UNIWERSYTET
WARMIŃSKO - MAZURSKI
W OLSZTYNIE

UNIVERSITY OF WARMIA AND MAZURY IN OLSZTYN
SCHOOL OF MEDICINE

Syllabus for Entrance Examinations

PHYSICS

Units and kinematics, Newtonian Mechanics

Units (fundamental measurements and dimensions, multiples and submultiples), scientific notation, trigonometric relations, logarithms, derivatives, integrals, vectors and scalars (vector representation, vector addition, vector subtraction, multiplying a vector by a scalar, vector dot multiplication, vector cross multiplication. Kinematics (displacement, velocity, acceleration). Motion with constant acceleration (linear motion, projectile motion. Newton's three laws (force, mass and weight, first, second, third law of dynamics). Drawing free-body diagrams. Gravity. Different kinds of motion (translational motion, rotational motion, circular motion). Forces and friction. Mechanical equilibrium (translational equilibrium, rotational equilibrium)

Work, Energy and Momentum

Energy (kinetic energy, potential energy, total mechanical energy, conservation of mechanical energy). Work (calculating work and power, work-energy theorem). Momentum (impulse, conservation of momentum). Collisions (elastic collisions, inelastic collisions).

Thermodynamics

Zeroth law of thermodynamics (temperature, different temperature scales, thermal expansion). First law of thermodynamics (heat, heat transfer, conduction, convection, radiation, specific heat, heat transformation, heat of fusion, heat of vaporization). The second law of thermodynamics and entropy.

Fluids and Solids

Characteristics of fluids and solids (density, pressure, gauge pressure). Hydrostatics (Pascal's principle, Archimedes principle, molecular forces in liquids). Bernoulli's equation. Elastic properties of solids (Young's modulus, shear modulus, bulk modulus).

Electrostatics

Definition of Electrostatics. Charges, fundamental unit of charge. Coulomb's law. Electric field (stationary test charge, stationary source charge, field lines). Electric potential. Electric potential energy. Equipotential lines. The electric dipole (dipole moment).

Magnetism

Definition of Magnetism. Source of magnetic field (magnetic materials, diamagnetic, paramagnetic and ferromagnetic materials, straight current – carrying wire, right-hand rule, circular loop of current – carrying wire). The magnetic field force (force on a moving charge, force on current – carrying wire).

DC and AC Circuits

Current (electrical conductors, ampere). DC Current. AC current. Circuits laws (Kirchhoff's junction rule, Kirchhoff's loop rule). Resistance. Characteristics of resistors that determine resistance (resistivity of the conductive material, length, cross-section area, temperature). Ohm's law. Power of resistors. Resistors in series. Resistors in parallel. Capacitance and capacitors. Parallel plate capacitors. Dielectric materials. Capacitors in series. Capacitors in parallel.

Periodic Motion, Waves, and Sound

Simple harmonic motion. Springs. Hooke's law. Angular frequency. Pendulum. General wave characteristics (transverse and longitudinal waves, frequency, phase, amplitude, period, wavelength, speed of the wave). Traveling and standing waves. Resonance. Sound (audible waves, infrasonic waves, ultrasonic waves). Intensity and loudness of sound. Sound level (decibels). Frequency and pitch. Beats. Doppler effect. Fundamental frequency. Open pipe, closed pipes.

Light and Optics

Electromagnetic spectrum (electromagnetic waves, color and visible spectrum. Geometrical optics (reflection, plane mirrors, spherical mirrors, concave and convex mirrors, converging and diverging mirrors). Refraction (the law of refraction – Snell's, index of refraction). Total internal reflection, critical angle. Spherical lenses. Converging and diverging lenses. Lensmaker's equation. Multiple lens system. Dispersion. Diffraction. Interference. Polarization.

Atomic Phenomena

Thermal blackbody radiation (ideal radiation, cavity radiation),Planck's formula.Wien's displacement law. Stefan-Boltzmann law. Photoelectric effect (threshold frequency, work function. The Bohr model of the hydrogen atom (energy levels, orbit, ground state, excited state. Emission and absorption of light. Fluorescence. Energy (in joules, in electron-volts).

Nuclear Phenomena

Nuclei (atomic number, mass number). Isotope. Atomic mass and atomic mass unit. Atomic weight. Nuclear binding energy and mass defect (binding energy). Nuclear reactions and decay. Fusion. Fission. Radioactive decay (alpha decay, beta decays, gamma decay). Radioactive decay half-life. Exponential decay.