COURSE DESCRIPTION CARD - SYLLABUS

Course name
Air Navigation

Course

Field of study
Aerospace Engineering

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

4

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 detailed knowledge related to selected issues in the field of navigation of flight mechanics and piloting techniques, and the use of flight simulators.

2. has basic knowledge of technical vocabulary, in particular specialized terminology used in the fields of science and technology related to aviation engineering.

3. has basic knowledge necessary to understand profile subjects and specialist knowledge about construction, methods of construction, manufacture, operation, aircraft control, safety systems, economic, social and environmental impact in the field of aviation engineering for selected specialties:

1. Piloting of aircraft

2. Aero engines and airframes.

Skills

1. knows how to use a language to a degree enabling understanding of technical texts in the field of aviation (knowledge of technical terminology).

2. has the ability to self-study using modern teaching tools, such as remote lectures, websites and databases, teaching programs, e-books.

3. can obtain information from literature, the Internet, databases and other sources. Is able to integrate obtained information, interpret and draw conclusions from them.

Social competences

1. is aware of the importance of maintaining the principles of professional ethics.

2. is able to properly set priorities for the implementation of the task specified by him or others based on available knowledge.

3. understand the need for critical assessment of knowledge and continuous education.

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

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

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	96	3,0
Classes requiring direct contact with the teacher	66	2,0
Student's own work (literature studies, preparation for exercises, preparation for colloquium / credit; preparation for laboratory classes, preparation of report) [1]	30	1,0

[1] delete or add other activities as appropriate