COURSE DESCRIPTION CARD - SYLLABUS

Course name
Air Navigation

Course

Field of study
Aviation

Year/Semester
2/4

Area of study (specialization)
Flight Training For Civil Aviation

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes

Other (e.g. online)

Tutorials
30

Projects/seminars

Number of credit points

5

Lecturers

Responsible for the course/lecturer:
mgr inż. Tomasz Nowak

mgr inż. Maciej Sypniewski

mgr inż. Michał Mleczak

mgr inż. Kajetan Szymańczyk

Responsible for the course/lecturer:

Prerequisites

The student starting this subject should have basic knowledge of basic knowledge about the shape of the Earth, coordinate systems and reference as well as the basics of radio navigation. He should also have the ability to apply the scientific method in solving problems and be ready to cooperate within a team.

Course objective

To acquaint the student with the practical performance of navigation tasks related to the planning, preparation and execution of a flight in selected environmental and operational conditions, change of time, use of typical navigation and radio navigation devices, use of radar devices, interpretation of measurement results, assessment of correctness of functioning and estimation of navigation and radio navigation equipment errors . Ability to use satellite system receivers used in navigation, interpretation of indications and assessment of the possibility of using satellite systems in particular types and phases

of navigation, use of navigation methods in professional air operations. The ability to put into practice calculations of grouping parameters.

Course-related learning outcomes

Knowledge

1. has extended and in-depth knowledge of mathematics including algebra, analysis, theory of differential equations, probability, analytical geometry as well as physics covering the basics of classical mechanics, optics, electricity and magnetism, solid state physics, thermodynamics, useful for formulating and solving complex technical tasks related to engineering aeronautical and modeling

2. has ordered and theoretically founded general knowledge in the field 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 in English, integrate them properly, interpret them and make a critical evaluation, draw conclusions and exhaustively justify the opinions they formulate

2. is able to properly use information and communication techniques, applicable 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. can, when formulating and solving tasks related to civil aviation, apply appropriately selected methods, including analytical, simulation or experimental methods

5. can solve tasks using the rules of air traffic and design a runway in accordance with the applicable ICAO requirements

6. student can use theoretical probability distributions. Student is able to analyze and interpret statistical data. Student is able to use the methods and tools of mathematical statistics in engineering practice

7. is able to prepare a short research paper while maintaining the basic editorial rules. He can choose appropriate methods for the conducted research and is able to carry out a basic analysis of the results.

8. is able to organize, cooperate and work in a group, assuming various roles in it, and is able to properly define priorities for the implementation of a task set by himself or others

9. is able to plan and implement the process of own permanent learning and knows the possibilities of further education (2nd and 3rd 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 obsolete

2. correctly identifies and resolves dilemmas related to the profession of an aerospace engineer

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:

- assessment of knowledge and skills demonstrated on the written test - 1.5 hour

Exercises:

The knowledge acquired as part of the exercises is verified by two 45-minute colloquia carried out during 7 and 15 classes

Programme content

Lecture:

Semester 4:

RADIO AIDS

Ground direction finding (DF)

Principles

Presentation and interpretation

Coverage and range

Errors and accuracy

Non-directional radio beacon (NDB)/automatic direction finding (ADF)

Principles

Presentation and interpretation

Coverage and range

Errors and accuracy

Factors affecting range and accuracy

VHF omnidirectional radio range (VOR): conventional VOR (CVOR) and Doppler VOR (DVOR)

Principles

Presentation and interpretation

Errors and accuracy

Distance-measuring equipment (DME)

Principles

Presentation and interpretation

Coverage and range

Factors affecting range and accuracy

Instrument landing system (ILS)

Principles

Presentation and interpretation

Coverage and range

Errors and accuracy

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Factors affecting range and accuracy

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Factors affecting range and accuracy

Instrument landing system (ILS)

Principles

Presentation and interpretation

Coverage and range

Errors and accuracy

Factors affecting range and accuracy

Microwave landing system (MLS)

Presentation and interpretation

Coverage and range

PERFORMANCE-BASED NAVIGATION (PBN)

Performance-based navigation (PBN) concept (as described in ICAO Doc 9613)

PBN principles

PBN components

PBN scope

Exercises:

Semester 4:

RADIO NAVIGATION

BASIC RADIO PROPAGATION THEORY

Basic principles

Electromagnetic waves

Frequency, wavelength, amplitude, phase angle

Frequency bands, sidebands, single sideband

Pulse characteristics

Carrier, modulation

Kinds of modulation (amplitude, frequency, pulse, phase)

Antennas

Characteristics

Polarisation

Types of antennas

Wave propagation

Structure of the ionosphere and its effect on radio waves

Ground waves

Space waves

Propagation with the frequency bands

Doppler principle

Factors affecting propagation

RADAR

Pulse techniques

Pulse techniques and associated terms

Ground radar

Principles

Presentation and interpretation

Airborne weather radar

Principles

Presentation and interpretation

Coverage and range

Errors, accuracy, limitations

Factors affecting range and accuracy

Application for navigation

Secondary surveillance radar and transponder

Principles

Modes and codes

Presentation and interpretation

Teaching methods

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

2. Exercises: examples given on the board and performance of tasks given by the teacher - practical exercises.

3. Practical exercises at the didactic and laboratory positions.

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,

6. 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

Breakdown of average student's workload

	Hours	ECTS
Total workload	115	5,0
Classes requiring direct contact with the teacher	70	3,5
Student's own work (literature studies, preparation for exercises, preparation for colloquium / credit; preparation for laboratory classes, preparation of report) [1]	45	1,5

[1] delete or add other activities as appropriate