

## [GJM101] THERMAL AND FLUID ENGINEERING

### GENERAL INFORMATION

<b>Studies</b>	DEGREE IN MECHATRONICS ENGINEERING		<b>Subject</b> ?
<b>Semester</b>	2	<b>Course</b>	3
<b>Character</b>	COMPULSORY		<b>Mention / Field of specialisation</b>
<b>Plan</b>	2020	<b>Modality</b>	Adapted Face-to-face
<b>Credits</b>	3	<b>Hours/week</b>	2.5
		<b>Language</b>	ENGLISH
		<b>Total hours</b>	45 class hours + 30 non-class hours = <b>75 total hours</b>

### PROFESSORS

BIZKARRA LANGARA, KEPA

### REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
PHYSICS I PHYSICS II CALCULUS I MATHEMATICS APPLIED TO ENGINEERING	(No previous knowledge required)

### SKILLS

#### VERIFICA SKILLS

##### SPECIFIC

**GJCE13** - Knowledge and ability to apply the basic principles of fluid mechanics and thermodynamics applied to the resolution of engineering problems.

##### BASIC

**G\_CB2** - To be able to apply knowledge to occupational or professional tasks; have the necessary skills to pose and defend arguments, and to solve problems within their field of study

**G\_CB5** - To have developed learning abilities required to embark on subsequent studies with a high level of autonomy.

### LEARNING RESULTS

**RG301** They assume responsibilities in the team, organizing and planning the tasks to be developed, dealing with contingencies and encouraging the participation of its members.

#### LEARNING ACTIVITIES

	CH	NCH	TH
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	1 h.	1 h.	2 h.

#### EVALUATION SYSTEM

	W
Self-assessment	30%
Co-assessment	35%
Observation (technical capacity, attitude and participation)	35%

#### MAKE-UP MECHANISMS

(No mechanisms)  
**Comments:** Continuous assessment. Retake is not foreseen.

**CH - Class hours:** 1 h.

**NCH - Non-class hours:** 1 h.

**TH - Total hours:** 2 h.

**RG302** They analyze the variables involved in the problem and propose actions for a stable situation.

#### LEARNING ACTIVITIES

	CH	NCH	TH
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	1 h.	1 h.	2 h.

#### EVALUATION SYSTEM

	W
Observation (technical capacity, attitude and participation)	100%

#### MAKE-UP MECHANISMS

(No mechanisms)  
**Comments:** Continuous assessment. Retake is not foreseen.

**CH - Class hours:** 1 h.  
**NCH - Non-class hours:** 1 h.  
**TH - Total hours:** 2 h.

**RG304** They define the problem, the development of the solution, as well as the conclusions in an effective way, arguing and justifying each of them, making a correct use of the language, in writing.

**LEARNING ACTIVITIES**

Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams

**CH**

2 h.

**NCH**

1 h.

**TH**

3 h.

**EVALUATION SYSTEM**

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

**W**

100%

**MAKE-UP MECHANISMS**

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

**Comments:** Revision and correction of the written report of the semester project

**CH - Class hours:** 2 h.  
**NCH - Non-class hours:** 1 h.  
**TH - Total hours:** 3 h.

**RG305** They define the problem, the development of the solution, as well as the conclusions in an effective way, arguing and justifying each one of them, and making a correct use of the language, orally.

**LEARNING ACTIVITIES**

Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams

**CH**

2 h.

**NCH**

1 h.

**TH**

3 h.

**EVALUATION SYSTEM**

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems

**W**

100%

**MAKE-UP MECHANISMS**

(No mechanisms)

**Comments:** Continuous assessment. Retake is not foreseen.

**CH - Class hours:** 2 h.  
**NCH - Non-class hours:** 1 h.  
**TH - Total hours:** 3 h.

**RGJ3316** They identify the properties of fluids, their hydrostatic and hydrodynamic behaviour and apply the basic concepts and main equations to analyse fluid systems

**LEARNING ACTIVITIES**

Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams

**CH**

4 h.

