Study program: IT in Mechanical engineering

Type and level of studies: Undergraduate Academic Studies

Course unit: Thermodynamics

Teacher in charge: Snežana Dragićević; Teaching assistant Milan Marjanović

Language of instruction: English

ECTS: 5

Prerequisites: -

Semester: Summer

Course unit objective:
Providing the necessary level of knowledge to understand and solve various theoretical and practical problems in thermodynamics and heat transfer. Mastering the basic thermodynamic principles and laws, understanding thermodynamic states and state changes of materials involved in energy transformation processes. Understanding the principles of heat engines and refrigeration devices, and the fundamentals of heat energy transfer.

Learning outcomes of Course unit:
On completing the course the student should be able to explain the fundamental concepts of thermodynamics; apply the First Law of Thermodynamics; determine the state variables of ideal gases, mixtures, and water vapor; calculate work and heat in a thermodynamic process; apply the Second Law of Thermodynamics; explain the thermodynamic operation of heat engines and calculate the thermal efficiency of basic reversible cycles (Carnot, internal combustion engines, gas and steam turbine power plants); explain the thermodynamic operation of irreversible processes and perform energy transfer calculations in refrigeration devices and heat pumps; perform calculations and analysis on heat transfer processes (conduction, convection, radiation, and combined heat transfer).

Course unit contents:

Theoretical classes

Basic thermodynamic concepts. Thermodynamic state variables. Gas laws. Ideal gas equation of state. Energy balances of thermodynamics. First Law of Thermodynamics for closed systems. Second Law of Thermodynamics, reversible and irreversible thermodynamic processes. Polytropic process of an ideal gas. Mixtures of ideal gases. Real gases - water vapour. Reversible processes, the Carnot reversible cycle, internal combustion engine cycles, gas and steam turbine power plants. Irreversible processes: refrigeration and heat pumps. Fundamentals of heat energy transfer: conduction, convection, radiation, and combined heat transfer.

Practical classes

The practical exercises cover problem-solving tasks from all the areas mentioned in the course content.

Literature:

1. Hilary D. Brewster, Heat and Thermodynamics, ISBN 978-93-80179-08-7, Oxford Book Company, 2009.
2. Philip S. Schmidt, Ofodike Ezekoye, John R. Howell, Derek Baker, Thermodynamics: an integrated learning system, ISBN 978-0471143437, John Wiley & Sons, 2006.
3. S. Dragicević, Thermotechnics - handbook of solved problems, Faculty of Technical Sciences Čačak, 2013.
4. D. Voronjec, R. Đorđević, B. Vasiljević, Đ. Kozić, V. Bekavac, Solved problems in thermodynamics, University in Belgrade, Faculty of Mechanical Engineering, 2006.

Number of active teaching hours: 4	**Lectures: 2**	**Practice: 2**

Teaching methods:
Theoretical classes encompass verbal presentations using computers, presentations, demonstrations, and discussions. Practical classes involve auditorium exercise.

Evaluation (maximum number of points 100)

Exam prerequisites:	No. of points:	**Final exam:**	No. of points:
Activities during teaching process	10	Final exam (written):	30
Practical teaching	40	Final exam (oral):	20