220034 - Hydraulic Systems

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 729 - MF - Department of Fluid Mechanics
Academic year: 2017
Degree: BACHELOR’S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
ECTS credits: 4,5
Teaching languages: Catalan

Teaching staff

Coordinator: Salvador de las Heras
Others: Hipòlit Moreno - Francisco Arias

Requirements

It is considered essential to have passed the subject of Fluid Mechanics.

Degree competences to which the subject contributes

Specific:
2. GrEVA - An adequate understanding of the following, as applied to engineering: aircraft systems and automatic flight control systems in aerospace vehicles.

Transversal:
1. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Teaching methodology

- Lecture presenting the contents.
- Practical work.
- Independent work and study exercises.
- Preparation and assessable activities in groups.

Learning objectives of the subject

After completing the course, students must have achieved Level 3 (application) with general learning objectives:

Technology in the field of specialty
- Understand the scientific foundations
- Know how to use the technology and the necessary engineering professional performance
- Analyze specific situations, define problems, make decisions and implement plans of action in the search for solutions.
- Apply knowledge to real situations, managing resources appropriately.
- Interpret studies, reports, and analyze data numerically.
- Select and manage the information sources.
- Use existing tools as support.
- Working in a multidisciplinary team.
- Evaluate the integral, personal motivation, mobility.
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Communication
- Understand and speak with the proper terminology.
- Discuss and argue on various forums.

Technology transfer.
- Analyze and evaluate the environmental, social and ethical profession.
- Have a critical and innovative spirit.
- Retraining in new technological developments through continuous learning.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>31h</th>
<th>27.56%</th>
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<tbody>
<tr>
<td></td>
<td>Hours small group:</td>
<td>14h</td>
<td>12.44%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>67h 30m</td>
<td>60.00%</td>
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# Content

## Module 1: INTRODUCTION TO THE HYDRAULIC SYSTEMS

### Description:
- 1.1. Energy transfer systems (STE)
- 1.2. STE by fluids (STEF)
- 1.3. Fluid (types, classification, properties, etc.)
- 1.4. Pros and cons of the STEF

### Related activities:
- A - Autotests
- C1 - Controls
- E - Application Exercises
- EP1 - First exam

### Learning time:
- 18h 30m
  - Theory classes: 6h
  - Laboratory classes: 2h
  - Self study: 10h 30m

## Module 2: COMPONENTS OF A STEF

### Description:
- 2.1. Conceptual scheme of a STEF
- 2.2. Pumps
- 2.3. Actuators: rotary and linear motors (cylinders)
- 2.4. Control elements (valves)
- 2.5. Fluid conditioning elements

### Related activities:
- A - Autotests
- C1 - Controls
- E - Application Exercises
- EP1 - First exam

### Learning time:
- 40h
  - Theory classes: 10h
  - Laboratory classes: 6h
  - Self study: 24h
# Module 4: SERVO HYDRAULIC VALVES AND DRIVE

**Description:**
- 4.1. Control Type
- 4.2. Servo and proportional valves
- 4.3. Servo valves / hydraulic cylinder
- 4.4. Applications (spoiler control, etc.)

**Related activities:**
- A - Autotests
- C2 - Controls
- E - Application Exercises
- EP2 - Second exam

<table>
<thead>
<tr>
<th>Learning time: 38h</th>
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<tbody>
<tr>
<td>Theory classes: 10h</td>
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<tr>
<td>Laboratory classes: 4h</td>
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<tr>
<td>Self study: 24h</td>
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# Module 5: LANDING GEAR

**Description:**
- 5.1. Landing gears
- 5.2. Hydraulic / pneumatic systems
- 5.3. Design criteria

**Related activities:**
- A - Autotests
- C2 - Controls
- E - Application Exercises
- EP1 - First exam
- EP2 - Second exam

<table>
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<th>Learning time: 16h</th>
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<tbody>
<tr>
<td>Theory classes: 5h</td>
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<tr>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td>Self study: 9h</td>
</tr>
</tbody>
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## Planning of activities

| **T - THEORY LESSONS** | **Hours:** 44h  
Theory classes: 25h  
Self study: 19h |
|------------------------|------------------|

| **ACTIVITY 1: A - AUTOTESTS** | **Hours:** 18h  
Self study: 18h |
|-------------------------------|------------------|

**Description:**
Evaluable autotests of 60 minutes to make as individual self-learning.

**Support materials:**
Questionnaires in ATENEA

**Descriptions of the assignments due and their relation to the assessment:**
Activity assessable where the note is within 10% of the rating system of the subject.

