COURSE DESCRIPTION CARD - SYLLABUS

Course name

Fundamentals of combustion process

Course

Field of study

Aerospace Engineering

Year/Semester

2/4

Area of study (specialization)

Onboard systems and aircraft propulsion

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

polish

Form of study

full-time

Requirements

elective

Number of hours

Lecture

30

Laboratory classes

15

Other (e.g. online)

Tutorials

15

Projects/seminars

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

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Wydział Inżynierii Środowiska i Energetyki

ul. Piotrowo 3 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Basic has knowledge in the field of fluid mechanics, physics, thermodynamics, chemistry and knowledge about fuels used in avaiation and construction of aircraft engines. Student should also have skills to calculate of basic thermodynamic parameters related to energy conversion processes.

Course objective

To present knowledge about fundamentals of combustion processes of fossil fuels and construction of selected parts aircraft propulsion systems.

Course-related learning outcomes

Knowledge

Has basic knowledge in physics, chemistry, thermodynamics necessary to understand issues in the field of the theory of machines and mechanisms, theory of drives energy systems.

Student has basic knowledge about metal, non-metallic materials used in combustion chamber construction, as well as fuels, technical gases, refrigerants used in aircrafts.

Has ordered, theoretically founded general knowledge covering key issues in the field of technical thermodynamics, i.e. the theory of thermodynamic transformations, heat flow and combustion processes.

Skills

Can carry out elementary technical calculations in the field of fluid mechanics and thermodynamics, such as heat and mass balances, elementary balance, combustion stoichiometric calculation as well as calculate thermodynamic cycles in energetic machines.

Is able to conduct a research experiment using measuring equipment, is able to perform measurements, such as measurements of temperature, flue gas composition as well as interpret results and draw conclusions.

Can apply the basic technical standards for safety

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

Can inspire and organize the learning process of others

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Knowledge acquired during the lecture is verified during the final test carried. Each test consists of 5 questions (open). Passing threshold: 50% of points. Final issues on the basis of which questions are prepared will be sent to students by e-mail using the university e-mail system.

Tutorials: Skills acquired as part of the tutorials will be verified basis on the final test, 5 tasks, Passing threshold: 50% of points.

Laboratory: Skills acquired as part of the laboratory classes will be verified basis on the final test, consisting of 10 tasks differently scored depending on their level of difficulty. Passing threshold: 50% of points.

Programme content

Lecture: Fundamentals of combustion process of gaseous, liguid and solid fules, Thermodynamic quantities describing the of gaseous fuels, Thermodynamic quantities describing the combustion process of fossil fuels, Flammability limits, low and high heating value, Adiabatic flame temperature,

laminar and turbulent flame speed, kinetic reaction of combustion process, laminar premixed flames, laminar diffusion flames, turbulent premixed flames, flame acoustic interaction, laser-otical method for combustion processes, combustion chambers, detonation, safety regimes, materials used for hot parts of engine, cooling principles

Tutorials: Solving of an enineering problems related to combustion process of fules used in aviation

Laboratory: analysis of fuel combustion in a kinetic and diffusion flame, calculations of equilibrium parameters of the combustion process, determination of laminar combustion speed, measurement of diffusion flame length, analysis of toxic compound distribution and temperature in a vortex flame,

Teaching methods

Lecture: multimedia presentation, illustrated with examples on the board

Tutorials: multimedia presentation, solving of an engineering problems illustrated with examples on the board

Laboratory: multimedia presentation and performance of tasks given by the teacher - practical exercises.

Bibliography

Basic

Dobski, T.: Combustion Gases in Modern Technologies, 2scd Ed., Wydawnictwo Politechniki Poznańskiej

Jarosiński J.: Techniki czystego spalania, WNT, Warszawa 1996

Molenda J.: Gaz ziemny. Paliwo i surowiec, WNT, Warszawa 2004

Andrzej Kowalkiewicz: Podstawy procesów spalania

Stefan Wisniewski, Termodynamika Techniczna,

Additional

Lefebvre: Gas Turbine Combustion,

Warnatz J., Maas U., Dibble R.W.: Combustion, Sprinter-Verlag, Berlin?Heidelberg 1999

Ecbert: Laser Diagnostic for combustion processes

Thierry Poinsot: Theoretical and numerical combustion

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	66	2,5
Student's own work (literature studies, preparation for laboratories, development of laboratories, preparation for passing and exam, participation in consultations)) [1]	34	1,5

[1] delete or add other activities as appropriate