COURSE DESCRIPTION CARD - SYLLABUS

Course name
General knowledge about the aircraft 2 [S1Lot2-PSPL>OWoS2]

Course

Field of study
Aviation

Year/Semester
2/3

Area of study (specialization)
Aircraft Piloting

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

1,00

Coordinators

Kajetan Szymańczyk
kajetan.szymanczyk@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge of airframe components, control systems, hydraulic, pneumatic, fuel, air conditioning, and emergency systems. Ability to apply the scientific method in problem-solving. Readiness to collaborate in a team environment.

Course objective

To familiarize students with the structure of an aircraft and its operational components. Course-related learning outcomes Knowledge: Extended knowledge of mathematics, including algebra, analysis, differential equations, probability, and analytical geometry, as well as physics (classical mechanics, optics, electricity and magnetism, solid-state physics, and thermodynamics), applicable to aviation engineering and modeling. Structured and theoretically based general knowledge of aviation technology and various air transport means, including their lifecycle processes. Detailed understanding of key technical issues related to air transport, including methods and tools for solving engineering problems in aviation. Knowledge of fundamental thermodynamics, fluid mechanics, and aerodynamics principles. Familiarity with engineering graphics and machine design, including technical drawing, object projection, fundamental engineering graphics principles, and CAD software applications in machine design. In-depth knowledge of manned and unmanned aircraft structures, onboard equipment, control systems, communication and recording systems, automation, and flight simulation technologies. Advanced understanding of material strength, elasticity, plasticity theories, stress hypotheses, calculation methods for beams, membranes, shafts, joints, and other structural elements. Basic knowledge of metallic, non-metallic, and composite materials used in aircraft construction, their properties, manufacturing methods, heat and thermochemical treatments, and the impact of plastic processing on material strength. Ability to self-learn using modern educational tools such as online lectures, databases, e-books, and learning programs. Skills: Ability to acquire information from various sources (literature, databases in Polish and English), integrate it appropriately, analyze it critically, draw conclusions, and justify opinions comprehensively. Proficiency in using information and communication technologies applicable to different stages of aviation operations. Ability to select appropriate materials for simple aircraft structures and distinguish between different aviation fuels. Effective communication using various technical formats, including technical drawings and formal engineering terminology. Ability to solve problems using fundamental knowledge of aerodynamics, flight mechanics, and fluid dynamics. Ability to design air transport vehicles with appropriate external requirements (e.g., environmental protection). Competence in analyzing technical objects and solutions, searching manufacturer catalogs and websites for ready-made machine components, and evaluating their suitability for personal technical and organizational projects. Competence in applying probability distributions, analyzing and interpreting statistical data, and using statistical methods and tools in engineering practice. Ability to organize, collaborate, and work in a team, taking on various roles and prioritizing tasks effectively. Capability to plan and execute lifelong learning processes, understanding opportunities for further education (graduate studies, postgraduate courses, certifications, and exams conducted by academic institutions, companies, and professional organizations). Social Competencies: Awareness that technical knowledge and skills quickly become outdated. Understanding of the importance of knowledge in solving engineering problems, with examples of defective engineering projects that led to financial, social, or health-related losses. Awareness of the social role of a technical university graduate, particularly the need to communicate engineering achievements, technical developments, and the traditions of the engineering profession to the public. Ability to correctly identify and resolve ethical dilemmas in aviation engineering and astronautics.

Course-related learning outcomes

Knowledge:
-

Skills:
-

Social competences:
-

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Assessment of knowledge and skills through a 1.5-hour written exam.
Exercises: Knowledge acquired during exercises is assessed through two 45-minute tests conducted during the 3rd and 7th classes.
Programme content:
Semester 6:
Measurement Sensors and Instruments, Air Data Measurement, Gyroscopic Instruments, Inertial

Navigation, Aircraft Automatic Control Systems, Trim Systems, Yaw Dampers, and Performance Envelope Protection
Magnetism: Direct-reading compass and induction compass., Automatic Throttle: Automatic thrust control system, Aircraft Maintenance, Monitoring, and Recording System, Digital Systems and Onboard Computers

Programme content

none

Course topics

1. Icing: Ice accumulation on aircraft surfaces reducing lift and increasing drag, potentially leading to loss of control.
2. Turbulence: Sudden and unpredictable changes in wind speed and direction, affecting aircraft handling and passenger comfort.
3. Wind Shear: Rapid changes in wind direction or speed at low altitudes, particularly hazardous during take off and landing.
4. Thunderstorms: Intense precipitation, lightning, turbulence, and possible hail, which can damage aircraft.
5. Tornadoes: Extreme air vortices posing a severe threat due to intense wind gusts.
6. Temperature Inversions: Reversal of the normal temperature gradient, leading to reduced visibility and wind shear.
7. Mountainous Region Hazards: Strong updrafts, downdrafts, turbulence, and sudden weather changes that challenge pilots.
8. Meteorological Information:
9. Weather Data Sources: Ground-based and satellite weather monitoring systems assisting pilots in flight planning and hazard avoidance.
10. Weather Maps: Graphical representations of atmospheric conditions for analyzing weather threats along flight routes.
11. Weather Warnings: Notifications about hazardous meteorological events (e.g., thunderstorms, strong winds) to aid operational decision-making.
12. Meteorological Services: Organizations providing aviation weather forecasts and warnings, such as METAR, TAF, and SIGMET.

Teaching methods

Lecture: Multimedia presentation supplemented with examples explained on the board.
Exercises: Board-based examples and problem-solving tasks assigned by the instructor, including practical exercises.

Bibliography

Basic:
Cichosz E., Aircraft Structure and Operation, WAT, Warsaw, 1986.
Olejnik A., Aircraft Construction, WAT, 1984.
Błaszczyk J., Aircraft Design, Vol. I: External Loads, WAT, Warsaw, 1984.
Danilecki S., Aircraft Design, Warsaw University of Technology Publishing, 2000.
Polak Z., Rypulak A., Bilski J., Avionics, Instruments, and Onboard Systems, WSOSP, Dęblin, 1999.
Spitzer Cary R., The Avionics Handbook, AvioniCon Inc., Williamsburg, 2001.
Kazana J., Lipski J., Construction and Operation of Onboard Aircraft Instruments, WKiŁ, Warsaw, 1983.

Additional:
-

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
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)	45	2,00