COURSE DESCRIPTION CARD - SYLLABUS

Course name

Numerical Thermomechanics

Course

Field of study
Aerospace Engineering

Year/Semester
3/6

Area of study (specialization)
Aircraft engines and airframes

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

dr inż. Robert Kłosowiak

email: robert.klosowiak@put.poznan.pl

tel. 61 665 23 31

Maszyn Roboczych i Transportu

ul. Piotrowo 3; 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Basic knowledge of 3D geometry modeling. Knowledge of heat flow processes in heat-flow machines and equipment. Ability to describe and define complex heat flow processes. The ability to effectively self-study in a field related to the chosen professional field. Is aware of the need to expand their competences, readiness to cooperate within a team

Course objective

Mastering engineering tools for solving thermal flow problems using numerical modeling. Getting to know the methods of describing various heat flow processes occurring in the assumed processes of thermal and mechanical energy conversion in order to modernize or rebuild technological systems in areas related to thermal energy, heating and cooling. Practical mastery of the ability to describe the implementation of effective thermal processes in which heat, momentum and mass exchange processes occur.

Course-related learning outcomes

Knowledge

1. has ordered, theoretically founded knowledge in the field of data processing for CFD, optimization of numerical simulations, quantitative and qualitative data analysis, data visualization, with particular emphasis on momentum and mass heat exchange phenomena in aviation issues.

2. has ordered, theoretically founded general knowledge covering key issues in the field of technical thermodynamics, i.e. the theory of thermodynamic transformations, heat flow, heat and cooling machines, in aviation issues including phenomena of momentum and mass heat exchange.

3. has ordered, theoretically founded general knowledge covering key issues in the field of fluid mechanics, in particular aerodynamics, and knowledge that allows links with phenomena of mass flow, momentum and energy.

Skills

1. is able to obtain information from literature, the Internet, databases and other sources. Able to integrate the information obtained, interpret and draw conclusions from them in order to optimize the phenomena of heat transfer of energy and energy

2. is able to carry out elementary technical calculations in the field of fluid mechanics and thermodynamics, such as heat and mass balances, pressure losses in flows around technical flying objects and their modules, and in particular carry out heat exchange analyzes in individual parts of TSO.

3. is able to conduct a research experiment using measuring apparatus, computer simulations, is able to perform measurements such as e.g. measurements of temperature, velocity and flow rate, pressure and forces, as well as interpret results and draw conclusions

Social competences

1. Is aware of the importance of maintaining the principles of professional ethics

2. can appropriately define priorities for the implementation of tasks specified by himself or others based on available knowledge

3. Understands the need for critical assessment of knowledge and continuous education

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Performing laboratory exercises and submitting a report on the exercise

Written exam

Final test

Programme content

Conduction in typical geometric configurations. Heat convection, differential equation, turbulence models, closed channel convection, surface flow convection, convection in gaps. Thermal radiation. The use of radiation in previously analyzed geometries. Discretization of momentum and mass heat transfer equations.

PART - 66 (PRACTICE - 22.5 hours)

MODULE 16. PISTON ENGINE

16.4 Engine fuel systems

16.4.1 Carburettors

Types, structure and principles of operation;

Icing and heating. [2]

Teaching methods

lecture, description, discussion, blackboard exercises, independent practical exercises, laboratories

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, preparation for tests) [1]	30	1,2

[1] delete or add other activities as appropriate