COURSE DESCRIPTION CARD - SYLLABUS

Course name
Gas Dynamics

Course

Field of study
Aerospace Engineering

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

Other (e.g. online)

Tutorials
30

Projects/seminars

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
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Faculty of Environmental and Energy Engineering

Piotrowo 3, PL60-965 Poznan

Responsible for the course/lecturer:

Prerequisites

Knowledge: mathematics, physics and fluid mechanics in the scope presented in the studies. Is able to apply the scientific method in solving problems. He knows the limits of his own knowledge and skills; can formulate questions precisely, understand the need for further education.

Course objective

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

Course-related learning outcomes

Knowledge

1. has extended and in-depth knowledge of mathematics including 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 engineering aeronautical and modeling

2. has ordered and theoretically founded general knowledge in the field of key technical issues and detailed knowledge of selected issues related to air transport, knows the basic techniques, methods and tools used in the process of solving tasks related to air transport, mainly of an engineering nature

3. has ordered, theoretically founded 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-study with the use of modern teaching tools, such as remote lectures, websites and databases, teaching programs, e-books

Skills

1. is able to obtain information from various sources, including literature and databases, both in Polish and in English, integrate them properly, interpret them and make a critical evaluation, draw conclusions and exhaustively justify the opinions they formulate

2. is able to properly use information and communication techniques, applicable 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 obtained results, and correctly draw conclusions from them

4. can, when formulating and solving tasks related to civil aviation, apply appropriately selected methods, including analytical, simulation or experimental methods

5. can solve tasks using the rules of air traffic and design a runway in accordance with the applicable ICAO requirements

6. student can use theoretical probability distributions. Student is able to analyze and interpret statistical data. Student is able to use the methods and tools of mathematical statistics in engineering practice

7. is able to prepare a short research paper while maintaining the basic editorial rules. He can choose appropriate methods for the conducted research and is able to carry out a basic analysis of the results.

8. is able to organize, cooperate and work in a group, assuming various roles in it, and is able to properly define priorities for the implementation of a task set by himself or others

9. is able to plan and implement the process of own permanent learning and knows the possibilities of further education (2nd and 3rd degree 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 obsolete

2. is aware of the importance of knowledge in solving engineering problems and knows examples and understands the causes of faulty engineering projects that have led to serious financial and social losses, or to a serious loss of health and even life

3. is aware of the social role of a technical university graduate, in particular understands the need to formulate and provide the society, in an appropriate form, with information and opinions on engineering activities, technological achievements, as well as the achievements and traditions of the engineer 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 as part of the lecture is verified on the basis of a written exam carried out during the examination session. The exam consists of 6-10 questions, variously scored. Passing threshold: 50% of points. The exam issues on the basis of which these questions were developed are forwarded to students by e-mail with a supported university e-mail system.

Knowledge acquired as part of the exercises is verified by two 45-minute colloquia on 7 and 15 lessons. All of the tests consist of 3-5 tasks, variously scored 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 the nozzle. Critical parameters and gas accumulation. Change of gas parameters in the flow through the conduit with variable cross-section, taking into account friction, heat exchange. Wave phenomena in one-dimensional flow. Normal shock wave. Two-dimensional flow. Supersonic flat flow. Oblique shock wave. Axial symmetrical flow.

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples given on the board.

2. Exercises: completing the tasks given by the teacher.

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

1. Prosnak W.J., Mechnika płynów, t II PWN Warszawa, 1971

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	47	2,0
Student's own work (literature studies, preparation for tutorials, preparation for tests/exam) [1]	53	2,0

[1] delete or add other activities as appropriate