Universidad Europea

1. BASIC INFORMATION

Course	Thermodynamics and propulsion
Degree program	Degree in Aerospace Engineering of aircrafts
School	Arquitectura, Ingeniería y Diseño
Year	Third
ECTS	6
Credit type	Compulsory
Language(s)	English
Delivery mode	Face to face
Semester	First
Academic year	2019-20
Coordinating professor	Jose Omar Martinez Lucci

2. PRESENTATION

This course belongs to the "Motopropulsion I" module:

- Thermodynamics and Propulsion 6 ECTS (second year)
- Fluid Mechanics I 6 ECTS (second year)

This course is an introduction to the principles of Thermodynamic. The course develops an intuitive understanding of thermodynamics by focusing on physical explanation

In the Thermodynamics and Propulsion, the following topics are covered: First and second law of thermodynamics, entropy, exergy, internal combustion engine, turbojet, turboprop and turbofan.

The subject of thermodynamics and propulsion is offered on the second academic year and is the basis for acquiring knowledge for advanced aeronautical engineering courses. In order to provide adequate training to the existing and predicting demand of this professional area, the student will participate in different phases of a research and real projects that different professor of UME have been developed in the field of thermodynamics and business management. This subject is a great value for the field of aeronautical propulsion. Aeronautical engineers can apply the knowledge of thermodynamics in designing aircraft engines.

The objectives of the course are:

1, To understand the principles of thermodynamics, first, second and third law governing the thermodynamics and its application in power plants.

2, To understand in an aircraft propulsion systems. –

3, To know the theory of conservation of mass and energy to the volume control, which are applied in cases of turbines, compressors, nozzles, diffusers and pumps. –

4, To know the property of entropy and its use for the analysis of thermodynamics in systems. Also know the property of exergy and its use in thermodynamics in systems. –

5, to understand the thermodynamic model of internal combustion engines, gas turbine power plants. –

6. To learn the basic procedures for the design of air-reactors and turbines to gas –

7 To know the space environment, and being able to analyze the heat exchange in the design of satellites.

3. COMPETENCIES AND LEARNING OUTCOMES

Core competencies:

- CB1: That students have demonstrated knowledge and understanding in a field of study that part of the basis of general secondary education, and is usually found at a level that, while supported by advanced textbooks, includes some aspects that will knowledge of the forefront of their field of study
- CB3: That students have the ability to gather and interpret relevant data (usually within their field of study) to make judgments that include reflection on relevant social, scientific or ethical
- CB5: That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy

Cross-curricular competencies:

- CT12 (N2): Knowledge of basic subjects and technologies, enabling the student to learn new methods, theories and technologies, and endowed it with great versatility to adapt to new situations (autonomous learning).
- CT16 (N3): To communicate and convey information, ideas and skills in the student's field of specialization, either in writing or orally, both to skilled and unskilled audiences (communication skills).
- CT18 (N2): Commit to the fulfillment of the tasks (Responsibility).

Specific competencies:

- CE8: To understand thermodynamics cycles for mechanic power generation and thrust

- CE19: Applied knowledge of: the science and technology of materials, mechanics and thermodynamics, fluid mechanics, aerodynamics and flight mechanics, navigation and air traffic, aerospace technology, theory of structures, air transport, economy and production projects; impact on environment.

  Notes: UNIQUE LEVEL: Competence developed at one level. Level 1 (N1): awareness about the importance of competences and basic application of it to several situations. Level 2(N2): interiorization and skillful handling of competences. Level 3 (N3): Full interiorization and handling of competences at any needed situation.

Learning outcomes:

- LO20. To conduct studies by integrating the technologies and engineering procedures which are developed in the competencies of this modules
- LO21. From a series of requirements, and prior information, to conceptualize an engineering problem, proposes an approach to solve it, and obtain the better solution. All this related to the competencies of this module
- LO22. To transfer some parts of an engineering problem to the laboratory, and utilize this resource as support to resolve it.

The table below shows the relation between the competencies developed during the course and the envisaged learning outcomes:

Competencies	Learning outcomes
CB1, CT16(N3), CE8	LO20. To conduct studies by integrating the technologies and engineering procedures which are developed in the competencies of this modules
CB3, CB5, CT12(N2), CT16(N3), CE8, CE19	LO21. From a series of requirements, and prior information, to conceptualize an engineering problem, proposes an approach to solve it, and obtain the better solution. All this related to the competencies of this module
CB3, CT12(N2), CT18(N2), CE8	LO22. To transfer some parts of an engineering problem to the laboratory, and utilize this resource as support to resolve it.

