



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Flow machinery

### Course

Field of study

Aerospace Engineering

Area of study (specialization)

Onboard systems and aircraft propulsion

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

3/5

Profile of study

general academic

Course offered in

polish

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

Other (e.g. online)

Tutorials

15

Projects/seminars

15

### Number of credit points

4

### Lecturers

Responsible for the course/lecturer:

PhD. eng. Bartosz Ziegler

bartosz.ziegle@put.poznan.pl

6652344

Responsible for the course/lecturer:

### Prerequisites

Knowledge of the basic concepts and dependencies of the mechanics of a rigid body and fluids.

Knowledge of thermodynamics, in particular fundamental transformations and relationships for ideal gases

### Course objective

To develop an understanding of the principle of operation, the interrelationship between flow and operational parameters, as well as design and aerodynamic constraints in the context of fluid flow machines with particular emphasis on axial compressors and turbines.

### Course-related learning outcomes

Knowledge

has knowledge in physics, covering the basics of classical mechanics, optics, electricity and magnetism, solid state physics, thermodynamics, necessary to understand issues in the field of the theory of



construction materials and materials science, theory of machines and mechanisms, theory of drives and mechatronic systems

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

has ordered, theoretically founded general knowledge covering key issues in the field of fluid mechanics, in particular aerodynamics, i.e. ideal liquids and gases, viscous Newtonian and non-Newtonian liquids, theory of heat-flow machines

#### Skills

can prepare and present a short verbal and multimedia presentation devoted to the results of an engineering task

has the ability to self-study using modern teaching tools, such as remote lectures, websites and databases, teaching programs, e-books

is able to communicate using a variety of techniques in a professional environment and other environments using the formal record of construction, technical drawing, concepts and definitions of the scope of the major studied

#### Social competences

can properly prioritize the implementation of tasks specified by him or others based on available knowledge

Understands the need for critical assessment of knowledge and continuous learning

is aware of the importance and understands the non-technical aspects and effects of engineering activities, including its impact on the environment, and the associated responsibility for the decisions taken

#### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written credit for the lecture and class parts, semester project

#### Programme content

Thermodynamics of compression and expansion processes (graphs  $h$ ,  $h_0$  (s),  $p$  (V)), reminder. Flat palisade kinematics. Mechanics of turbine and compressor palisades, unit work, forces, dimensionless parameters. Aerodynamic restrictions in flows through palisades. Three-dimensional flows in rotating machines (radial equilibrium and its consequences, secondary flows). Constructional solutions. Characteristics of compressors and turbines.

#### Teaching methods



Auditorium lecture, computational exercises, group projects and their optimization

### Bibliography

Basic

Tadeusz J. Chmielniak – „Maszyny Przepływowe”

Additional

S.L. Dixon, Fluid Mechanics, Thermodynamics of Turbomachinery

### Breakdown of average student's workload

	Hours	ECTS
Total workload	101	4,0
Classes requiring direct contact with the teacher	66	2,5
Student's own work (literature studies, tutorial preparation, project) <sup>1</sup>	35	1,5

<sup>1</sup> delete or add other activities as appropriate