

## SUBJECT TEACHING GUIDE

### G1081 - Thermodynamics and Fluids Mechanics

#### Degree in Marine Engineering

Academic year 2023-2024

| 1. IDENTIFYING DATA              |  |                  |                    |                  |                    |
|----------------------------------|--|------------------|--------------------|------------------|--------------------|
| Degree                           | Degree in Marine Engineering                     |                  |                    | Type and Year    | Compulsory. Year 2 |
| Faculty                          | School of Maritime Engineering                   |                  |                    |                  |                    |
| Discipline                       | Subject Area: Thermodynamics and Fluid Mechanics |                  |                    |                  |                    |
| Course unit title and code       | G1081 - Thermodynamics and Fluids Mechanics      |                  |                    |                  |                    |
| Number of ECTS credits allocated | 6  | Term             | Semester based (2) |                  |                    |
| Web                              |  |                  |                    |                  |                    |
| Language of instruction          | Spanish  | English Friendly | No                 | Mode of delivery | Face-to-face       |

|                  |  |  |  |  |  |
|------------------|--|--|--|--|--|
| Department       | DPTO. INGENIERIA ELECTRICA Y ENERGETICA        |  |  |  |  |
| Name of lecturer | CARLOS JAVIER RENEDO ESTEBANEZ                 |  |  |  |  |
| E-mail           | carlos.renedo@unican.es                        |  |  |  |  |
| Office           | E.T.S. de Náutica. Planta: + 2. DESPACHO (236) |  |  |  |  |
| Other lecturers  |  |  |  |  |  |

### 3.1 LEARNING OUTCOMES

- Know how to solve Thermodynamics problems
- Know how to solve problems of Fluid Mechanics

#### DEGREE IN MARINE ENGINEERING

Operate the main and auxiliary machinery and the corresponding control systems in accordance with Rule III / 1 of the SCTW Convention as amended

Plan and schedule operations in accordance with Rule III / 2 of the SCTW Convention as amended

Manage the operation of hydraulic and pneumatic equipment (pumps and compressors) controlled electrically and electronically in accordance with Rule III / 2 of the SCTW Convention as amended

#### 4. OBJECTIVES

Get knowledge of thermodynamics and fluid mechanics, for application to the resolution of practical cases.

Knowing the behavior of fluids and apply it to solve practical cases

Knowledge of the behavior of fluid flow and design methods of ducts and pipes

Knowing the basis of the principles of the behavior of hydraulic machines

Be able to analyze the behavior of the basic power and cooling cycles

##### DEGREE IN MARINE ENGINEERING

(TABLES OF CORRESPONDENCE WITH RULE III / 1 OF THE STCW)

Know the basic construction and operating principles of the machine systems, including: other auxiliary machinery, including different pumps, air compressors, purifiers, fresh water generators, heat exchangers and cooling systems

Know the basic construction and operating principles of machine systems

(TABLES OF CORRESPONDENCE WITH RULE III / 2 OF THE STCW)

Know and apply the theoretical principles of Thermodynamics

Know the theoretical principles to perform the control of power generating machines in hydraulic and pneumatic systems

#### 6. COURSE ORGANIZATION

##### CONTENTS

|     |   |
|-----|---|
| 1   | SUBJECT PRESENTATION  |
| 2   | FLUID MECHANICS   |
| 2.1 | Introduction to Fluid Mechanics   |
| 2.2 | Fluid Statics   |
| 2.3 | Fluid Dynamics  |
| 2.4 | Fluid Flow in Pipes   |
| 2.5 | Water hammer and cavitation   |
| 2.6 | Introduction to Hydraulic Machines  |
| 2.7 | Fluid mechanics Lab: Practice 1: viscosity test (Haake VT550 rotational viscometer). Practice 2: Test of a venturi (Lab test Bank ). Practice 3: Test of losses in pipes and fittings (Lab test Bank). Practice 4: Exploded hydraulic machines. Practice 5: Test couplings centrifugal pumps (Bank test lab )                 |
| 3   | THERMODYNAMICS  |
| 3.1 | Basics concepts   |
| 3.2 | First law of thermodynamics   |
| 3.3 | Second law of thermodynamics  |
| 3.4 | State functions   |
| 3.5 | Power Cycles  |
| 3.6 | Refrigeration Cycles  |
| 3.7 | Psychrometry  |
| 3.8 | Thermodynamics Lab. Practice 1: Simulation of Thermodynamic properties (ProAgua and ProGases Programs). Practice 2: Simulation of Power Cycles (ProAgua and ProGases Programs). Practice 3: Simulation of refrigeration cycles (ISCOOL / DUPREX Program). Practice 4: Simulation of properties of moist air (Psychro Program) |

### 7. ASSESSMENT METHODS AND CRITERIA

| Description  | Type         | Final Eval. | Reassessn | %      |
|--------------|--------------|-------------|-----------|--------|
| Exam 1       | Written exam | No          | Yes       | 15,00  |
| Exam 2       | Written exam | No          | Yes       | 15,00  |
| Exam 3       | Written exam | No          | Yes       | 15,00  |
| Exam 4       | Written exam | No          | Yes       | 15,00  |
| Exam 5       | Written exam | No          | Yes       | 15,00  |
| Exam 6       | Written exam | No          | Yes       | 15,00  |
| Lab report   | Work         | No          | Yes       | 10,00  |
| TOTAL        |              |             |           | 100,00 |
| Observations |              |             |           |        |

This subject is taught in Spanish.

