POZNAN UNIVERSITY OF TECHNOLOGY
EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)
pl. M. Skłodowskiej-Curie 5, 60-965 Poznań

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Aircraft construction

Course

Field of study
Aviation and Astronautics

Year/Semester
III/4

Area of study (specialization)
Aircraft engines and airframes

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
english

Form of study
full-time

Requirements
elective

Number of hours

Lecture
45

Laboratory classes
30

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

6

Lecturers

Responsible for the course/lecturer:
dr inż. Bartosz Ziegler

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Responsible for the course/lecturer:
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Faculty of Civil and Transport Engineering

ul. Piotrowo 3; 60-965 Poznań

Prerequisites

The student should have basic knowledge and skills in thermodynamics (the concepts of enthalpy, entropy, heat, perfect gas model, basic gas conversions), fluid mechanics (forces exerted by a fluid on a flow channel, flow classification, isentropic flows, viscous phenomena and their impact on the field flow) and aerodynamics (wing and profile aerodynamics, criterion numbers, boundary layer theory, turbulence), and knowledge from the Theory of aircraft engines of the previous semester. Basic knowledge in the field of mechanics, airframe construction, metrology, strength of materials, non-destructive testing. He can apply the scientific method in solving problems, carrying out experiments and gain conclusions

Course objective

Expand knowledge of the flow aircraft engines from the previous semester, the mechanics and thermodynamics of their components as well as the principles of cooperation of flow components. Familiarize students with the problems of aircraft operation (elements of the airframe structure). Understanding the currently used operation and diagnosis systems increasing the safety of aircraft operation. Acquainting with basic aerial structures and methods of testing their strength. Familiarizing students with the principles of strength calculations for aircraft structures. To acquaint students with currently used systems supporting the design of aircraft structures.

Course-related learning outcomes

Knowledge

1. The student knows the 0-dimensional, ideal and quasi-real thermodynamic models specific to aviation flow engines

2. Student knows and understands the relationship of thermodynamics of a flow engine with its design features. Is able to link this information with design criteria and optimization directions

3. Knows and understands the basic concepts and principles of industrial property and copyright protection and the need to manage intellectual property resources

Skills

1. Is able to obtain information from literature, also in English, interpret acquired information, assess their credibility and accuracy

2. Is able to implement a 0-dimensional physical model of a flow-through engine in any computing environment

3. Is able to develop a manual and repair instructions for a simple machine or its components from the group of machines covered by the selected specialty

Social competences

1. Is aware of the importance and understands the non-technical aspects and effects of engineering activities, including its impact on the environment and the associated responsibility for decisions

2. Is aware of the responsibility for their own work and readiness to comply with the principles of teamwork and taking responsibility for jointly completed tasks

3. Can think and act in a creative and entrepreneurial way

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture (final grade consists of three components):

1. Written pass / final exam (65%)

2. Grade from a small mid-term group project (20%)

3. Assessment of individual homework (15%)

exercises:

1. Assessment of computational problems (100%)

To pass the course, it is required to obtain not less than 60% of component points.

The 60% -100% range curve is determined individually in each semester.

Programme content

Gas inlet aerodynamics; Compressors (mechanics of flat and rotating palisades, stage operation, stage compression, dimensionless parameters of stage compression); Combustion chambers - chamber energy balance, basics of intraventricular process; Turbines (mechanics of flat and rotating palisades, stage work, stage expansion, dimensionless parameters); boosters; Discharge nozzles; Conditions for cooperation of flow-engine components; Map of engine controls; Mechanics of work of propeller propulsion systems

Calculation of supersonic inlet geometry; calculating the kinematics and dynamics of compressor and turbine palisades as well as the resulting unit work of the degree, spring, work coefficients and Lieblein accumulation factor; Energy and mass balance of the combustion chamber, pressure drop in the combustion chamber, calculation of the efficiency of afterburners and variable cross-sections of the adjustable nozzle; Determination of work parameters and propeller design based on one-dimensional theories.

General information on the types of aircraft structures. Materials used for the production of airframe components. Concepts related to the probability and reliability of aircraft structures. The probability of working in the state of fitness. Technical operation of aircraft. Aircraft maintenancein practice. The influence of various factors on aircraft airframe wear. Non-destructive testing of aircraft structures. Problems of assessing the technical condition of the aircraft's reliability and operational durability. Technical services for servicing and repairing airframe structures. Operational flight safety factors. Safety of aircraft against the background of aviation law and regulatory requirements.

Teaching methods

Blackboard based lecture, project classes in computer laboratory with practical examples of calculations presented on lecture

Bibliography

Basic

1. K. Kaw, Mechanics of Composite Materials, second edition, Taylor & Francis Group, LL, 2006;

2. M. Chun-Yung Niu, Airframe structural design. Practical Design Information and Data on Aircraft Structures, Conmilit Prcss Ltd., 1988;

3. A. Abłamowicz, W. Nowakowski, Podstawy aerodynamiki i mechaniki lotu, Wydawnictwa komunikacji i łączności, Warszawa 1980;

4. T. H. G. Megson, Aircraft Structures for engineering students (fourth edition), Elsevier Ltd., 2007;

5. E. ÜNAY, Load analysis of an aircraft using simplified aerodynamic and structural models, February 2015;

6. M. Bijak-Żochowski, Mechanika materiałów i konstrukcji, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2006;

7. W. Błażewicz, Budowa samolotów – obciążenia, Wydawnictwo Politechniki Warszawskiej, Warszawa 1979;

8. M. Skowron, Budowa samolotów – obciążenia. Zbiór zadań, Wydawnictwo Politechniki Warszawskiej, Warszawa 1979;

9. C. Galiński, Wybrane zagadnienia projektowania samolotów, Biblioteka Instytutu Lotnictwa, Warszawa 2016;

10. Dzierżanowski P. „Turbinowe silniki odrzutowe", Wydawnictwa Komunikacji i Łączności (own copy is not obligatory. The lecture covers the content sufficiently)

Additional

1. A. Milikiewicz, Praktyczna aerodynamika i mechanika lotu samolotu odrzutowego w tym wysokomanewrowego, Wydawnictwo ITWL, Warszawa 2011;

2. M. Dębski, D. Dębski, Wybrane zagadnienia wytrzymałości zmęczeniowej konstrukcji lotniczych, Wydawnictwa Naukowe Instytutu Lotnictwa, Warszawa 2014;

3. A. Abłamowicz, W. Nowakowski, Podstawy aerodynamiki i mechaniki lotu, Wydawnictwa komunikacji i łączności, Warszawa 1980;

4. M. Bijak-Żochowski, Mechanika materiałów i konstrukcji, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2006;

5. R.P.L. Nijssen, Composite materials an introduction, Inholland University of Applied Sciences, 2015;

Breakdown of average student's workload

	Hours	ECTS
Total workload	150	6,0
Classes requiring direct contact with the teacher	85	3,4
Preservation of lecture messages, preparation of homework, group mid-term project, preparation for written tests [1]	65	2,6

[1] delete or add other activities as appropriate