



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Elements of aircraft design theory and aircraft engine diagnostics

### Course

Field of study

Aviation and Astronautics

Area of study (specialization)

Aircraft engines and airframes

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

3 / 6

Profile of study

general academic

Course offered in

polish

Requirements

elective

### Number of hours

Lecture

45

Laboratory classes

Other (e.g. online)

Tutorials

15

Projects/seminars

30

### Number of credit points

10

### Lecturers

Responsible for the course/lecturer:

dr hab. inż. Grzegorz Szymański prof. PP

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ul. Piotrowo 3; 60-965 Poznań

Responsible for the course/lecturer:

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### Prerequisites

Basic knowledge of mechanics, metrology, material strength and machine construction. He can apply the scientific method in solving problems, carrying out experiments and inference. He knows the limits of his own knowledge and skills; can formulate questions precisely, understand the need for further education. Basic knowledge on aircraft desing, being capable of performing basic engineering calculations.

### Course objective

The aim of the course is to learn theoretical and practical issues related to research and diagnostics of aircraft engines, including: the scope of engine tests and methods of diagnosis, diagnostic modeling and



forecasting future states of aircraft engines. Student gains knowledge on design and construction of airframes.

### Course-related learning outcomes

#### Knowledge

1. Has basic knowledge in the field of main departments of technical mechanics: kinematics and material point dynamics as well as rigid body and material strength has basic knowledge in the field of technical diagnostics as well as methods and methods of solving problems of technical condition assessment and forecasting, knows: conditions for diagnosing technical objects, the essence of technical diagnostics in aviation engineering, tasks and objectives of technical diagnostics
2. Has basic knowledge in the field of metrology, knows: measurement methods, characteristics of measuring instruments and their classification by purpose, principles of operation and metrological features, workshop metrology, sensors and transducers, recording of results, measurement systems, measurement errors
3. Has basic knowledge in the field of technical diagnostics of means of transport as well as methods and methods of solving problems of assessment of their technical condition and forecasting, knows: conditions of diagnosing technical objects, the essence of technical diagnostics applied to air transport means, tasks and objectives of technical diagnostics
4. has basic knowledge in the field of the main departments of technical mechanics: statics of kinematics and material point dynamics and rigid body and strength of materials, including the basics of elasticity and plasticity theory, strain hypotheses, methods of calculating beams, membranes, shafts, joints and other simple structural elements, as well as methods for testing the strength of materials and the state of deformation and stress in structures
5. Has basic knowledge of the basics of machine construction and theory of machines and mechanisms
6. has structured, theoretically founded knowledge of engineering graphics and machine construction: technical drawing, object projection, basic principles of engineering graphics, the use of CAD (Computer Aided Design) in machine design

#### Skills

1. Is able to use native and international languages to the extent that it is possible to understand technical texts and to write using technical dictionaries machine descriptions in the field of aviation and astronautics (knowledge of technical terminology)
2. Is able to create a system diagram, select elements and perform basic calculations of the electrical and electronic systems of aircraft machines or devices
3. Is able to organize and substantively direct the design and operation of an uncomplicated on-board device, machine or technical flying object from the group covered by the selected specialty
4. Can draw a diagram and a simple machine element in accordance with the principles of technical drawing



5. Is able to obtain information from literature, the Internet, databases and other sources. Is able to integrate the information obtained, interpret and draw conclusions from them as well as create and justify opinions
6. is able to create a system diagram, select elements and perform basic calculations of the electrical and electronic systems of aircraft machines or devices
7. knows how to use verbal communication with one additional foreign language at the everyday language level, is able to describe in this language the issues of the field of study being studied, is able to prepare technical descriptive and drawing documentation of an engineering, transport and / or logistics task

#### Social competences

1. Understands the need for lifelong learning; can inspire and organize the learning process of others
2. 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 taken
3. Is able to think and act in an entrepreneurial manner
4. Is aware of the responsibility for their own work and readiness to comply with the principles of teamwork and taking responsibility for jointly implemented tasks

#### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

- written exam,
- classes - exam
- project assignment

#### Programme content

Basic stages of engine testing. The role and scope of bench tests and during flight. Braking of aircraft engines and their capabilities. Technical measures in aircraft engine tests. Methods of bench tests and during flight of aircraft engines. Determination of operating parameters and characteristics of aircraft engines. Registration and processing of results from engine tests.

Trend and cost analysis, mission profile, initial weight assignment, airframe loads, engine loads, hull utility aspects, hull-wing configuration, landing gear requirements, systems and their usage, basic construction applications, engine types and their use, engine beds, inlets, engine cooling, propellers, empennage types, wing design, steering, high lift devices, stability assesment, wing, hull, empennage, powerplant loads assesment.

#### Teaching methods

1. Lecture: multimedia presentation, illustrated with examples given on the board.



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

### Bibliography

#### Basic

1. Bukowski J., Łucjanek W., Napęd śmigłowy. Teoria i konstrukcja, Wyd. MON, Warszawa 1986r
2. Mysłowski J., Doładowanie silników, Wyd. Komunikacji i Łączności, Warszawa 2006r
3. R.B. Randall: Vibration based condition monitoring, Wiley, 2011.
4. Niziński S. Michalski R.: Diagnostyka obiektów technicznych. Monograficzna seria wydawnicza Biblioteka Problemów Eksploatacji, Warszawa - Sulejówek - Olsztyn - Radom, 2002.
5. J. Marciniak: Diagnostyka techniczna kolejowych pojazdów szynowych. WKiŁ, Warszawa 1982.
6. B. Żółtowski: Podstawy diagnostyki maszyn. Wydawnictwo. Uczelniane Akademii Techniczno-Rolniczej w Bydgoszczy, Bydgoszcz 1996.
7. C. Cempel, F. Tomaszewski: Diagnostyka Maszyn. Zasady ogólne, przykłady zastosowań. M.C.N.E.M.T, Radom 1992.
8. Raymer ?Aircraft Design, a Conceptual Approach?
9. S. Danilecki ?Projektowanie samolotów?
10. R. Cymerkiewicz ?Budowa samolotów?

#### Additional

1. Anderson ?Aircraft Performance and Design?
2. R. Cymerkiewicz ?Budowa samolotów?

### Breakdown of average student's workload

	Hours	ECTS
Total workload	250	10,0
Classes requiring direct contact with the teacher	100	4,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests and project) <sup>1</sup>	150	6,0

<sup>1</sup> delete or add other activities as appropriate