



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Gas Dynamics

Course

Field of study

Aviation

Area of study (specialization)

Aircraft engines and airframes

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

15

Laboratory classes

Other (e.g. online)

Tutorials

30

Projects/seminars

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

prof. dr hab. inż. Andrzej Frąckowiak

Responsible for the course/lecturer:

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Faculty of Environmental and Energy

Engineering

Piotrowo 3, PL60-965 Poznan

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 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

2. has ordered, theoretically founded knowledge in the field of data processing for MES and CFD, numerical simulations, quantitative and qualitative data analysis, data visualization

3. has knowledge of the method of presenting test results in the form of tables and graphs, performing the analysis of measurement uncertainties

4. the student has knowledge of aviation safety and management. The student knows the concept of the human factor and methods of assessing human reliability, has detailed knowledge related to selected issues in the field of human capabilities and limitations during aircraft operation in flight, its impact on health and the ability to perform air operations, as well as the possibility of improving physical condition

5. 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 basic knowledge of aerodynamics, flight mechanics and body flow

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. 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
2. 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.

PART - 66 (THEORY - 33.75 hours)

MODULE 8. BASIC AERODYNAMICS

8.2 Aerodynamics

Air flow around the body; Boundary layer, stratified flow, turbulent, undisturbed, relative air flow, jet deflection, vortex, stagnation. [2]

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	1,9
Student's own work (literature studies, preparation for tutorials, preparation for tests/exam) ¹	53	2,1

¹ delete or add other activities as appropriate