# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Aircraft and engines maintenance [S1Lot2-SLiPL>EPiSL]

## 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

Course offered in
Polish

Form of study
full-time

Requirements
elective

## Number of hours

Lecture
15

Laboratory classes
0

Other
0

Tutorials
15

Projects/seminars
0

## Number of credit points

2,00

## Coordinators

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## Lecturers

## Prerequisites

1. Knowledge: Basic mathematical knowledge in the field of statistics and probability in order to calculate reliability parameters and measures and indicators of airframe and aircraft engine operation engineering 2. Skills: Is able to adopt and plan an appropriate model of the operation process and create computer tools to support the airframe and aircraft engine operation process using a spreadsheet or relational database 3. Social competences Is aware of the level of his/her knowledge and skills and understands the need for further education - improving professional and personal competences

## Course objective

Objectives of the course: - To teach the principles of airframe and aircraft engine maintenance based on adopted maintenance processes and operational models; - To familiarize with the basic issues related to reliability, availability, operational susceptibility, durability, service life and operational properties and characteristics of airframes and aircraft engines; - To familiarize with the methods of testing the operational reliability of airframes and aircraft engines, adopt an appropriate model of the operational process and suggest appropriate extension or modification of maintenance processes depending on the needs; - To plan and supervise the operation process of a selected aircraft structure taking into account appropriate quality standards in order to ensure a high level of flight safety;

## Course-related learning outcomes

Knowledge:
1. has extended and deepened knowledge of mathematics including algebra, analysis, theory of differential equations, probability, analytical geometry as well as physics including the basics of classical mechanics, optics, electricity and magnetism, solid state physics, thermodynamics, useful for formulating and solving complex technical tasks related to aeronautical engineering and modeling
2. has structured, theoretically based general knowledge in the field of technology and various means of air transport, about the life cycle of means of transport, both hardware and software, and in particular about the key processes occurring in them
3. has structured and theoretically based general knowledge in the field of key issues of technology and detailed knowledge in the field 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 structured, theoretically based general knowledge covering key issues in the field of technical thermodynamics, fluid mechanics, in particular aerodynamics
5. has structured, theoretically based knowledge in the field of engineering graphics and machine design: technical drawing, object projection, basic principles of engineering graphics, application of CAD (Computer Aided Design) computer graphic programs in machine design
6. has detailed knowledge related to selected issues in the field of construction of manned and unmanned aircraft, 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
7. has extended knowledge in the field of strength of materials, including the theory of elasticity and plasticity,
stress hypotheses, methods of calculating beams, membranes, shafts, connections and other structural elements, as well as methods of testing the strength of materials and the state of deformation and stress in structures and also has basic knowledge in the field of the main areas of technical mechanics: statics, kinematics and dynamics of a material point and a rigid body
8. has basic knowledge of metallic, non-metallic and composite materials used in machine design, in particular their structure, properties, manufacturing methods, heat and thermochemical treatment and the influence of plastic processing on their strength, as well as fuels, lubricants, technical gases, refrigerants, etc.
9. has the ability to self-educate using modern teaching tools, such as remote lectures, Internet sites and databases, teaching programs, e-books

Skills:
1. is able to obtain information from various sources, including literature and databases, both in Polish and English, integrate it properly, interpret and critically evaluate it, draw conclusions, and comprehensively justify
the opinions he formulates
2. is able to appropriately use information and communication techniques, which are used at various stages of the implementation of aviation projects
3. is able to appropriately select materials for simple aircraft structures, indicate differences between fuels used in aviation
4. is able to communicate using various techniques in a professional environment and other environments using a formal record of the structure, technical drawing, concepts and definitions of the scope of the studied
field of study
5. is able to solve tasks using basic knowledge concerning aerodynamics, flight mechanics and flow around bodies
6. is able to design means of transport with appropriate external requirements (e.g. concerning environmental
protection)
7. is able to analyse objects and technical solutions, is able to search in catalogues and on manufacturers' websites for ready-made components of machines and devices, including means and devices, assess their suitability for use in their own technical and organisational projects
8. is able to use the language of mathematics (differential and integral calculus) to describe simple engineering issues.
9. is able to organise, cooperate and work in a group, assuming different roles in it and is able to

appropriately
define priorities for the implementation of a task specified by themselves or others
10. is able to plan and implement the process of their own permanent learning and is familiar with the possibilities of further education (second and third cycle studies, postgraduate studies, courses and exams conducted by universities, companies and professional organisations)

Social competences:
1. understands that in technology, knowledge and skills become outdated very quickly
understands the causes of malfunctioning engineering projects that led to serious financial and social losses
or to serious loss of health or even life
3. is aware of the social role of a technical university graduate, in particular understands the need to formulate
and communicate to the public, in an appropriate form, information and opinions on engineering activities, technical achievements, as well as the achievements and traditions of the engineering profession
4. correctly identifies and resolves dilemmas related to the performance of the profession of an aviation and astronautics engineer

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

-Written test
-Oral test

## Programme content

- Basic concepts of airframe and aircraft engine operation.
- Reliability theory, characteristics and reliability models.
- Characteristics of selected models of airframe and aircraft engine operation.
- Reliability forecasting in the aircraft operation process.
- Basic models of failures and damages.
- Availability, suitability, durability and service life of a technical object in relation to aircraft structures.
- Operational susceptibility as a property of airframes and aircraft engines.
- Computer systems for supporting operation. PART - 66 (THEORY - 22.5 hrs.)

