



**STUDY: AERONAUTICS – MODULE: CIVIL
PILOT, MILITARY PILOT, AIR TRAFFIC
CONTROLLER**

SEMESTER (III)

Syllabus

Academic year 2023/2024

Course:		Aircraft Electrical Systems			
Head of course: prof. Tino Bucak, Ph.D.					
Co-lecturers: Asst. Prof. Jurica Ivošević, Ph.D.					
Semester: III	Course code:	Lectures: 10	Auditory exercises: 10	Laboratory exercises:	ECTS credits: 2

Objective of the course:

- Static electricity, DC and AC current, electromagnetism, circuit elements. Semiconductors and logic circuits. Aircraft electrical energy sources: batteries, generators, GPU, APU, emergency power systems. Power distribution, converters and loads. Regulation and protection devices. New system designs and future road maps.

Learning outcomes:

- DEVELOPMENT OF GENERAL COMPETENCES (KNOWLEDGE AND SKILLS)
- During the course, students acquire knowledge of operation and use of aircraft electrical systems. After successfully finishing the course, students are qualified to implement theoretical knowledge and skills in upcoming flying lessons: to prepare the flight according to general flying principles in accordance with international standards and procedures, to properly interpret electrical system behavior and recognize false indications and system failures, which should increase overall flight safety.
- By applying the scientific methods the student will be enabled to increase the situational awareness at all phases of flight preparation and execution and will open the possibility of his or hers scientific development in this field.
- DEVELOPMENT OF SPECIFIC COMPETENCES (KNOWLEDGE AND SKILLS)
- After successfully finishing the course, student will develop following specific competences:
- Be able to understand simple schematic design and analysis of a typical aircraft DC and/or AC electrical system (power sources, distribution system, loads, regulation and protection devices).





- Understand the working principles of chemical energy sources, DC and AC generators, carbon pile and electronic voltage regulators, protection relays, overload fuses, static dischargers, DC and AC motors and actuators, aircraft lighting, fire and ice protection systems.
- At all time be aware of present situation and be able for adequate action in emergency cases due to power failures (Ni-Cd battery thermal runaway, generator malfunction, network short-circuit), storm lighting stroke, mechanical failures (landing gear stuck due to actuator malfunction) etc.





LECTURES and EXERCISES

Week	Syllabus	Form of classes	Performed by	Lessons	Remark
1.	<ul style="list-style-type: none">Aircraft electrical systems - introduction: requirements, normization and standards, systematization	L	Jurica Ivošević	2	
2.	<ul style="list-style-type: none">Static electricity, DC and AC current, electromagnetism, circuit elements: resistors, capacitors, coils.	L/AE	Jurica Ivošević	1+1	
3.	<ul style="list-style-type: none">Semiconductors and logic circuits	L/AE	Jurica Ivošević	1+1	
4.	<ul style="list-style-type: none">Aircraft chemical energy sources (batteries)	L	Jurica Ivošević	2	
5.	<ul style="list-style-type: none">Aircraft DC generators: construction, operating principles, classification. Regulation and protection systems.	L/AE	Jurica Ivošević	1+1	



6.	<ul style="list-style-type: none">Aircraft AC generators: construction, operating principles, classification. Regulation and protection systems.	L/AE	Jurica Ivošević	1+1	
7.	<ul style="list-style-type: none">External, auxiliary and emergency power sources. Power converters: rectifiers, inverters, converters, transformers.	L	Jurica Ivošević	2	
8.	<ul style="list-style-type: none">Field excercises: Aircraft Maintenance Facility visit.	AE	Jurica Ivošević	2	
9.	<ul style="list-style-type: none">1. check exam	AE	Jurica Ivošević	1	
10.	<ul style="list-style-type: none">Power distribution systems. Regulation and overload protection systems.	L/AE	Jurica Ivošević	1+1	
11.	<ul style="list-style-type: none">Power consumption: loads, actuators, lighting, environment regulation, rain, ice and fire protection, ignition systems	L	Jurica Ivošević	2	



12.	<ul style="list-style-type: none">▪ New system designs and future road maps	L	Jurica Ivošević	2	
13.	<ul style="list-style-type: none">▪ Solving numerical tasks and ATPL exam questions.	AE	Jurica Ivošević	2	
14.	<ul style="list-style-type: none">▪ Public presentation and discussion of the seminar papers	AE	Jurica Ivošević	4	
15.	<ul style="list-style-type: none">• 2. check exam	AE	Jurica Ivošević	1	

L = Lectures; **AE** = Auditory Exercises; **LE** = Laboratory Exercises; **S** = Seminars



STUDENT OBLIGATIONS AND EXAMS

Conditions for obtaining signatures:

Students are required to attend lectures and exercises. A student can fail a maximum of three terms of lectures and three terms of exercises. Exceptionally, in the case of justified absences, two additional terms of lectures and exercises will be granted, which equals to the maximum of 5 lectures and 5 exercises permitted absence. Therefore, student must collect at least 10 points, according to the following table.

Seminar paper

Students are obliged to make a seminar paper, present it and defend in the present of the other students and teacher. Submission and discussion of the seminar papers is done during the semester in the term of exercises. If a student (in the case of justified absence) does not create and defense seminar paper, in consultation with the teacher determines the submission date at the consultation. Seminar paper consists of the presentation of theoretical themes related to the syllabus. Student with the relevant seminar paper can be achieved minimum of 10 and maximum of 20 points. Student cannot compensate the lack of minimum number of points in check exams or final written exams with points in seminar paper, but only increase the already achieved a positive mark

Exams

The student has the possibility to adjoin two partial exams (check exams - colloquiums) which, if both passed, are recognized as a written exam. The first partial exam is usually held in the middle of semester and the other at the end of the semester. The partial exam includes materials processed until that period, and the other material from that point until the end of the semester. Both exams consist of tasks that combine different solving methods: test questions in the form of multiple choice with one correct answer offered, math/formulae deduction, sketching and describing. The minimum passing threshold is 80% of the total number of points, i.e. 40 out of the maximum 50 points per each check exam. If a student fails both exams, the entire syllabus will be mandatory at the final written exam in the exam term.

Final written exam contains tasks designed in the same way as in both check exams, with the same passing criteria (80%), and at least 80 of 100 points, according to the table.

Grade before the oral exam is formed according to the sum of points achieved by attending lectures and exercises and seminar papers completed along with the points obtained in check exams or final written exam, according to the table.

Students who successfully pass both exams, apply to the oral examination in one of the regular (after-semester) exam terms and answer the questions from entire syllabus. Grade is formed as the arithmetic mean value of the first and second exams and oral exams. Grade from the check exams is not transferable in the next-semester exam term.

Students who pass the final written exam, access the oral examination. Grade is formed as the arithmetic mean value of the written and oral exams.

The exception in both cases is negatively evaluated oral examination, in which the overall examination score is insufficient (1).

The oral examination is mandatory and the student can get the lower or higher grade than the one that corresponds to the points collected. Exceptionally, in case of maximum points collected, student is relieved from oral exam and graded with the overall excellent (5) score.



LITERATURE

a) Obligatory literature:

- Bucak, T.: Zrakoplovni elektro-sustavi, FPZ, Zagreb, 2001., 2022.
- Ivošević, J., Bucak, T.: Zrakoplovni elektrosustavi - zbirka zadataka i riješenih primjera, Zagreb
- Upute za prijavu, izradbu i obranu završnog i diplomskog rada, FPZ, Zagreb, 2016.

b) Recommended literature:

- Pallett, E. H. J.: Aircraft Electrical Systems, Longman Scientific&Technical, England, 1987.
- Anon: Electrics, Nordan AS, Sandefjord, Norway, 2006.





Course quality assurance and performance assessment

1. Lectures

Lectures follow the syllabus of the textbooks listed in the compulsory literature, and are performed using the combined lecturing methods (whiteboard, Power Point, flip chart presentations). The use of a textbook and recommended literature allows students to prepare the lecture topics in advance. The students are encouraged to read the topic of the forthcoming lecture in advance and to take part in the pro-active discussion. Students are further referred to the relevant data sources and programs on the Internet. Some topics are further covered with video clips presentations along with a commentary for better understanding. At any time students have the option to ask questions or start a discussion about topics that might need additional clarification, commentary and/or support with examples.

2. Exercises

On the auditory exercises:

- a) students solve numerical tasks that enable them better understand the physical basics of aircraft instrumentation and electrical systems
- b) students are proposed seminar paper and instructions for its creation. Seminar work is made during the semester mostly in after-classes time, which provides the ability to apply knowledge obtained during the lectures and exercises.
- c) students practice with types of questions that are usual for the ATPL license exams and publicly defend the seminar papers.





On the laboratory exercises:

- a) students become familiar with the elements of instrumentation and electrical systems, learning how they function, with emphasis on the failures that may occur during their utilization.

- b) assisted by certified flight instructors, students carry out flight procedures on the flight synthetic training devices (FSTD), with the flight- and engine dynamics simulation capability of Piper Seneca III (twin piston) and Piper Cheyenne III (twin turboprop) engine aircraft.

On each exercise student receives a task that must be resolved during the exercise.





4. DOCUMENTATION

The student's attendance record is kept during the semester. The documentation is published on the Internet (e-student).

Documentation of all tests and check exams is an integral part of the exam, which is kept and stored in accordance with the "Statute of theoretical exams..." at the Department of Aeronautics.

5. SCORING SYSTEM

Number	Student activity	Minimum number of points	Maximum number of points
1.	Lectures attendance	10	15
2.	Exercise attendance	10	15
4.	Seminar paper	10	20
6.	Written exam (or 2 check exams)	80	100
TOTAL		110	150

The cumulative collected number of points	Final grade
110 - 119	2
120 - 129	3
130 - 139	4
140 - 150	5

