COURSE DESCRIPTION CARD - SYLLABUS

Course name
Gas dynamics [S1Lot2-PSPL>DG]

Course

Field of study
Aviation

Year/Semester
3/5

Area of study (specialization)
Aircraft Piloting

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
0

Other
0

Tutorials
30

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Possesses knowledge of mathematics, physics and fluid mechanics within the scope presented in studies. Can apply the scientific method to solve problems. Knows the limitations of own knowledge and skills; can formulate questions precisely, understands the need for further education.

Course objective

To acquaint students with basic theoretical knowledge related to the flow of gases.

Course-related learning outcomes

Knowledge:
1. has extended and deepened knowledge of mathematics covering algebra, analysis, theory of differential equations, probability, analytical geometry as well as physics covering the basics of classical mechanics, optics, electricity and magnetism, solid state physics, thermodynamics, useful for formulating and solving complex technical tasks related to aeronautical engineering and modeling
2. has structured and theoretically based general knowledge of key issues of technology and detailed knowledge of selected issues related to air transport,

knows basic techniques, methods and tools used in the process of solving tasks
related to air transport, mainly of an engineering nature3. has structured, theoretically based general knowledge covering key issues in the field of fluid mechanics,
in particular the dynamics of ideal gases, the theory of thermal-flow machines. 3. has structured, theoretically based knowledge in the field of data processing for MES and CFD, numerical simulations, quantitative and qualitative data analysis, data visualization
4. has the ability to self-educate using modern teaching tools, such as
remote lectures, Internet sites and databases, teaching programs, e-books

Skills:
1. is able to obtain information from various sources, including literature and databases, both in Polish and English, integrate it properly, interpret and critically evaluate it, draw conclusions, and comprehensively justify the opinions he/she formulates
2. is able to properly use information and communication techniques, which are
applied at various stages of the implementation of aviation projects
3. is able to properly plan and perform experiments, including measurements and computer simulations, interpret the results obtained, and correctly draw conclusions
from them
4. is able to formulate and solve tasks related to civil aviation, apply appropriately
selected methods, including analytical, simulation or experimental methods
5. is able to solve tasks using air traffic problems and design a runway
in accordance with applicable ICAO requirements
6. the student is able to use theoretical probability distributions. The student is able to analyze and interpret statistical data. The student is able to apply methods and tools of mathematical statistics
in engineering practice
7. the student is able to use theoretical probability distributions. The student is able to analyze and interpret statistical data. The student is able to apply the methods and tools of mathematical statistics
in engineering practice
8. is able to organize, cooperate and work in a group, assuming different roles in it and is able to appropriately determine priorities for the implementation of a task specified by himself or others
9. is able to plan and implement the process of his own permanent learning and knows the possibilities of further education (2nd and 3rd cycle studies, postgraduate studies, courses and exams conducted by universities, companies and professional organizations)

Social competences:
1. understands that in technology knowledge and skills very quickly become outdated
2. is aware of the importance of knowledge in solving engineering problems and knows examples and understands the causes of malfunctioning engineering projects that led to serious
financial, social losses or to serious loss of health or even life
3. is aware of the social role of a graduate of a technical university, in particular understands the need to formulate and communicate to the public, in an appropriate form, information and opinions concerning engineering activities, technical achievements, as well as the achievements and traditions of the engineering profession
4. correctly identifies and resolves dilemmas related to the profession of an aerospace engineer

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired during the lecture is verified by a written exam conducted
during the exam session. The exam consists of 6-10 questions, scored differently. Passing threshold: 50% of points. The exam topics, based on which the questions are developed, will be
sent to students by email using the university's email system. Knowledge acquired during the exercises is verified by two 45-minute tests conducted during the 7th
and 15th classes. Each test consists of 3-5 tasks, scored differently depending on their level of difficulty. Passing threshold: 50% of points.

Programme content

Basic thermodynamic concepts. Speed of sound. Classification of gas flows. One-dimensional flow. Basic equations. Adiabatic and isentropic flows. Flow through a nozzle. Critical parameters and gas

accumulations. Change of gas parameters in flow through a pipe with
variable cross-section, taking into account friction, heat exchange. Wave phenomena in one-dimensional flow. Normal shock wave. Two-dimensional flow. Plane supersonic flow. Oblique shock wave. Axially symmetric flow.

Course topics

1. Basic thermodynamic concepts. Speed of sound. Classification of gas flows.
2. One-dimensional flow. Basic equations. Adiabatic and isentropic flows. Flow through a nozzle.
3. Critical parameters and gas accumulations. Change of gas parameters in flow through a pipe with variable cross-section, taking into account friction, heat exchange.
4. Wave phenomena in one-dimensional flow. Normal shock wave.
5. Two-dimensional flow. Plane supersonic flow. Oblique shock wave. Axially symmetric flow.

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples provided on the board. 2. Exercises: completing tasks given by the instructor.

Bibliography

Basic:
1. Zucker R, Biblarz O., Fundamentals of gas dynamics, Second Edition, John Wiley & Sons Inc., New Jersey, 2002
2.Rup K., Izentropowe i nieizentropowe przepływy gazu, PWN Warszawa, 2003
3. Genick Bar-Meir, Fundamentals of Compressible Fluid Mechanics, GNU Free Documentation License, 2013

Additional:
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Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	47	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	53	2,00