



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Elements of fluid flow theory, machine operation, geographical information and air law

### Course

Field of study

Aviation and astronautics

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

3/5

Profile of study

general academic

Course offered in

polish

Requirements

elective

### Number of hours

Lecture

90

Laboratory classes

30

Other (e.g. online)

Tutorials

15

Projects/seminars

### Number of credit points

12

### Lecturers

Responsible for the course/lecturer:

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### Prerequisites

A student starting this subject should have basic knowledge of aviation law and intellectual property protection. He should also have the ability to apply the scientific method in solving problems and be ready to cooperate within a team.

Knowledge of mathematical analysis and statistics, technical drawing and machine parts. The ability to think logically, use information obtained from the library and the Internet. Understands the needs of learning and acquiring new knowledge

The student has basic knowledge about geography and Earth sciences. The student is able to associate and integrate information, analyze environmental phenomena, draw conclusions, formulate and justify opinions. The student is able to carry out literature research and knows the rules of discussion.

Knowledge: mathematics, physics and fluid mechanics in the scope presented in the studies. Is able to apply the scientific method in solving problems. He knows the limits of his own knowledge and skills; can formulate questions precisely, understand the need for further education.

### Course objective

To acquaint the student with the activities of Aviation Organizations, regulations on the licensing of aviation personnel, and air traffic management system.

Learning the basic concepts of measurement techniques. Getting to know the instruments and measuring methods used in machine construction. Acquiring the ability to calculate and select the tolerance and fit symbol for holes, shafts and threads. Acquiring knowledge about measurement methods, error calculation and calculation of uncertainty of direct and indirect measurement.

Understanding the basics and extended information about the Geographic Information System (GIS).

To acquaint students with the basic theoretical knowledge related to the flow of gases.

### Course-related learning outcomes

Knowledge

- 1.
- 2.
- 3.

Skills

- 1.



2.

3.

Social competences

1.

2.

3.

### 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 (semesters 3 and 4);

Exercises:

knowledge acquired as part of the exercises is verified by two 45-minute colloquia carried out during 3 and 7 classes (semester 5)

Laboratory:

Credit based on an oral or written answer regarding the content of each laboratory exercise and a written report. To get credit, all exercises must be passed.

### Programme content

Lecture (Air law 3):

Semester 3:

Air Traffic Services (ATS) and Air Traffic Management (ATM): airspace, air traffic control (ATC) services, light information service (FIS), alerting service. Principles governing required navigation performance (RNP) and air traffic service (ATS) route designators. ICAO Doc 4444 - Air Traffic Management. ATS system capacity and air traffic flow management (ATFM). General provisions for air traffic services (ATS). ATC clearances.

Semester 4:

Horizontal speed control instructions. Altimeter-setting procedures. Reporting of operational and meteorological information. Separation methods and minima. Separation in the vicinity of aerodromes (ADs). Procedures for aerodrome (AD) control service. Radar services. Aeronautical Information Services (AIS).

Exercises (Air law 3):

Semester 5:



Integrated aeronautical information package. Notices to airmen (NOTAMs). Aeronautical information regulation and control (AIRAC). Aeronautical information circulars (AICs). Pre-flight and post-flight information/data. AERODROMES (ICAO Annex 14, Volume I - Aerodrome Design and Operations, and Regulation (EU) No 139/2014). Aerodrome (AD) operational services, equipment and installations. Search and Rescue (SAR). Security - Safeguarding International Civil Aviation against Acts of Unlawful Interference (ICAO Annex 17).

Lecture:

Measurement theory, measurement and its essence, measurement result, methods, types and methods of measurement, system of SI units of measurement, definition of metro, etalons, standards of length and angle measures, standard plates, measuring rollers and balls, angle plates, angles, pattern hierarchy, measurement errors, definition and classification, systematic, accidental and excessive errors, elimination and estimation of errors, determination of measurement uncertainty, statistical analysis of measurement results, measurement tools, their division and characteristics, measurement methods, indirect methods errors, caliper, micrometric instruments, sensors, length gauges, altimeters, microscopes, projectors, tolerance and fit systems of machine parts, angle and cone measurements, measurement of shape and position deviations, measurements of basic gear parameters, surface roughness measurements. Fundamentals of the coordinate technique.

Introduction to geographical information systems, characteristics of geographical data (attributes, relationships, types of graphic objects, geographical data models); reference systems, reference systems, coordinate systems; cartographic mappings, legal aspects of geographical information systems; properties of spatial data and the nature of error sources; GIS data sources, GIS software

Basic thermodynamic concepts. Speed of sound. Classification of gas flows. One-dimensional flow. Basic equations. Adiabatic and isentropic flows. Flow through the nozzle. Critical parameters and gas accumulation. Change of gas parameters in the flow through the conduit with variable cross-section, taking into account friction, heat exchange. Wave phenomena in one-dimensional flow. Normal shock wave. Two-dimensional flow. Supersonic flat flow. Oblique shock wave. Axial symmetrical flow.

### 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. Laboratorium: zajęcia przy stanowiskach w laboratorium

### Bibliography

Basic

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  4. Doc 7030/4 - Regionalne Procedury Uzupełniające dla Regionu Europy
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  2. Sydenham P.H., Podręcznik metrologii, t1, Wyd. Kił, Warszawa, 1988
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6. Kwiecień J.: Systemy informacji geograficznej ? podstawy. Wydawnictwa Uczelniane ATR w Bydgoszczy, Bydgoszcz 2004
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8. Shashi Shekhar, Shashi Shekhar, Hui Xiong: Encyclopedia of GIS Wydawnictwo Springer, wydanie II, 2017.
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#### Breakdown of average student's workload

	Hours	ECTS
Total workload	360	12,0
Classes requiring direct contact with the teacher	150	5,0
Student's own work (literature studies, preparation for written tests ) <sup>1</sup>	210	7,0

<sup>1</sup> delete or add other activities as appropriate