**NCH**

3 h.

**TH**

7 h.

Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints

2,5 h.

3 h.

5,5 h.

Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects

10 h.

5 h.

15 h.

**EVALUATION SYSTEM**

Presentation and defence of exercises, case studies, computer practical work, simulation practical work,

**W**

15%

**MAKE-UP MECHANISMS**

Individual written and/or oral tests or individual coding/programming tests

laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems  
 Individual written and/or oral tests or individual coding/programming tests 85%

**Comments:** If a retake exam is needed, the final mark will be obtained 25% first mark 75% second one

**CH - Class hours:** 16,5 h.  
**NCH - Non-class hours:** 11 h.  
**TH - Total hours:** 27,5 h.

**RGJ3317** They examine heat transfer by convection, conduction and radiation in addition to sizing heat transfer components between fluids

**LEARNING ACTIVITIES**

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	3,5 h.	3,5 h.	7 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2,5 h.	3 h.	5,5 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	10 h.	5 h.	15 h.

**EVALUATION SYSTEM**

	<i>W</i>
Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems	15%
Individual written and/or oral tests or individual coding/programming tests	85%

**MAKE-UP MECHANISMS**

Individual written and/or oral tests or individual coding/programming tests  
**Comments:** If a retake exam is needed, the final mark will be obtained 25% first mark 75% second one

**CH - Class hours:** 16 h.  
**NCH - Non-class hours:** 11,5 h.  
**TH - Total hours:** 27,5 h.

**RGJ3318** They design and size fluid and heat transfer systems

**LEARNING ACTIVITIES**

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	1,5 h.	1 h.	2,5 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	1 h.	1,5 h.	2,5 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	4 h.	1 h.	5 h.

**EVALUATION SYSTEM**

	<i>W</i>
Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems	15%
Individual written and/or oral tests or individual coding/programming tests	85%

**MAKE-UP MECHANISMS**

Individual written and/or oral tests or individual coding/programming tests  
**Comments:** If a retake exam is needed, the final mark will be obtained 25% first mark 75% second one

**CH - Class hours:** 6,5 h.  
**NCH - Non-class hours:** 3,5 h.  
**TH - Total hours:** 10 h.

**CONTENTS**

## 1.-FLUID PROPERTIES

1.1.- Basics concepts and definition

1.2.- Properties of the fluid

## 2.- HYDROSTATIC

2.1.- Basics concepts and definition

2.2.- Pressure measurements

2.3.- Pascal's law

2.4.- Static forces acting on submerged surface

## 3.- HYDRODYNAMICS

3.1.- Basic concepts

3.2.- Conservation of Mass

3.3.- Conservation of Momentum

3.4.- Conservation of Energy (Bernoulli's principle)

## 4.- VISCOUS FLOW

4.1.- Load loss

4.2.- Reynold's experiment

4.3.- Poiseuille's equation

4.4.- Darcy-Weisbach equation. General concepts

4.5.- Localized load loss

4.6.- Union of pipes

## 5.-HEAT TRANSFER MECHANISMS

5.1.-Conduction

5.2.-Convection

5.3.-Radiation

6.-FINS (extended surfaces)

## 7.-CONVECTION IN PLATES AND PIPES

7.1-Determination of the film coefficient

## 8.-HEAT EXCHANGERS DESIGN

### LEARNING RESOURCES AND BIBLIOGRAPHY

#### Learning resources

Moodle Platform  
Subject notes

#### Bibliography

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A heat transfer textbook, John H. Lienhard IV and John H. Lienhard V, third edition, Cambridge MA, Phlogiston Press, 2004.

Heat Transfer A Practical Approach, Cengel, Yunus A and Cengel, Yunus, McGraw Hill Professional, 2003.

Fundamentals of heat and mass transfer, Incropera Frank, Dewitt David, Bergman Theodore, Lavine Adrienne, sixth edition, 2011

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