MODULE 7A. TECHNICAL MAINTENANCE OPERATIONS
7.13 Control cables
7.16 Aircraft weight and balance
a) Calculation of the centre of gravity/limitations: use of relevant documents. [2]
b) Preparation of the aircraft for weighing; Weighing the aircraft. [2]
7.17 Aircraft Handling and Storage
Aircraft taxiing and towing and associated safety measures;
Aircraft lifting, chocking, securing and associated safety measures; Aircraft storage methods;
Fuel tank filling/deflation procedures; De-icing and anti-icing procedures;
Electrical, hydraulic and pneumatic supplies at grounding;
Influence of environmental conditions on aircraft handling and operation. [2]
7.19 Extraordinary Events
a) Lightning strike and HIRF penetration investigation. [2]
b) Investigation after extraordinary events such as difficult landing and flight through turbulence. [2]
7.20 Maintenance Procedures Maintenance planning; Modification procedures; Storage procedures;
Certification/release procedures; Interface with aircraft operation;
Maintenance inspection/quality control/quality assurance; Additional maintenance procedures;
Inspection of life-limited components. [2] MODULE 10. AVIATION REGULATIONS
10.6 Continuing airworthiness
Detailed understanding of Part-21 provisions for continuing airworthiness. Detailed understanding of Part-M. [2]
10.7 Applicable national and international requirements: (if not superseded by EU requirements)
a) Maintenance programmes, maintenance checks and investigations; Airworthiness directives;
Service bulletins, manufacturer's maintenance information; Changes and repairs;
Maintenance records: maintenance manual, structural repair manual, illustrated parts catalogue, etc.
For A to B2 licences only:

Master minimum equipment list, minimum equipment list, shipping deviation list; [2]
b) Continuing airworthiness;
Minimum equipment requirements - test flights For B1 and B2 licences only:
ETOPS, maintenance and shipping requirements;
All-Weather Operation, Category 2/3 Operation. [1] MODULE 17A. PROPELLER
17.5 Propeller Ice Guard
Equipment for de-icing, fluid and electrical. [2]
17.6 Propeller Maintenance Static and dynamic balancing; Blade path determination;
Blade damage assessment, erosion, corrosion, damage effects, laminar separation; Propeller treatment/repair systems;
17.7 Propeller Storage and Maintenance Propeller maintenance and lack of maintenance [2]

## Course topics

Presentation of basic concepts related to the operation of airframes and aircraft engines, reliability theory, characteristics and reliability models. Characteristics of selected models of operation of airframe structures and aircraft engines. Forecasting reliability in the process of aircraft operation. Basic models of failures and damages. Lifespan of technical objects.

## Teaching methods

Lecture / Exercises

## Bibliography

Basic:
1. Jerzy Lewitowicz, Kamila Kustroń: Podstawy eksploatacji statków powietrznych, Tom 1 i 2
2. Zbigniew Zagdański, Stany awaryjne statków powietrznych
3. Jerzy Lewitowicz, Leszek Lorycha, Jerzy Manerowski, Problemy badań i eksploatacji techniki lotniczej, Tom 6 Wydawnictwo Instytutu Technicznego Wojsk Lotniczych , Listopad 2006
4. Szczepanik R., Tomaszek H., Zarys metody oceny niezawodności i trwałości urządzeń lotniczych z uwzględnieniem stanów granicznych, Problemy Eksploatacji 2005
5. Tomaszek H., Żurek J., Jasztal M., Prognozowanie uszkodzeń zagrażających bezpieczeństwu lotów statków powietrznych, Wydawnictwo Naukowe Instytutu Technologii Eksploatacji, Warszawa 2008

Additional:
1. Paweł Lindstendt, Praktyczna diagnostyka maszyn i jej teoretyczne podstawy
2. Dzierżanowski p., (i inni), Napędy lotnicze, Turbinowe silniki śmigłowe i śmigłowcowe, Wydawnictwo Komunikacji i Łączności, 1985
3. Dzierżanowski p., (i inni), Napędy lotnicze, Turbinowe silniki odrzutowe, Wydawnictwo Komunikacji i Łączności, 1983
4. Dzierżanowski p., (i inni), Napędy lotnicze, Zespoły wirnikowe silników turbinowych, Wydawnictwo Komunikacji i Łączności, 1982
5. Józef Zieleziński, Budowa płatowców, Wydawnictwo Komunikacji i Łączności, Warszawa 1974
6. Kocańda S., Szala J.,Podstawy obliczeń zmęczeniowych, Wydawnictwo Naukowe PWN, 1997

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 50 | 2,00 |
| Classes requiring direct contact with the teacher | 30 | 1,00 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 20 | 1,00 |