COURSE DESCRIPTION CARD - SYLLABUS

Course name
Aircraft propulsion systems [S1Lot2>NSP]

Course

Field of study
Aviation

Year/Semester
2/3

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
compulsory

Number of hours

Lecture
30

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Knowledge: The student has a basic knowledge of air transport. Skills: The student is able to associate and integrate the obtained information, analyze the phenomena occurring in the environment, draw conclusions, formulate and justify opinions. Social competences: The student is able to independently search for information in the literature and knows the rules of discussion; the ability to formulate a research problem and search for its solution, independence in problem-solving, the ability to cooperate in a group

Course objective

To acquaint the student with the basic principles of the work of aircraft engines, their construction and use

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, theoretically founded general knowledge in the field of technology and various means of

air transport, about the life cycle of means of transportation, both hardware and software, and in particular about the key processes taking place in them
3. 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
4. Has detailed knowledge related to selected issues in the field of manned and unmanned aircraft construction, in the field of on-board equipment, control systems, communication and recording systems, automation of individual systems, has basic knowledge of flight simulation training devices and simulation methods used to solve air transport issues
5. Has basic knowledge of metal, non-metal and composite materials used in machine construction, in particular about their structure, properties, methods of production, heat and thermo-chemical treatment and the influence of plastic processing on their strength, as well as fuels, lubricants, technical gases, refrigerants e.t.c.
6. Has basic knowledge of environmental protection in transport, is aware of the risks associated with environmental protection and understands the specificity of the impact of mainly air transport on the environment as well as social, economic, legal and other non-technical conditions of engineering activities

Skills:
1. Is able obtain information from various sources, including literature and databases, both in Polish and in English, integrate them properly, interpret and critically evaluate them, draw conclusions and exhaustively justify their opinions
2. Is able to design elements of means of transport with the use of data on environmental protection
3. Can analyze objects and technical solutions, can search in catalogs and on manufacturers" websites, ready components of machines and devices, including means and devices, assess their suitability for use in their own technical and organizational projects
4. Student is able to make a comprehensive assessment of ecological parameters of an aircraft propulsion unit, based on the values of emission factors for harmful gaseous compounds and particulate matter

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:

Learning outcomes presented above are verified as follows:
The knowledge and skills in the field of the lecture will be checked as a result of the test at the end of the semester.
The assessment from the laboratories will consist of partial grades from reports and a test.

Programme content

1. Classification of propulsion engines based on thrust generation method, application, or construction.
2. Discussion and definition of parameters such as rotational speed, thrust force, load, specific fuel consumption, etc.
3. Structure of piston aircraft engines and propulsion system construction.
4. Principles of selecting and combusting the fuel-air mixture, operating and combustion parameters.
5. Strategies for developing and implementing alternative aircraft propulsion systems, including electric, hydrogen, and hybrid engines.
6. Mechanics and thermodynamics of flow and rocket engines. Basic concepts and transformations related to turbine propulsion.

Course topics

1. Classification and types of aircraft propulsion
2. Basic operating parameters of aircraft propulsion
3. Requirements for aircraft propulsion
4. Piston aircraft engines - operating principle and methods of control
5. Construction of piston engines
6. Electric drives in aviation
7. Turbine engines - principle of operation and control methods
8. Construction of turbine engines
9. Rocket engines
10. Thermodynamic aspects of flow engines

Teaching methods

Informative (conventional) lecture (providing information in a structured way) - may be of a course (introductory) or monographic (specialist) character.
Laboratory method

Bibliography

Basic:
1. Piotr Strzelczyk. Wybrane zagadnienia aerodynamiki śmigieł. Oficyna Wydawnicza Politechniki Rzeszowskiej. Rzeszów 2008.
2. W. Cheda, M. Malski. Techniczny poradnik lotniczy. Silniki. WKiŁ, Warszawa 1984
3. The Jet Engines. Wyd. Rolls Royce 1986 r.
4. Dzierżanowski P., Kordziński W., Otyś J., Łyżwiński M., Szczeciński S., WiatrekR.: Napędy Lotnicze. Turbinowe silniki odrzutowe. WKŁ, Warszawa 1983.
5. Dzierżanowski P., Kordziński W., Otyś J., Szczeciński S., WiatrekR.: Napędy Lotnicze. Turbinowe silniki śmigłowe i śmigłowcowe. WKŁ, Warszawa 1985.

Additional:
1. Kotlarz W.: Turbinowe zespoły napędowe źródłem skażeń powietrza na lotniskach wojskowych. (Turbine Driving Systems as Pollution Sources at Military Airports), Air Forces Academy, Dęblin 2004

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
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)	28	1,00