**Subject: BIOPHYSICS**

**Subject: VETERINARY MEDICINE**

**Laboratory classes – list of experiments and corresponding questions**

|  |  |  |  |
| --- | --- | --- | --- |
| 1. **THERMODYNAMICS** | | | |
| **Entropy/Enthalpy**   * Thermodynamic system and thermodynamic parameters; * State functions * Heat, work and internal energy, units; * Temperature as a measure of particles energy, scale of temperature; * Specific heat; * First law of thermodynamics; * Thermodynamic processes * Volume work and inner energy changes, enthalpy; * Second law of thermodynamics; * Entropy: thermodynamic and statistical definitions. | | **Blood flow**   * Thermodynamic system and thermodynamic parameters; * Zeroth law of thermodynamics; * Temperature as a measure of particles energy, scale of temperature; * Heat, work and internal energy, units; * Heat and heat transfer; * Specific heat, heat capacity; * Thermal expansion; * First law of thermodynamics; * Heat balances. | |
| 1. **TRANSPORT PHENOMENA. MATTER, ENERGY AND MOMENTUM EXCHANGE** | | | |
| **Viscosity**   * Mass, weight and density * Liquids and fluids; * Pressure – methods of measurement and units; * Buoyancy; * Newtonian and non-Newtonian fluids; * Continuity equation and Bernoulli’s principle; * Laminar and turbulent flow; * Viscosity, viscosity force (Newton’s law of hydrodynamics); * Viscosity coefficient – properties and methods of measurement; * Hagen-Poiseuille equation and Stocks law; | **Surface tension**   * Weight, gravity and density of bodies; liquids and fluids - definitions; * Kinetic and molecular theory of fluid structure; * Surface tension factor; * Detergents; * Wetting and non-wetting liquids, contact angle; * Surface phenomena: adhesion, cohesion, capillarity * The phenomenon of formation and types of meniscus; * Measuring the surface tension coefficient with a stalagmometer | | **Ohm’s Law**   * Current strength and voltage – definitions and units; * Alternating and direct current; * Current flow in electrical circuit; * Resistance and conductivity; * Ohm’s law; * Electrical resistivity and conductivity; * The dependence of resistance from geometrical parameters and temperature; * Kirchhoff's circuit laws; * Resistors series and parallel circuits. |
| 1. **OSCILATIONS AND MECHANICAL WAVES. BIOMECHANICS** | | | |
| **Mathematical Pendulum**   * Oscillations and simple harmonic motion basic concepts; * Harmonic motion equation; * Declination, velocity and acceleration in harmonic motion; * Newton's law of universal gravitation; * Mathematical pendulum; * Frequency, period and oscillations’ amplitude * Gravitational acceleration measurements with mathematical pendulum application. | **Spring Pendulum**   * Oscillations and simple harmonic motion basic concepts; * Harmonic motion equation; * Declination, velocity and acceleration in harmonic motion; * Frequency, period and oscillations’ amplitude * Mass and weight; * Mass on a spring movement; * Hook’s law * Isochronous oscillations | | **Torque**   * An idea of rigid body; types of motion; * Torque (moment of force) and angular momentum; * Angular momentum conservation; * Moment of inertia (angular mass), Steiner theorem (Huygens-Steiner, parallel axis theorem); * Dynamic’s laws for circular motion; * Kinetic energy of circular motion; |
| **Ultrasounds**   * Mechanical waves and mechanical wave equation; * Basic concepts of wave movement: amplitude, period and frequency, wavelength etc * Velocity of mechanical waves and its dependency from medium elasticity; * Hook’s law and Young’s modulus; * Acoustic waves and ultrasounds; * Methods of obtaining ultrasounds. * Sound intensity and sound intensity level; * Acoustic impedance; * Doppler effect and its application in blood flow measurements; | **Lever**   * Statics and static equilibrium * Centre of the mass (gravity) * Equilibrium equation; * Stability and balance; * Leavers and mechanical advantage * Examples of biomechanical levers | |  |
| 1. **ELECTROMAGNETIC WAVES** | | | |
| **Microscope/Lenses**   * Reflection and refraction, Snell’s law * Refractive indexes; * Total internal reflection and critical angle; * Lenses types; * Focal point and focal length; * Image construction in converging and diverging lenses * Lens-maker’s equation and simplified lens equation; * Optical power, units * Dispersion; * Microscope and magnifying glass (single microscope); | **Spectrophotometer**   * EM radiation and EM spectrum (Vis, UV) * Forms of inner energy of particles * Spectrophotometer – construction and principle of operation * Beer–Lambert law and its validity * Absorbance, attenuation coefficient, absorbance additivity, transmittance * Jablonski diagram * Energy units in spectroscopy * Emission and absorption spectrums | | **Polarimeter**   * EM radiation as a wave and particle - wave–particle duality * EM spectrum. * Polarization and features of polarized light * Types of polarization * Methods of polarization (reflection on dielectric, multiply refraction in dielectric, birefringence, dichroism, Nicol prism) * Rotation of the plane of polarization by optically active substances * Polarimeter – construction and principle of operation |
| 1. **NUCLEAR PHYSICS AND RADIOACTIVE DECAY** | | | |
| **Radioactive decay**   * Atom structure; * α, β and γ decays * Exponential decay; * Exponential decay constant and half-life; * Radioactive decay rates; * Dosimetry and radiation protection; * Nuclear reactions |  | |  |