**Nazwa przedmiotu:**

Thermodynamics I

**Koordynator przedmiotu:**

Prof. Piotr Furmański

**Status przedmiotu:**

Obowiązkowy

**Poziom kształcenia:**

Studia I stopnia

**Program:**

Aerospace Engineering

**Grupa przedmiotów:**

Wspólne

**Kod przedmiotu:**

ANW116

**Semestr nominalny:**

2 / rok ak. 2009/2010

**Liczba punktów ECTS:**

5

**Liczba godzin pracy studenta związanych z osiągnięciem efektów uczenia się:**

**Liczba punktów ECTS na zajęciach wymagających bezpośredniego udziału nauczycieli akademickich:**

**Język prowadzenia zajęć:**

polski

**Liczba punktów ECTS, którą student uzyskuje w ramach zajęć o charakterze praktycznym:**

**Formy zajęć i ich wymiar w semestrze:**

|  |  |
| --- | --- |
| Wykład: | 30h |
| Ćwiczenia: | 30h |
| Laboratorium: | 0h |
| Projekt: | 0h |
| Lekcje komputerowe: | 0h |

**Wymagania wstępne:**

Basic calculus

**Limit liczby studentów:**

**Cel przedmiotu:**

Knowledge of basic laws governing energy conversion and ways to determine quality of different energy conversion processes. Knowledge of the fundamentals of thermodynamics applied to combustion processes.

**Treści kształcenia:**

Lecture: Thermodynamic system and its properties, thermodynamic functions, irreversible and reversible transformations,microscopic and macroscopic energy, internal energy. Energy interactions (work, heat, energy exchange accompanying mass flow). Enthalpy. 1st Law of Thermodynamics for open system. Special cases (closed system, steady state, cycles). Thermal efficiency of engines and Coefficent of performance (COP) for refrigerators and heat pumps. Entropy and its features. Balance of entropy for open systems. Entropy generation and 2nd Law of Thermodynamics. Carnot cycle. Thermodynamic equilibrium and its types. Conditions for thermal, mechanical and phase equilibrium. Chemical potential. Simple substance. Diagrams of state. Thermal expansion and isothermal compressibility. Thermodynamic functions for simple substances. Special cases of simple substances (incompressible substance, perfect gas). Thermodynamic functions for incompressible substances and perfect gases. Specific heats of the perfect gases. Characteristic transformations of perfect gases (polytropic process,throttling). Fundamentals of thermodynamics in combustion. Stoichiometric and nonstoichiometric reactions. Air excess ratio. Mass balance of reactants. Standard state. Thermal effects of combustion. Exercises: Examples of thermodynamic analysis of processes based on the 1st Law of Thermodynamics. Determination of a system state after transformations as well as amount and form of energy exchanged between the system and the surroundings. Calculation of efficiency of different engine cycles and COP of refrigerators and heat pumps. Examples of thermodynamic analysis based on the entropy balance. Thermodynamic transformations in systems containing incompressible substances, vapours and perfect gases. Determination of an amount of air needed for combustion, composition of combustion products and the maximum temperature of combustion.

**Metody oceny:**

4 tests, practical and theoretical exams, point system

**Egzamin:**

**Literatura:**

Recommended texts (reading): 1) Y.A. Cengel, M.A. Boles: “Thermodynamics. An Engineering Appproach, McGraw Hill 2) Materials for students placed on website

**Witryna www przedmiotu:**

**Uwagi:**

## Efekty przedmiotowe