COURSE DESCRIPTION CARD - SYLLABUS

Course name
Air Navigation

Course

Field of study
Aviation

Year/Semester
2/3

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
15

Laboratory classes

Other (e.g. online)

Tutorials
30

Projects/seminars

Number of credit points

1

Lecturers

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

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

3. has the ability to self-study with the use of modern teaching tools, such as remote lectures, websites and databases, teaching programs, e-books

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. 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

6. 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.

7. 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

8. 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. is aware of the importance of knowledge in solving engineering problems and knows examples and understands the causes of faulty engineering projects that have led to serious financial and social losses, or to a serious loss of health and even life

3. is aware of the social role of a technical university graduate, in particular understands the need to formulate and provide the society, in an appropriate form, with information and opinions on engineering activities, technological achievements, as well as the achievements and traditions of the engineer profession

4. 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 3:

BASICS OF NAVIGATION

The Earth

Form

Earth rotation

Position

Position reference system

Triangle of velocities (TOV)

Construction

Projections

Methods of projection

Polar stereographic

Direct Mercator

Lambert

Exercises:

Semester 3:

Direction

Datums

Track and heading

Distance

WGS-84 ellipsoid

Units

Graticule distances

Air mile

Speed

True airspeed (TAS)

Mach number (M)

CAS/TAS/M relationship

Ground speed (GS)

Flight log

Gradient versus rate of climb/descent

Triangle of velocities (TOV)

Construction

Dead reckoning (DR)

Dead reckoning (DR) technique

Navigation in climb and descent

Average airspeed

Average wind velocity (WV)

Ground speed (GS)/distance covered during climb or descent

VISUAL FLIGHT RULE (VFR) NAVIGATION

Ground features

Ground features

Visual identification

VFR navigation techniques

Use of visual observations and application to in-flight navigation

Unplanned events

GREAT CIRCLES AND RHUMB LINES

Great circles

Properties

Convergence

Rhumb lines

Properties

Relationship

Distances

Conversion angle

CHARTS

Chart requirements

ICAO Annex 4 ‘Aeronautical Charts’

Convergence

Scale

Practical use

Symbology

Plotting

Time

Local Mean Time (LMT)

Mean solar day

Local Mean Time (LMT) and Universal Time Coordinated (UTC)

Standard time

Standard time and daylight saving time

International Date Line

Sunrise and sunset

Sunrise and sunset times

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	30	1,0
Classes requiring direct contact with the teacher	17	0,5
Student's own work (literature studies, preparation for exercises, preparation for colloquium / credit; preparation for laboratory classes, preparation of report) [1]	13	0,5

[1] delete or add other activities as appropriate