Tárgytematika / Course Description
Physics

MENB_BÉTA033

Tárgyfelelős neve / Teacher's name: dr. Horváth Zoltán
Félév / Semester: 2024/25/1
Beszámolási forma / Assesment: Vizsga
Tárgy heti óraszáma / Teaching hours(week): 2/1/0
Tárgy féléves óraszáma / Teaching hours(sem.): 0/0/0

OKTATÁS CÉLJA / AIM OF THE COURSE

The basic aim of the course is to give students a deeper understanding and knowledge of the practical applicability of the laws of physics. It contributes to the basic aim of the course to give students a deeper understanding of the laws of physics than they learned in high school. This knowledge can mainly be applied in the agriculture and food industry. Furthermore, it can allow students to contribute to the sustainable development of agriculture and food security. The subject matter is presented so that student can acquire the essential knowledge of material and energy saving production and, at the same time, they can also take into account the environmentally friendly requirements. Moreover the course encourages individual creativity of students.

TANTÁRGY TARTALMA / DESCRIPTION

Lecture 1. Introduction of the research activities of the Department of Biosystems and Food Engineering. Use of the laws of physics in agroecology and food innovation.

Lecture 2. Base quantities and base units of the International System of Measurement; SI and ENGLISH units andconversion factors; significant figures and standard form.

Lecture 3. Vectors: demonstration in the Cartesian coordinate system; magnitude of vectors; adding vectors numerically, subtracting vectors graphically; product of vectors: DOT product (scalar product); cross product of vectors.

Lecture 4. Newton’s Laws of motion: velocity; motion on straight line with uniform acceleration; graphs: v= f(**t**) at const **a**; a=f(t); s= f(**v**), motion along a curve; rotational motion, tangential velocity; Acceleration in a circle at uniform scalar tangential velocity. Test 1.

Lecture 5. Friction in a inclined plane; coefficients of friction (kinetic and static); balance of centrifugal force and force of friction in a circular motion; mass moment of inertia of rigid bodies, kinetic energy of rotational motion; moment of inertia of a ring; derivation.

Lecture 6. Fluid mechanics; hydrostatic law with derivation; buoyancy force vs. density; fraction of ice above surface; Archimedes principle.

Lecture 7. Fluid dynamics: Bernoulli's equation: principle of energy conversation; changing energy from one form to another; ideal and Newtonian fluids; dynamic and kinematic viscosity; dimensionless numbers in fluid mechanics. Test 2.

Lecture 8. Heat conduction; steady heat conduction in plane walls (also multilayer); thermalconductivity; thermal resistance network; thermal resistance in parallel; heat conduction in cylinders and spheres (also multilayer); introduction to partial differential equations of heat transfer.

Lecture 9. Thermodynamic systems; types of energy; thermodynamic properties;general gas law for ideal gases; isoprocesses in the closed systems of an ideal gas; special state transition types of gases presented in p-v diagram (Cartesian coordinate system);the first law of thermodynamics; phase transition of fluids; entropy; second law of thermodynamics; Carnot cycle in p-v and T-s diagram; thermal efficiency of cycles. Test 3.

Lecture 10. Electromagnetic spectrum; spectral regions (VIR, NIR, SWIR, MIR, TIR); basic laws of radiation (Stefan-Boltzmann law, Planck's law, Wien's displacement law, Kirchhoff's law); reflectivity, absorptivity and transmissivity in biological materials; multispectral and hyperspectral detection of solar radiation reflectance; different vegetation indices; thermal remote sensing.

Lecture 11. Electricity and magnetism; Coulomb's law; energy of a system of charges; Ohm's law; capacitance; Gauss law; combination circuits; Kirchhoff's rules; Lorentz force; Ampere's law; magnetic field and force; working principle of electric motors.

Lecture 12. Mass of protons, neutrons, and electrons; energy equivalent of nuclear matter; volume and density of nuclei; binding energy of nuclei; half-life of nuclear decay; nuclear fusion; biological effects of radiation.

Lecture 13. Application of discussed laws in agricultural and food production practice; measuring principles.

Lecture 14. Summary of the topics in the semester. Useful formulas. Test 4.

SZÁMONKÉRÉSI ÉS ÉRTÉKELÉSI RENDSZERE / ASSESMENT'S METHOD

During the semester students need to write four tests in order to assess how well students follow the lectures. If the average of these tests exceeds 60% and the student has attended 70% of the lectures, a mark will be offered. If the student accepts the offered mark, then the student does not have to take the final exam.

At the end of the semester a written final exam will be given. If the answers are not clear or clarification is needed, the teacher has the right to ask oral questions regarding those particular answers.

KÖTELEZŐ IRODALOM / OBLIGATORY MATERIAL

Belal E. Baaquie: Laws of Physics : A Primer. Core Curriculum. National University Singapure (Free)

Recommended literature:

H.L. Field-J. M. Long: Introduction to agricultural engineering technology. Springer

K.F.Kuhn: Basic Physics. Wiley

You Tube relevant movies for distance education: M. van Biezen, http://ilectureonline.com; Kahn Academy, free versions, https://www.khanacademy.org/donate

AJÁNLOTT IRODALOM / RECOMMENDED MATERIAL