COURSE DESCRIPTION CARD - SYLLABUS

Course name
Gas dynamics [S1Lot2-SLiPL>DG]

Course

Field of study
Aviation

Year/Semester
3/5

Area of study (specialization)
Aircraft Engines and Airframes

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

prof. dr hab. inż. Andrzej Frąckowiak
andrzej.frackowiak@put.poznan.pl

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 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 nature
2. has structured, theoretically based knowledge of data processing for MES and CFD, numerical simulations, quantitative and qualitative data analysis, data visualization
3. has basic knowledge of research methods and the method of preparing and

conducting scientific research, and also knows the principles of writing a scientific paper
4. the student has knowledge of safety and management in aviation. 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 ability to perform flight operations, as well as possibilities of improving physical condition
5. 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 exhaustively justify the opinions he/she formulates
2. is able to properly use information and communication techniques, which are applied at various stages of aviation project implementation
3. is able to properly plan and perform experiments, including measurements and computer simulations, interpret the obtained results, and correctly draw conclusions from them. them conclusions
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 basic knowledge of aerodynamics, flight mechanics and flow around bodies
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 use methods and tools of mathematical statistics in engineering practice
7. is able to prepare a short scientific paper, observing basic editorial principles. Is able to select appropriate methods for the research being conducted and is able to conduct a basic analysis of the results. 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 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 graduate of a technical university, in particular understands the need to formulate and convey 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
2. correctly identifies and resolves dilemmas related to the performance of the profession of an aviation and astronautics 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 e-mail using the university's e-mail 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. PART - 66 (THEORY - 33.75 hrs.)

MODULE 8. BASICS OF AERODYNAMICS
8.2 Aerodynamics
Air flow around a body;
Boundary layer, laminar flow, turbulent, undisturbed, relative air 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 a 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.
6. Air flow around a body; Boundary layer, stratified flow, turbulent, undisturbed, relative air flow, stream deviation, vorticity, stagnation.

Teaching methods

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

Bibliography

Basic:
-

Additional:
-

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