COURSE DESCRIPTION CARD - SYLLABUS

Course name
Thermodynamics of real and reacting fluids

Course

Field of study
Aerospace Engineering

Year/Semester
1/I

Area of study (specialization)
Aeronautical Engineering

Profile of study
general academic

Level of study
Second-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

3

Lecturers

Responsible for the course/lecturer:
dr hab. inż. Rafał Ślefarski

email: rafa.slefarski@put.poznan.pl

tel. 616652218

Faculty of Energy and Environmental Engineering

ul. Piotrowo 3 60-965 Poznań

Responsible for the course/lecturer:
Msc. eng. Joanna Jójka

email: joanna.jojka@put.poznan.pl

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Faculty of Energy and Environmental Engineering

ul. Piotrowo 3 60-965 Poznań

Prerequisites

Student has basic knowledge in the field of chemistry, fluid mechanics, combustion processes, heat transfer and energy conversion for fuels used in aviation and aeronautics fields. Student should also have skills required to solve engineering problems with scientifically valid methodologies. Can effectively acquire the information from various sources including datasheets, literature and Internet.

Course objective

To acquaint students with extended knowledge combustion processes and energy conversion as well as interaction of chemical reaction and aerodynamics phenomena

Course-related learning outcomes

Knowledge

Student has extensive knowledge, necessary for understanding of profile subjects and specialist knowledge about construction, methods of construction, manufacturing, exploitation, air traffic management, security systems, impact on the economy, society and environment of the aviation and cosmonautics for selected specialties: Aeronautical Engineering

Student has detailed knowledge in the field of chemistry, combustion processes, stoichiometry, heat exchange processes, heat conversion into a thrust for fuels used in aviation and aeronautics.

Skills

Student is able to communicate using various techniques in a professional environment and other environments using a formal record of construction, technical drawing, concepts and definition of the scope of the studied field of study.

Student has the ability to self-study using modern teaching tools, such as remote lectures, websites and databases, didactic programs, e-books.

Social competences

Student understands the need to learn throughout life; he can inspire and organize the learning process of other people.

Student is ready to critically evaluate the knowledge and content received, recognize the importance of knowledge in solving cognitive and practical problems and consult experts in the case of difficulties in solving the problem.

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 20 closed questions. 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.

Skills acquired as part of the tutorials 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: Laminar and turbulent flow, turbulence, turbulence scales, laminar flames, turbulent flames, laminar and turbulent flame speed, thermal and chemical mechanics of fuel ignition, chemical kinetics, reaction mechanism, stoichiometry of combustion process, heat exchange from the flame, hydrodynamic, acoustic and thermos-diffusive flame instabilities, laser diagnostic methods in combustion process.

Tutorials: solution of an scientific problems in the field of real and reacting fluids flow in application of aerospace engines. Introduction to computional fluid mechanics calculation.

Teaching methods

Lecture: multimedia presentation, illustrated with examples on the board

Tutorials: multimedia presentation illustrated with examples given on a blackboard and performance of tasks given by the teacher - practical exercises

Bibliography

Basic

Józef Jarosiński: Techniki czystego spalania

N. Swaminathan: Turbulent premixed flames

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

P. Jansohn. Modern Gas Turbine Systems

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

Additional

Thierry Poinsot: Theoretical and numerical combustion

R. Probstein: Synthetic Fuels

Wilk R.K.: Low-emission Combustion, Wydawnictwo Politechniki Śląskiej, Gliwice 2

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	47	1,9
Student's own work (literature studies, preparation for tutorials, preparation for passing and exam, participation in consultations) [1]	28	1,1

[1] delete or add other activities as appropriate