COURSE DESCRIPTION CARD - SYLLABUS

Course name
Air navigation [S1Lot2-PSPL>NL]

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
30

Projects/seminars
0

Number of credit points

2,00

Coordinators

Tomasz Nowak

Lecturers

Prerequisites

A student starting this subject should have basic knowledge of the basics of the Earth's shape, coordinate and reference systems, and the basics of radio navigation. They should also have the ability to apply the scientific method to solving problems and be willing to work as part of a team.

Course objective

Familiarizing students with practical performance of navigation tasks related to planning, preparing and executing a flight in selected environmental and operational conditions, time changes, use of typical navigation and radio navigation devices, use of radar devices, interpretation of measurement results, assessment of correct functioning and estimation of errors of navigation and radio navigation devices. Ability to use satellite system receivers used in navigation, interpretation of indications and assessment of the possibility of using satellite systems in individual types and phases of navigation, application of navigation methods in professional flight operations. Ability to apply calculations of grouping parameters in practice.

Course-related learning outcomes

Knowledge:
1. has extended and deepened knowledge of mathematics including algebra, analysis, theory of differential

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 and theoretically based general knowledge 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

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/she formulates
2. is able to appropriately use information and communication techniques that are used 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. is able to formulate and solve tasks related to civil aviation, apply appropriately selected methods, including
analytical, simulation or experimental methods
5. is able to solve tasks using air traffic problems and design a runway in accordance with applicable ICAO requirements
6. the student is able to use theoretical probability distributions. The student is able to analyze and interpret statistical data. The student is able to use the methods and tools of mathematical statistics in engineering practice
7. is able to prepare a short scientific paper, observing basic editorial principles. Is able to select appropriate
methods for the research being conducted and is able to conduct a basic analysis of the results.
8. is able to organize, 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 himself or others
9. is able to plan and implement the process of his own permanent learning and knows the possibilities of further education (second and third 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 outdated
2. correctly identifies and resolves dilemmas related to the profession of an aviation and astronautics engineer

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: - assessment of knowledge and skills demonstrated in the written test - 1.5 hours. Exercises: - knowledge acquired during the exercises is verified by two 45-minute tests conducted during the 7th and 15th
classes

Programme content

Lecture:
GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS)
Global Navigation Satellite Systems (GNSS)
General
Operation
Global Navigation Satellite System (GNSS)
Space Segment (Example: NAVSTAR GPS)
Control Segment
User Segment

Navigation System Integrity with Global Positioning System (NAVSTAR GPS)
Accuracy Factors and Errors Ground-Based,
Satellite-Based, and Airborne Augmentation Systems
Ground-Based Augmentation Systems (GBAS)
Satellite-Based Augmentation Systems (SBAS)
Airborne Augmentation Systems (ABAS)
Navigation Specifications Area Navigation (RNAV) and Required Navigation Performance (RNP)
Navigation Functional Requirements RNP and RNAV Specification Designation Performance-Based
Usage Specific RNAV and RNP System Features Performance-Based Navigation (PBN)
Operations Performance-Based Navigation (PBN)
Principles of Performance-Based Navigation (PBN)
Built-in Performance Monitoring and Alerting
Abnormal Situations
Database Management
Specific Specification Requirements RNAV and RNP RNAV 10 RNAV 5 RNAV 1 / RNAV 2 / RNP 1 / RNP 2
Required Navigation Approach (RNP APCH)
Required Navigation Approach Required Approach (RNP AR APCH)
Advanced Navigation Parameters Required (A-RNP)

Course topics

Topics include satellite navigation systems, ground, satellite and aircraft augmentation systems, navigation specifications and requirements. Area navigation, PBN navigation principles, RNAV system functions and requirements.

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples given on the board.
2. Exercises: examples given on the board and carrying out tasks given by the practical exercises instructor.

Bibliography

Basic:
1. Narkiewicz J., Podstawy układów nawigacyjnych, PWN, Warszawa 1999 r.
2. Ortyl A., Autonomiczne systemy nawigacji lotniczej, WAT, Warszawa 2000 r.
3. Janik F., Malinowski C., Podstawowa nawigacja lotnicza, Wydawnictwa komunikacyjne, Warszawa 1957 r.
4. Wyrozumski W., Podręcznik nawigacji lotniczej, Aeroklub PRL,
5. Wolper James S., Understanding mathematics for aircraft navigation, McGraw-Hill Companies Inc, 2001 r.
7. Narkiewicz J., Globalny system pozycyjny. WKiŁ 2003 r.
8. Advanced Avionics Handbook FAA-H-8083-6, Federal Aviation Administration. Washington 2009 r.

Additional:
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Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	32	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	43	2,00