Study program: Electrical Power Engineering and Mechatronics

Type and level of studies: Undergraduate Academic Studies

Course unit: Applied Thermodynamics and Fluid Mechanics

Teacher in charge: Snežana Dragićević; Teaching assistant Milan Marjanović

Language of instruction: English

ECTS: 5

Prerequisites: -

Semester: Winter

Course unit objective:
The course provides the necessary level of knowledge for understanding and solving various theoretical and practical problems in applied thermodynamics and fluid mechanics. It covers basic thermodynamic concepts and energy conversion methods, and heat transfer knowledge in relevant engineering application. In addition, the course gives insight into basic concepts of fluid mechanic topics include fluid statics and the basic laws of fluid flow. Students gain expertise in these areas through overlapping themes, understanding the broad applicability and importance of these disciplines in their future careers.

Learning outcomes of Course unit:
After completion of the course the student should be able to: understand the thermodynamic properties of systems, including the nature of heat, and apply this knowledge; describe thermodynamic and hydraulic systems and identify their interaction with the environment; calculate thermodynamic system properties; apply the first law of thermodynamics on various engineering devices and solve problem including energy conversion and efficiencies; perform calculations and analysis of basic heat transfer methods through flat and cylindrical surfaces; explain the fundamental physical properties of fluids; apply basic hydrostatic equations, and define pressure; calculate hydrostatic forces on plane and curved surfaces; explain the basic equations used in fluid mechanics like the Bernoulli equation, the energy equation for a steady flow system; calculate pressure drops due to friction and local energy losses, average flow velocities, fluid flows, and pump power in pipelines.

Course unit contents:

Theoretical classes

Thermodynamic system properties. Ideal gas laws. The first law of thermodynamics. Energy balances of thermodynamics. Heat transfer by conduction, convection, and radiation. Introduction and physical properties of fluids. Fluid statics: hydrostatic pressure, Euler's equations, Pascal's law, the force of pressure on plane and curved surfaces, buoyancy. Fluid kinematics: basic concepts of fluid flow, laminar and turbulent flow, Bernoulli's equation, energy losses in fluid flow, pipeline calculations, pump systems.

Practical classes

Determination of thermodynamic properties and applying thermodynamic laws to ideal gases; temperatures and heat fluxes in heat transfer problems; hydrostatic pressure and forces on plane and curved surfaces; application of Bernoulli's equation in the calculation of fluid flow parameters in pipelines. Part of the computational exercises is realized through the use of software tools (FluidSim, Eplan). Laboratory exercises take place in the laboratory and involve demonstrating the operation of a pumping system and analyzing operational parameters under various operating conditions.

Literature:

1. Donald F. Elger, Barbara A. LeBret, Clayton T. Crowe, John A. Roberson, Engineering Fluid Mechanics, 12th Edition, ISBN 978-1-118-88068-5, John Wiley & Sons, 2019.
2. Marcel Escudier, Introduction to Engineering Fuid Mechanics, Oxford University Press, ISBN 978-0-19-871988-5 , USA, 2017.
3. Philip S. Schmidt, Ofodike Ezekoye, John R. Howell, Derek Baker, Thermodynamics: an integrated learning system, ISBN 978-0471143437, John Wiley & Sons, 2006.
4. S. Dragicević, Thermotechnics - handbook of solved problems, Faculty of Technical Sciences Čačak, 2013.

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

Teaching methods:
The course consists of lectures, exercises with problem solving demonstrations and laboratory lessons.

Evaluation (maximum number of points 100)

Exam prerequisites:	No. of points:	**Final exam:**	No. of points:
Homework	20	Final exam (written):	20
Tests	40	Final exam (oral):	30