmonic motion: period, frequency, displacement, velocity and acceleration 2. Energy in Simple Harmonic Motion 3. To learn to apply the law of conservation of energy to the analysis of harmonic oscillators.

8	25.09	***WAVES AND SOUNDS*** 1.Propagation of waves in different substances 2.To understand the relationships among the parameters that characterize a wave: period, frequency, wavelength and intensity; the inverse square law 3.To learn the properties of logarithms and how to manipulate them when solving sound problems – the Sound Intensity Level, dB scale 4.To understand standing waves, including calculation of wavelength and frequency in strings and tubes
9	26.09	***FLUIDS*** 1. Density, mass and weight 2. Pressure and related force 3. Pascal's principle – hydraulic lift 4. To understand the applications of Archimedes' principle and the buoyant force 5. Fluids in motion: flow rate and the law of continuity 6. Viscosity 7. Flow in tubes: Poiseuille's equation
		10-15 min short quiz
10	27.09	***TEMPERATURE AND KINETIC THEORY OF GASES*** 1. Temperature and Thermometers 2. Thermal Equilibrium and the Zero-th Law of Thermodynamics. 3. To understand The Ideal Gas Law 4. To solve problems with the Ideal Gas Law 5. Molecular Interpretation of Temperature
11	28.09	***KINETIC THEORY OF GASES CONTINUED. THERMAL ENERGY*** 1. To distinguish temperature, heat and internal energy 2. To understand the First Law of thermodynamics 3. To understand concepts of specific heat and latent heat 4. Heat exchange – the calorimetry solving problems

12	28.09	***ELECTRIC CHARGE AND FIELD*** 1. Electric charge and its conservation 2. Induced charge 3. Electric force - Coulomb's Law 4. Electric field and the electric field lines 5. Electric Potential
13	29.09	***ELECTRIC CURRENTS AND DC CIRCUITS*** 1.To understand the concept of electric current 2. The electrical resistance, resistors and resistance 2. To use the Ohm's law to solve problems 3. To understand electric power 5. Electromotive force (EMF) and terminal voltage 6. Resistors in series and parallel, Kirchhoff's rules
14	02.10	***MAGNETISM AND ELECTROMAGNETIC INDUCTION*** 1. Magnets and magnetic fields 2. Sources of magnetic fields: field due to a straight wire and field inside a solenoid 3. Force on an electric current in a magnetic field 4. Force on electric charge moving in a magnetic field 5. Faraday's law of induction; Lenz's law. Practice with Lenz's law
		10-15 min short quiz
15	04.10	***ELECTROMAGNETIC WAVES AND GEOMETRIC OPTICS*** 1. Electromagnetic waves and the electromagnetic spectrum: wavelength, frequency and speed of propagation 2. Polarised vs unpolarised light: the Malus law 3. Refraction of light: index of refraction, Snell's law; total internal reflection; fibre optics
16	05.10	***GEOMETRIC OPTICS - CONTINUED*** 1. Thin lenses, focal point, focal length, optical power

		2. Ray tracing: converging and diverging lenses 3. The tin lenses equation; magnification 4. Combination of lenses 5. Lensmaker's equation
17	06.10	***NUCLEAR PHYSICS AND RADIOACTIVITY*** 1. Structure and properties on the nucleus, nuclear size 2. Binding energy and Nuclear Forces 3. Radioactivity: alpha, beta and gamma decay; Conservation of nucleon number and charge 4. The law of radioactive decay; the half-life time ***ELEMENTS OF MODERN PHYSICS: EARLY QUANTUM THEORY AND MODELS OF THE ATOM*** 1. Photon theory of light, photon energy, Planck's constant 2. Photoelectric effect 3. Compton effect 4. Early models of the atoms, atomic spectra, the Bohr model: energy levels, transitions, absorption and emission Wave-particle duality: the de'Broglie hypothesis
18	06.10	**TEST EXAMINATION 3:00 pm OLAT Parkowa street**

COURSE	COORDINATOR	PLACE OF CLASSES
Welcome Lecture	**Prof. Adrianna Mostowska MSc., Ph.D**	**PUMS Center of Medical Biology, address: 8 Rokietnicka str. room 3009**
PHYSICS **Department of Biophysics,** **6, Grunwaldzka str,** **(61) 854-66-91**	**Assoc. Prof. Anna Marcinkowska-Gapińska, MSc, PhD** intro.biophys@ump.edu.pl	**PUMS Center of Medical Biology, address: 8 Rokietnicka str.** **room 2008 (gr. I & IV),** **room 2009 (gr. II & V),** **room 2018 (gr. III & VI)**
CHEMISTRY **Department of General Chemistry,** **8, Rokietnicka St.(UCBM),** **61 854-65-89**	**Dr Bogna Gryszczyńska, MD, PhD** pums.intro.medchem@gmail.com **Dr Krzysztof Strzyżewski MD, Ph.D** pums.intro.medchem@gmail.com	**PUMS Center of Medical Biology, address: 8 Rokietnicka str.** **room 1052 (gr. I & IV),** **room 3008 (gr. II & V), *6.10 room 3018** **room 4051 (gr. III & VI)**
BIOLOGY **Department of Cell Biology,** **5D Rokietnicka St.,** **61 854 71 90**	**Dr Aleksandra Śliwa MD, PhD** *(coordinator for MD students)* intro.medbiol@ump.edu.pl **Dr Małgorzata Tokłowicz, MSc, PhD** *(coordinator for DDS students)* intro.medbiol@ump.edu.pl	**PUMS Center of Medical Biology, address: 8 Rokietnicka str.** **room 3009 (gr. I & IV),** **room 1019 (gr. II & V),** **room 3018 (gr. III & VI)**