Information sheet for the course
Thermomechanics

University: *Alexander Dubček University of Trenčín*

Faculty: *Faculty of special technology*

Course unit code: *MŠT/B/4-36/d* | **Course unit title:** *Thermomechanics*

Type of course unit: *compulsory*

Planned types, learning activities and teaching methods:
2 lecture hours and 1 hour seminars per week, face to face method.

Number of credits: *2*

Recommended semester: *5^{th} semester in the 3^{rd} year (full-time)*
6^{th} semester in the 3^{rd} year (part-time)

Degree of study: *I. (bachelor)*

Course prerequisites: *MŠT/B/4-35/d Fluid mechanics*

Assessment methods:
Continuous assessment: 100% attendance and active creative work on exercises meet the goals set exercises, mastery of technical terminology, min. 60% attendance at lectures, semester work properly. The ongoing evaluation is necessary to obtain min. 25 points out of a total of 50 points. Final assessment: Assignment form of a written test with emphasis on theoretical knowledge of the subject and the support of the oral response, which is verified mastering nature of physical phenomena, laws of conservation of mass, momentum, conservation of energy in fluid flow to various examples. Defend and explain the test questions and examples with additional queries. Point-rated evaluation criteria: (E) ≥ 56 points, (D) ≥ 67 points (C) ≥ 77 points (B) ≥ 87 points (A) ≥ 95 points.

Learning outcomes of the course unit:
Student will complete a basic overview of the basic energy balance in the technical equipment of thermal processes and the behavior of the agents working in these processes and of the foundations of fluid flow. Understand the principles of thermal cycles of energy conversion and energy and exergy evaluation.

Course contents:
Basic concepts of thermodynamics and the properties of pure substances: basic concepts, state and using process variables. Thermodynamic system. The specific heat capacity. The ideal gas and ideal gas laws. Mixtures of ideal gases. Mass and mole fractions. The first law of thermodynamics (I.ZTD) I.ZTD for a closed system. Volume work. Internal energy. The first and second formulation I.ZTD. Enthalpy. Technical work. I.ZTD for an open system. Reversible and irreversible processes. Basic reversible processes of an ideal gas: Isochoric, isobaric, isothermal, adiabatic and polytropic process. Heat thermodynamic cycles. Reversible Carnot cycle and heat balance. The reverse Carnot cycle. Irreversible Carnot cycle. The second law of thermodynamics (II.TD): Features reversible and irreversible processes. Entropy. Entropy isolated closed system with reversible and irreversible processes. Gibbs equation. Entropy diagrams ideal gas. Gibbs free enthalpy. Helmhotz free energy. Third Law of Thermodynamics (III.ZTD) Nernst theorem-absolute value of entropy. Exergy and anergy. Exergy in an open system, exergická force. Gouy-barn law. Otto and Diesel comparator circuit. Thermal efficiency and job. Comparative Brayton Cycles: closed and open Brayton circulation. Thermal efficiency and job. Clausius-Rankine comparator circuit. Energy analysis Clausius-Rankine circulation. Real Gases: Equations of state of real gases. Throttling of real gases. Joule-Thomson effect. Liquefaction of real gases. Circulation compressor. Refrigeration machines and heat pumps. The absorption refrigeration machine. Heat Transfer - Thermokinetics: Basic concepts and modes of heat transfer. Differential equation of heat and Conditions clarity. Stationary heat conduction:

Stationary heat conduction in planar and cylindrical wall without internal heat sources. Stationary heat conduction in a plane wall with evenly distributed internal heat sources. Unsteady heat conduction: Unsteady heat conduction. Unsteady heat conduction in planar and cylindrical wall without internal heat sources. Heating and cooling radiators for small and large Biot number .. one-dimensional model of the temperature field of the casting solidification. Convective heat transfer: Basic concepts and modes of transmission of the body flow. Newton's law. The equations valid in the boundary layer. Continuity equation. Navier-Stokes theorem. Fourier's law of heat conduction. Fourier-Kirchhoff dif. heat equation. Similarity theory: The main criteria of similarity. Basic terms and sentence similarity theory. Heat transfer by free convection in unlimited and limited space. Forced convection on a flat wall. Forced convection in the pipeline. Heat transfer with phase transformations: Heat transfer by boiling and condensation. Heat exchangers. Heat transfer planar and cylindrical wall. Mean logarithmic temperature gradient. Radiation heat transfer: Basic concepts and principles of radiation. Planck's law. Wien approximation. Stefan-Boltzman law. Kirchhoff's law. Lambert law. Principles of calculation of heat transfer radiation. Combined heat transfer by convection and radiation.

Recommended of required reading:

Taraba, B. A KOL.: MECHANIKA TEKUTÍN. TERMOMECHANIKA. BRATISLAVA, STU 2004. ISBN 80-227-1265-5.
Taraba, B. A KOL.: MECHANIKA TEKUTÍN. TERMOMECHANIKA. ZBIERKA PRÍKLADOV. STU, BRATISLAVA 2002. ISBN 85-254-1729-0.
Antal, Š, Mahera, A.: TERMOMECHANIKA. ZBIERKA PRÍKLADOV. SJF STU. ES STU, BRATISLAVA 2000.
KABÁT, E.: Termomechanika. Termokinetika. SjF SVŠT. ALFA, Bratislava 1984.

Language: *Slovak*

Remarks:

Evaluation history

Total number of students being evaluated: 332

A	B	C	D	E	FX
14.45	22.20	26.20	17.47	19.58	0.30

Lecturers: *prof. Ing. Jozef Turza, CSc.*
Ing. Beáta Kopiláková, PhD.

Last modification: *15.4.2014*

Supervisor: *Assoc. prof. Ing. Peter Lipták, CSc., guarantee of the study program "Mechanisms in Special Technology".*