COURSE DESCRIPTION CARD - SYLLABUS

Course name

Theory of Aircraft Engines

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 studies

Course offered in

english

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

4

Lecturers

Responsible for the course/lecturer:

prof. dr hab. inż. Krzysztof Wisłocki

email:krzysztof.wislocki@put.poznan.pl

Wydział Inżynierii Lądowej i Transportu

tel. 61-665-2240

ul. Piotrowo 3; 60-965 Poznań

Responsible for the course/lecturer:

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

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.

Course-related learning outcomes

Knowledge

1. 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 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

3. has knowledge of the method of presenting test results in the form of tables and graphs, performing the analysis of measurement uncertainties

4. has knowledge of the method of presenting test results in the form of tables and graphs, performing the analysis of measurement uncertainties

5. 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

6. has the ability to self-study with the use of modern teaching tools, such as remote lectures, websites and databases, teaching programs, e-books

Skills

1. is able to obtain information from various sources, including literature and databases, both in Polish and in English, integrate them properly, interpret them and make a critical evaluation, draw conclusions and exhaustively justify the opinions they formulate

2. is able to properly use information and communication techniques, applicable at various stages of the implementation of aviation projects

3. is able to properly plan and perform experiments, including measurements and computer simulations, interpret the obtained results, and correctly draw conclusions from them

4. can, when formulating and solving tasks related to civil aviation, apply appropriately selected methods, including analytical, simulation or experimental methods

5. is able to properly select materials for simple aviation structures, and can indicate the differences between the fuels used in aviation

6. is able to communicate using various techniques in the professional environment and other environments using the formal notation of construction, technical drawing, concepts and definitions of the scope of the study field of study

7. is able to design elements of means of transport with the use of data on environmental protection

8. student can use theoretical probability distributions. Student is able to analyze and interpret statistical data. Student is able to use the methods and tools of mathematical statistics in engineering practice

9. can use the language of mathematics (differential and integral calculus) to describe simple engineering problems.

10. Student is able to make a comprehensive assessment of the ecological parameters of an aircraft propulsion unit based on the values of emission factors for harmful gaseous compounds and particulate matter

11. is able to prepare a short research paper while maintaining the basic editorial rules. He can choose appropriate methods for the conducted research and is able to carry out a basic analysis of the results.

12. is able to organize, cooperate and work in a group, assuming various roles in it, and is able to properly define priorities for the implementation of a task set by himself or others

13. is able to plan and implement the process of 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. 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:

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. Written 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

Lecture semester I:

Physical basis of thrust generation by aircraft propulsion systems; Course of gasodynamic parameters along the flow channel of a turbine engine; Quasi-real thermodynamic engine cycle single-flow; Influence of flight parameters (speed, ceiling) and engine parameters (pressure, preheating, efficiency of compression and expansion processes, etc.) on unit performance parameters of the engine (thrust specific, specific fuel consumption, component and overall efficiencies); Bypass engines (auxiliary channel circulation, characteristics); Fundamentals of construction and thermodynamic cycles rocket engines

Classes semester I:

Calculation of work cycle of a turbine/jet engine; determination of individual parameters (specific thrust, specific fuel consumption, component and overall efficiencies) based on flight parameters and thermodynamic cycle parameters; Calculation of optimal springs i required compression of compressor units for given flight parameters; Calculation of parameters cycle component processes; Calculation of basic rocket performance based on simplified ones dependence.

PART - 66 (THEORY - 33.75 hours)

MODULE 16. PISTON ENGINE

16.5 Starting and ignition system

Starting systems and preheating systems; Types of magneto, construction and principles of operation; Ignition wiring system, spark plug body; Low and high voltage systems. [2]

16.6 Intake system, exhaust system and cooling system

Design and operation: suction system including variable blowing systems; Exhaust system, engine cooling system - air and liquid. [2]

16.11 Installation of the drive device

Configuration of firewalls, shields, acoustic panels, engine mount, suspension anti-vibration, wires, pipes, power supplies, connectors, cable harnesses, steering cables, rods controls, lifting points and drains. [2]

Teaching methods

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

Bibliography

Basic

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

Additional

Any adequate literature on topic

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	42	1,7
Preservation of lecture messages, preparation of homework, group mid-term project, preparation for written tests [1]	58	2,3

[1] delete or add other activities as appropriate