COURSE DESCRIPTION CARD - SYLLABUS

Course name
Numerical hermomechanics

Course

Field of study

Year/Semester
3/5

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
30

Other (e.g. online)

Tutorials

Projects/seminars
0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
Dr inż Robert Kłosowiak

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Faculty of Environmental Engineering and Energetic

ul. Piotrowo 3, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Basic knowledge in the field of thermodynamics, fluid mechanics and processes of energy flow and conversion in thermo-flow machines and devices. Ability to describe and calculate basic thermodynamic processes and simple thermal energy conversion systems. The ability to effectively self-study in a field related to the chosen field of study. Is aware of the need to expand their competences, readiness to cooperate within a team.

Course objective

Acquainting with basic thermodynamic processes, thermodynamic transformations and energy conservation equations. Understanding the methods of description of various thermodynamic factors and thermodynamic cycles implementing the assumed processes of thermal and mechanical energy conversion in left-hand cycles. Getting to know the available forms of renewable energy and its conversion pathways.

Getting to know the methods of numerical modeling of heat flow. Defining boundary conditions. Acquiring the ability to apply the knowledge acquired so far to solve technical problems. Acquiring the ability to use engineering programs to simulate phenomena, interpret results and validate with experimental data.

Course-related learning outcomes

Knowledge

1. Characterize the principles of operation of thermal and thermal systems of technological processes in thermal systems, power plants, combined heat and power plants and thermal heat supply systems.

2. explain the need for efficient use of heat energy resources, including primary energy temperature levels.

Skills

1. apply knowledge of the phenomena of heat flow, momentum and mass occurring in energy processes necessary for effective heat energy conversion.

2. determine the correctness and effectiveness of heat transport processes in machines and heat-flow devices used in industrial and municipal installations.

Social competences

Is able to think and act effectively in the area of heat transfer processes in machines and thermal devices to minimize primary energy consumption and protect the environment.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture

continuous assessment in each class, rewarding activity and quality of perception and a final written exam

Exercises:

checking and rewarding the knowledge necessary to implement the problems posed in a given area of computational tasks, continuous assessment and assessment of knowledge and skills related to the implementation of the exercise task,

Programme content

Introduction to numerical methods used in thermal technology. Introduction to CFD analysis. Presentation of turbulence models. Dimensional analysis and similarity conditions. Numerical techniques for solving heat transfer problems. Boundary conditions. Thermal properties of materials.

Teaching methods

lecture

Bibliography

Basic

1. Brodowicz K.: Teoria wymienników ciepła i masy, PWN 1982

2. Hobler T.: Ruch ciepła i wymienniki, WNT 1979

3. Kostowski E.: Przepływ ciepła, Wyd. P. Śl. 1991

4. Kostowski E.: Zbiór zadań z przepływu ciepła, Wyd. P. Śl. 1988

5. Staniszewski B. Red.: Wymiana ciepła ? zadania i przykłady, PWN 1965

6. Staniszewski B.: Wymiana ciepła, PWN 1979

7. Wiśniewski St., Wiśniewski T.: Wymiana ciepła, WNT 1997

8. Holman J.P., Heat transfer, London McGraw-Hill 1992

9. Incropera F.P., De Witt D.P.: Fundamentals of Heat and Mass Transfer, John Wiley & Sons, New York 2002

Additional

Patankar S.V., Numerical Heat Transfer and Fluid Flow, CRC Press, 1980.

Guo Z, Shu C., Lattice Boltzmann Method and Its Applications in Engineering (Advances in Computational Fluid Dynamics), World Scientific, 2013

Mohamad A.A., Lattice Boltzmann Method: Fundamentals and Engineering Applications with Computer Codes, Springer, 2011

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	45	1,8
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	30	1,2

[1] delete or add other activities as appropriate