COURSE DESCRIPTION CARD - SYLLABUS

Course name

Heat and mass transfer

Course

Field of study	Year/Semester
Aerospace Engineering	3/5
Area of study (specialization)	Profile of study
Aircraft engines and airframes	general academic
Level of study	Course offered in
First-cycle studies	polish
Form of study	Requirements
full-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
15	15	-0
Tutorials	Projects/seminars	
15	-0	

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

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Maszyn Roboczych i Transportu

ul. Piotrowo 3; 60-965 Poznań

Responsible for the course/lecturer:

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Prerequisites

Basic knowledge of selected heat flow processes in heat-flow machines and equipment. The ability to describe and calculate complex heat flow processes. The ability to effectively self-study in a field related to the chosen field of study.

Course objective

Acquaintance with complex heat flow processes and energy conservation equations including convection processes realizing momentum exchange. 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 knowledge in the field of mathematics, including algebra, analysis, theory of differential equations, probabilistics, analytical geometry necessary to understand and describe the basic issues related to aviation engineering, and in particular to describe heat flow phenomena occurring in jet turbine engines.

2. has expanded knowledge necessary to understand profile subjects and specialist knowledge about construction, methods of construction, manufacture, operation, with the participation of heat transfer phenomena of momentum and mass and their impact on the economy, society and the environment in the field of aviation engineering for selected specialties:

1. Piloting of aircraft

2. Aero engines and airframes

3. has ordered, theoretically founded general knowledge covering key issues in the field of technical thermodynamics, i.e. the theory of thermodynamic changes, heat flow, heat and cooling machines.

Skills

1. has the ability to self-study with the use of modern teaching tools, such as remote lectures, websites and databases, teaching programs, electronic books, for detailed analysis of momentum and mass heat exchange classes as well as analysis of special construction cases occurring in aviation.

2. is able to obtain information from literature, the Internet, databases and other sources. Is able to integrate obtained information, interpret and draw conclusions from them, with particular regard to the specificity of aircraft engine design in the aspect of heat exchange.

3. 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.

Social competences

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

2. Understands the need for critical assessment of knowledge and continuous learning.

3. can inspire and organize the learning process of others.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture

continuous assessment in every class, rewarding activity and quality of perception.

written final exam

Blackboard exercises:

test and rewarding knowledge necessary to implement the problems posed in a given area of computational tasks,

continuous assessment, during each class - rewarding the increase in the ability to use known principles and methods,

assessment of knowledge and skills related to the implementation of the exercise task,

Laboratory exercises:

test and rewarding knowledge necessary to implement the problems posed in a given area of laboratory tasks,

assessment of knowledge and skills related to the implementation of the laboratory exercise,
assessment of the report of the exercise.

Programme content

Introduction to methods for describing heat transfer processes. Conduction in typical geometric configurations. Dimensional analysis and similarity conditions. Introduction to numerical methods. Heat convection - differential equation, turbulence models. Convection in closed channels. Convection by flowing around the surface. Convection in gaps. Thermal radiation. Heat transfer at boiling and condensation. Heat exchangers. Fundamentals of mass diffusion and convection

PART - 66 (THEORY - 22.5 hours, PRACTICE - 11.25 hours)

MODULE 2. PHYSICS

2.3 Thermodynamics

b) Isothermal and adiabatic expansion and compression, engine thermodynamic cycle, constant volume and constant pressure, refrigeration container and heat pump;

Latent heat of melting and evaporation, thermal energy, heat of combustion. [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

1. Madejski J.: Teoria wymiany ciepła, Szczecin, WUPSz 1998

2. Bejan A.: Heat Transfer, John Wiley & Sons, Inc., New York 1993

3. Cengel Y.A.: Heat and Mass Transfer, Mc Graw Hill, New York 2006

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	45	1,8
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests) [1]	55	2,2

[1] delete or add other activities as appropriate