**Level**: bachelor

**Course title:** Continuum Mechanics

**Status**: obligatory

**ECTS**: 5

**Requirements**: Mechanics

**Learning objectives**

Acquiring the basic knowledge of the dynamic laws of the continuum mechanics, as well as correct understanding of the phenomena and processes characteristic for the continuum media.

**Learning outcomes**

After taking the course, the student should have developed:
**General abilities**: basic knowledge of this field, following the literature, analysis of various solutions and the choice of the most adequate solution, application in practice and other subjects.
**Subject-specific abilities:** the basic knowledge of kinematics and dynamics of the continuum, including the complete system of dynamic equations which describe ideal and viscous fluid, whirls formation as well as the influence of the Earth's rotation on it, examples of the whirls in the Earth's atmosphere; basics of dimensional analysis; elements of turbulent motion and Reynolds equations.

**Syllabus**

*Theoretical instruction*

Crossover from discontinuum to continuum approach. Concept of the infinitesimal continuum element. Lagrange's and Euler's method. Local and substantial derivative. Tensor of deformation and the meaning of its components. Tensor of velocity of deformation. Equation of continuity. Surface and body forces. Stress tensor and its basic properties. General dynamic equation of motion. Equation of kinetic energy. First and second law of thermodynamics. Complete system of equations. Ideal and real fluids. Basic quantities which characterize the motion of fluids. Pressure in ideal fluids. Basic dynamic equation of ideal fluid. Barotropic and baroclinic flows. Different forms of Euler equation. Fluid in rest. Steady flow. Potential flow. Whirls in fluids. Wave propagation of small perturbations. Hypersound fluid flow. Shock waves. Newton fluids. Navier-Stokes equation. Initial and boundary conditions. Dimensional analysis and Π-theorem. Nondimensional equation of viscous fluid. High and low Reynolds number flows. Elements of turbulent motion and Reynolds equations.

*Practical instruction*

Exercises.

| **Weekly teaching load** | | | | Other: |
|---|---|---|---|---|
| Lectures: 3 | Exercises: 2 | Other forms of teaching: 0 | Student research: 0 | |