The continuous evaluation through Partial Exams requires a minimum attendance of 60 of the 78 contact hours of the subject (classroom, laboratory, tutorials and evaluation) of which at least 50 must be in the classroom and laboratory; This assistance must have a positive attitude (exclusive attention throughout the class; the use of mobile phones is expressly prohibited during the course of the classes).

The score in the final grade of the 6 Partial Exams is (90%, 1.5 points / control): 1.5 points if the exercise grade > 80%; 1.1 point if the grade for the exercise is > 60%; 0.65 pts if the grade for the exercise is > 30%; 0 points if the grade for the exercise is < 30%.

Students who do NOT opt for the continuous assessment modality, or who have not reached the minimum attendance requirement required for the continuous assessment, will be assessed the knowledge acquired in the entire subject (theory, problems and laboratory practices) in the exam of the ordinary call.

In the exams of the ordinary and extraordinary calls the students will be evaluated of the entire subject, and will consist of:

Fluid Mechanics Problems (2.9 pts)

Thermodynamic Problems (2.9 pts)

Fluid Mechanics Theory (1.6 pts)

Thermodynamic Theory (1.6 pts)

A test on Laboratory knowledge (1 points), the student can choose to take this part of the final exam, or to keep the mark of the laboratory practice reports made and delivered.

In none of the exams of the subject is the use of programmable calculators or electronic devices that allow communication established.

The exams will provide the tables, diagrams or graphs necessary to solve the problems.

When taking the partial exams, students can write down on the classroom blackboard as many formulas, diagrams, tests, ... as they consider necessary (exercises cannot be written down).

For the ordinary and extraordinary exams, students can deliver to the responsible teacher, with at least 3 days in advance, two individual chuleterios that may include formulas, diagrams, ctes, ... (exercises cannot be written down). The extension of each of them is up to 2 sheets; the first can be used in the part of thermodynamic exercises, and the second in the part of fluid mechanics exercises.

IT IS EXPECTED THAT, IN THE EVENT THAT THE SOCIAL DISTANCE MEASURES ESTABLISHED BY THE SANITARY AUTHORITIES DO NOT ALLOW THE WRITTEN EXAMS (PARTIAL AND / OR THE END OF RECOVERY) TO BE DEVELOPED, THE EVALUATION WILL BE PERFORMED:

A) AN EXAMINATION THROUGH MOODLE FOR THE PART CORRESPONDING TO MECHANICS OF FLUIDS (ALWAYS AND WHEN PARTIAL EXAMS 1, 2 AND 3 HAVE NOT BEEN DEVELOPED NORMALLY). IN THIS PLATFORM THE SPECIFIC CONDITIONS OF REALIZATION WITH THE SUFFICIENT ADVANCE WILL BE EXPLAINED. YOUR WEIGHT ON THE FINAL NOTE WILL BE 45%.

B) AN EXAMINATION THROUGH MOODLE FOR THE PART CORRESPONDING TO THERMODYNAMICS (ALWAYS AND WHEN PARTIAL EXAMS 4, 5 AND 6 HAVE NOT BEEN DEVELOPED NORMALLY). IN THIS PLATFORM THE SPECIFIC CONDITIONS OF REALIZATION WITH THE SUFFICIENT ADVANCE WILL BE EXPLAINED. YOUR WEIGHT ON THE FINAL NOTE WILL BE 45%.

C) A LABORATORY PRACTICE EXAM (individually carried out) THROUGH MOODLE. IN THIS PLATFORM THE SPECIFIC CONDITIONS OF REALIZATION WITH THE SUFFICIENT ADVANCE WILL BE EXPLAINED. YOUR WEIGHT ON THE FINAL NOTE WILL BE 10%.

D) DEPENDING ON THE CIRCUMSTANCES OF EXCEPTIONALITY, PREVIOUS EXAMS MAY BE HELD ON THE SAME DAY, OR ON DIFFERENT DAYS.

E) WHEN THE EVALUATION PROCESS IS CONDUCTED THROUGH MOODLE, STUDENTS WILL NEED TO HAVE:

INTERNET CONNECTION, COMPUTER AND SCANNER OR PHOTO CAMERA.

Observations for part-time students

They are evaluated under the same conditions as full-time students.

## 8. BIBLIOGRAPHY AND TEACHING MATERIALS

### BASIC

Transparencias utilizadas por el profesor para la impartición de la asignatura

Moodle de la asignatura

Mecánica de Fluidos y Máquinas Hidráulicas; Claudio Mataix; Ed. Oxford, 2001

Termodinámica Lógica y Motores Térmicos; Agüera Soriano, J.; Ed Ciencia 3, S.A.

Problemas Resueltos. Termodinámica Lógica y Motores Térmicos; Agüera, J; Ed Ciencia 3, S.A., 1999

Termodinámica para Ingenieros; Potter, M, Somerton C; Ed MCGrawHill, 2004

DTIE 3.01: PSICROMETRIA, Jose Manuel Pinazo Ojer y Arcadio Garcia Lastra, Ed ATECYR, 2009