

Course guide

220034 - SH - Hydraulic Systems

Last modified: 02/04/2024

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 729 - MF - Department of Fluid Mechanics.

Degree: BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 4.5 **Languages:** Catalan

LECTURER

Coordinating lecturer: 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:

CE24. Adequate and applied knowledge in engineering: aircraft systems and automatic flight control systems for aerospace vehicles. (Specific technology module: Aircraft).

Transversal:

07 AAT N3. 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.

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.

STUDY LOAD

Type	Hours	Percentage
Hours small group	14,0	12.44
Self study	67,5	60.00
Hours large group	31,0	27.56

Total learning time: 112.5 h

CONTENTS

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

Full-or-part-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

Full-or-part-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

Full-or-part-time: 38h

Theory classes: 10h
Laboratory classes: 4h
Self study : 24h

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

Full-or-part-time: 16h

Theory classes: 5h
Laboratory classes: 2h
Self study : 9h

ACTIVITIES

T - THEORY LESSONS

Full-or-part-time: 44h

Self study: 19h

Theory classes: 25h

ACTIVITY 1: A - AUTOTESTS

Description:

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

Specific objectives:

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

Material:

Questionnaires in ATENEA

Delivery:

Activity assessable where the note is within 10% of the rating system of the subject.

Full-or-part-time: 18h

Self study: 18h

ACTIVITY 2: C1 - CONTROL

Description:

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

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

Material:

Formula sheet done by the students themselves on one side of A4 paper.

Delivery:

Activity assessable where the note is within 10% of the rating system of the subject.

Full-or-part-time: 4h

Self study: 3h

Theory classes: 1h

ACTIVITY 3: C2 - CONTROL

Description:

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

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

Material:

Formula sheet done by the students themselves on one side of A4 paper.

Delivery:

Activity assessable where the note is within 10% of the rating system of the subject.

Full-or-part-time: 4h

Self study: 3h

Theory classes: 1h

ACTIVITY 4: E - APPLICATION EXERCISES

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.

Specific objectives:

Promote the implementation of the contents of the subject.

Material:

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

Delivery:

Activity deliverable. A portion of the generated application exercises and others will be self-assessors note no note value. The part with note shall be within 10% of the rating system of the subject.

Full-or-part-time: 24h

Self study: 10h

Laboratory classes: 14h

ACTIVITY 5: EP - FIRST EXAM

Description:

Exam to do individually.

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

Material:

Formula sheet used in controls.

Delivery:

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.

Full-or-part-time: 8h 30m

Self study: 6h 30m

Theory classes: 2h



EF - SECOND EXAM

Description:

Exam to do individually.

Specific objectives:

Upon completion of this activity, the student should be able to:

- Demonstrate the achievement of specific objectives related to the content of moduls 1, 2, 3 and 4.

Material:

Formula sheet used in controls.

Delivery:

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.

Full-or-part-time: 10h

Self study: 8h

Theory classes: 2h

GRADING 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%

EXAMINATION RULES.

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.

BIBLIOGRAPHY

Basic:

- Cundiff, John S. Fluid power circuits and controls: fundamentals and applications [on line]. Boca Raton: CRC Press, 2002 [Consultation: 14/09/2022]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=263326>. ISBN 0849309247.
- Chapple, Peter. Principles of hydraulic system design. Oxford: Coxmoor, 2003. ISBN 1901892158.
- Ewald, R. [et al.]. The hydraulic trainer, vol. 2, Proportional and servo valve technology. Mannesmann Rexroth, 1986.
- Heras, Salvador de las. Fluidos, bombas e instalaciones hidráulicas [on line]. 2a ed. Barcelona: Iniciativa Digital Politècnica, 2018 [Consultation: 10/03/2023]. Available on: <http://hdl.handle.net/2117/127556>. ISBN 9788498807288.

Complementary:

- Tucker, Bill L. Aircraft fluid power systems. Casper, NY: Endeavor books, 1997. ISBN 9780965370653.
- Watton, John. Fundamentals of fluid power control [on line]. Cambridge: Cambridge University Press, 2009 [Consultation: 18/07/2024]. Available on: <https://www-cambridge-org.recursos.biblioteca.upc.edu/core/books/fundamentals-of-fluid-power-control/46CC3F0706DCC2FD0611A92D81EB7C9E>. ISBN 9780521762502.
- Heras, Salvador de las; Codina, Esteve. Modelización de sistemas fluidos mediante bondgraph. Terrassa: los autores, 1997. ISBN 8460570355.

- Heras, Salvador de las. Instalaciones neumáticas. Barcelona: UOC, 2003. ISBN 9788497880022.