**Specific objectives:**
Acquiring the ability to know, understand and apply knowledge of the basic principles of the modules / topics, individual work and time management.

| **ACTIVITY 2: C1 - CONTROL** | **Hours:** 4h  
Theory classes: 1h  
Self study: 3h |
|-------------------------------|------------------|

**Description:**
Controls multiple choice evaluable 45 minutes to hours of theory and / or Individual problems where in groups of 2 people.

**Support materials:**
Formula sheet done by the students themselves on one side of A4 paper.

**Descriptions of the assignments due and their relation to the assessment:**
Activity assessable where the note is within 10% of the rating system of the subject.

**Specific objectives:**
Acquiring the ability to know, understand and apply knowledge of the basic principles of the modules / topics, individual or team work and time management. Upon completion of this activity, the student should be able to:
- Demonstrate the achievement of specific objectives related to the content of modules 1, 2 and 3

| **ACTIVITY 3: C2 - CONTROL** | **Hours:** 4h  
Theory classes: 1h  
Self study: 3h |
|-------------------------------|------------------|

**Description:**
Controls multiple choice evaluable 45 minutes to hours of theory and / or Individual problems where in groups of 2 people.

**Support materials:**
Formula sheet done by the students themselves on one side of A4 paper.
### ACTIVITY 4: E - APPLICATION EXERCISES

**Hours:** 24h  
Laboratory classes: 14h  
Self study: 10h

**Description:**  
Application exercises (example of application), summaries of reading articles, book chapters, book report, summary of attendance at seminars and / or conferences. proposed by the / the teacher / s.

**Support materials:**  
Collection of problems of the subject hanging in ATHENA. It can also be considered supplemental material.

**Specific objectives:**  
Acquiring the ability to know, understand and apply knowledge of the basic principles of the modules / topics, individual or team work and time management. Upon completion of this activity, the student should be able to:  
- Demonstrate the achievement of specific objectives related to the content of modules 4 and 5

### ACTIVITY 5: EP - FIRST EXAM

**Hours:** 8h 30m  
Theory classes: 2h  
Self study: 6h 30m

**Description:**  
Exam to do individually.

**Support materials:**  
Formula sheet used in controls.

**Descriptions of the assignments due and their relation to the assessment:**  
The test is 30% of the final grade and will be the date, time and scheduled classroom. Deliver the final test time devoted to the activity.

**Specific objectives:**  
Upon completion of this activity, the student should be able to:  
- Demonstrate the achievement of specific objectives related to the content of modules 1, 2 and 4

### EF - SECOND EXAM

**Hours:** 10h  
Theory classes: 2h  
Self study: 8h
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**Description:**
Exam to do individually.

**Support materials:**
Formula sheet used in controls.

**Descriptions of the assignments due and their relation to the assessment:**
The test is 30% of the final grade and will be the date, time and scheduled classroom. Deliver the final test time devoted to the activity.

**Specific objectives:**
Upon completion of this activity, the student should be able to:
- Demonstrate the achievement of specific objectives related to the content of modules 1, 2, 3 and 4.

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**Qualification system**

- 1st Evaluation: midterm exam, weight: 30% (with the possibility of recovery test midterm)
- 2nd Evaluation: final exam, weight: 30%
- Controls (Type test hours of class theory and / or problems): 20%
- Autotests (type self-test individual)): 10%
- Practical exercises (proposed real applications, reading articles, chapters reading books, attending seminars and / or conferences, etc.): 10%

**Regulations for carrying out activities**

Individual autotests as independent learning.
Controls are multiple choice and will individually or in pairs with an approximate duration of 45 minutes. A formula sheet can be handmade form by students.
The exams consist of two exercises lasting approximately two hours.
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Bibliography

Basic:


Complementary:


Others resources: