COURSE DESCRIPTION CARD - SYLLABUS

Course name

Theory of Aircraft Engines - semester 1

Course

Field of study	Year/Semester
Aerospace Engineering	II/4
Area of study (specialization)	Profile of study
Aircraft engines and airframes	general academic
Level of study	Course offered in
First-cycle studies	english
Form of study	Requirements
full-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30		
Tutorials	Projects/seminars	
30		

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

Dr inż. Bartosz Ziegler

bartosz.ziegler@put.poznan.pl

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)

Course objective

Teach the theory of aviation propulsion systems based on flow heat engines (turbine single and double flow jet engines, turboprop engines, jet and rocket engines). In particular, learn the analytical tools needed for the quantitative analysis of such engines, as well as familiarize yourself with the qualitative relationships between the characteristic parameters

Course-related learning outcomes

Knowledge

1. Has extensive knowledge on selected areas of flight mechanics in context of airframe loads

2. Has extended knowledge required to comprehend tasks in area of designing aircraft and endurance of airframes

3. Has extended knowledge in aera of rigid body mechanics and material strength in context of aircraft design

Skills

1. Is able to obtain information from literature, the Internet, databases and other sources, in particular English. Is able to integrate obtained information with his knowledge, interpret and draw conclusions from them

2. Is able to create a quantitative description of the principle of operation and physical components of a flow aircraft engine or its component

3. Is able to use formulas, technical graph tables and create such based on known models of physical changes

Social competences

1. Is able to properly set priorities for the implementation of tasks specified by himself or others based on available knowledge

2. Understands the need for critical assessment of knowledge and continuous learning

3. 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

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 basics of thrust generation by aircraft drives; The course of gasodynamic parameters along the flow channel of a turbine engine; Quasi-real thermodynamic cycle of a single-flow engine; Influence of flight parameters (speed, altitude) and engine parameters (compression, heating, efficiency of compression and expansion processes, etc.) on unit utilization parameters of the engine (unit thrust, unit fuel consumption, components and general efficiency); Double-flow motors (auxiliary channel circuit, characteristics); Fundamentals of construction and thermodynamic cycles of rocket engines

Classes semester I:

Calculation of turbine / jet engine circulation work; determination of unit parameters (unit thrust, unit fuel consumption, components and general efficiency) based on flight parameters and thermodynamic cycle parameters; Calculation of optimal springs and required springs of compressor sets for given flight parameters; Calculation of parameters of circulation components; Calculation of basic rocket performance based on simplified relationships.

PART - 66 (THEORY - 40 hours)

MODULE 16. PISTON ENGINE

16.5 Starting and Ignition Systems

Starting systems and pre-heating systems;

Types of magneto, construction and principles of operation;

Ignition cable system, spark plug body;

Low and high voltage systems. [2]

16.6 Intake, exhaust and cooling system

Design and operation: suction system including variable air supply systems;

Exhaust system, engine cooling system - air and fluid. [2]

16.11 Installing the Drive Unit

Configuration of firewalls, guards, acoustic panels, engine mount, suspensions

anti-vibration, cables, pipes, power supplies, connectors, cable harnesses, steering lines, joysticks

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	120	4,0
Classes requiring direct contact with the teacher	48	1,6
Preservation of lecture messages, preparation of homework, group mid-term project, preparation for written tests [1]	72	2,4

[1] delete or add other activities as appropriate