Course Description

Discipline/Course: Thermodynamics
The Basic Educational Program specialty: Mechanical engineering

Department of High Technology Physics in Mechanical Engineering
Instructor: Anna G. Knyazeva, Professor
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Learning Outcomes:
The student must,
Know:
• concepts of the thermodynamic system; The basic laws of classical thermodynamics; The concept of irreversible processes and entropy; Potential theory; Onsager's theory;
• representations of local equilibrium; Production of entropy; Generalized flows and forces;
• basic concepts of technical thermodynamics and concepts of thermodynamic processes;
• basic concepts of chemical thermodynamics;
• areas of application of modern thermodynamics and the main directions of its development
Be able to:
• use the method of cycles to describe real technological processes
• calculate thermodynamic properties;
• Calculate the production of entropy in irreversible processes;
• apply thermodynamic laws to the description of objects of different physical nature
Own:
• the main methods of modern thermodynamics;
• Knowledge of the history of the development of thermodynamics..

Course Objectives and Content:
consists in the formation in the students of the general ideas, knowledge and skills needed to describe the general laws in the state and evolution of macroscopic systems in physics, engineering, chemistry, biology, sociology, etc., in acquaintance with the basic directions of the application of general thermodynamic theory.

Course Outline:

1. Basic thermodynamical laws
2. Potentials theory (definitions, extremal properties; general equilibrium and stability conditions)
3. Basis for phase equilibrium and phase transitions
4. Elements of thermodynamics for heterogeneous and multicomponent systems
5. Principles of technical thermodynamics
6. Introduction to chemical thermodynamics
7. Connection between thermodynamics and statistical physics
8. Classical thermodynamics for irreversible processes
9. Modern directions of thermodynamics

Course Delivery: one semester, 32 hours of lectures, 32 hours of laboratory work.

Prerequisites: To successfully master the discipline, the student must know the fundamental foundations of the courses: "Higher Mathematics" - know the simplest methods of solving the ODE; Integral and differential calculus, "Physics", "Informatics" - must own any application package (for example, MATHCAD)

Final Assessment: pass/fail exam

Course Developer: Anna G. Knyazeva, Professor