4. CONTENT

- Principles of thermodynamics and its application to control volume.
- Behavior and analysis of the gas volumes. Thermodynamic potentials. General thermodynamic relationships.
- Equilibrium systems. Transitions of phase

- Maintenance and selection of power plants
- Fundamentals of design of aeroreactors and gas turbines
- Problem resolution of utilization, selection and performance
- Application to the design of satellites (thermal Control and heat transfer)

5. TEACHING-LEARNING METHODOLOGIES

The types of teaching-learning methodologies used are indicated below:

- Lecture-based class
- Integration of team work
- Self-study
- Mentoring, academic monitoring and assessment

6. LEARNING ACTIVITIES

Listed below are the types of learning activities and the number of hours the student will spend on each one:

Campus-based mode:

Type of educational activity	Number of hours
Lecture-based class	20 h
Integration of team work	60 h
Self-study	50 h
Mentoring, academic monitoring and assessment	20 h
TOTAL	**150 h**

7. ASSESSMENT

Listed below are the assessment systems used and the weight each one carries towards the final course grade:

Assessment criteria	Weight (%)
• 1. Exam, test and other type of assessment.	30%-35%
• 2. Reports, articles and informs.	15%-30%
• 3. Alternative system of assessment.	15%-30%
• 4. Conferences, company-tour visit and experiences in situ	10%-10%
• 6. Transversal skills (rubric)	10%-15%

When you access the course on the *Campus Virtual*, you'll find a description of the assessment activities you have to complete, as well as the delivery deadline and assessment procedure for each one.

7.1. First exam period

- Exams, tests and other test and alternative techniques of assessment 35%
- Writing of articles, reports and project and Transversal skills 35% of the final grade
- Homework 30% of the final grade

To pass the course in the first exam period, you must obtain a final course grade of at least 5 out of 10 (weighted average). Minimums needed to pass:

- To obtain 5 points over 10 points of the final exam.
- To obtain 5 points over 10 points of the final project.
- To obtain 5 points over 10 points of the homework.
- In order to be evaluated you must have a minimum of 50% attendance (ATTENDANCE IS VALID ONLY REGISTERED IN THE GRP SYSTEM)

The failed assignments, homework or lab reports during academic year can be submitted on extraordinary session. To pass the course, each assignment shall have, at least, five points out of ten and it is mandatory to pass all assignments, activities and exams. If the student fails or does not submit some activities these activities will not be considered for the average of the final grade.

In the case, when the student do not reached the minimum required to pass any evaluable activity. The final grade will be:

• The mean average when the mean value is less than or equal to 4

• 4 if the value of the mean average is greater than 4

The grade will be considered as NP (Not Presented) when the student has not delivered any evaluable activity of which they are part of the weighted average.

7.2. Second exam period

Assessment activities:

- Realization of different tasks, problems and practical exercises, individually 20%
- Realization of laboratory practices and report 10%
- Realization of a project 20%
- Oral presentations presentation of the project 15%.
- Final exam 35%

To pass the course in the second exam period, you must obtain a final grade of at least 5 out of 10 (weighted average).

In the case, when the student do not reached the minimum required to pass any evaluable activity. The final grade will be:

• The mean average when the mean value is less than or equal to 4

- 4 if the value of the mean average is greater than 4

The grade will be considered as NP (Not Presented) when the student has not delivered any evaluable activity of which they are part of the weighted average.

8. SCHEDULE

This table shows the delivery deadline for each assessable activity in the course:

Assessable activities	Deadline
Activity 1 .Self-study – Introduction to the thermodynamics and First law of thermodynamics	Week 3-4
Activity 2 Self-study - Definition of the substance properties and application, second law of the thermodynamics.	Week 6-7
Activity 3 Self-study- Power plants and heat transfer	Week 9-10
Activity 4 Integration of team work and Mentoring, academic monitoring and assessment - laboratories and team project	Week 13
Activity 5 Final exam	Last week

This schedule may be subject to changes for logistical reasons relating to the activities. The student will be notified of any change as and when appropriate.

9. BIBLIOGRAPHY

- Fundamentals of Engineering Thermodynamics, Michael Moran, Howard Shapiro. 6th edition, editorial Wiley, 2007
- Mechanics and Thermodynamics of Propulsion, Philip Hill, Carl Peterson. 2nd edition, Edison Wesley, 1992

10. DIVERSITY MANAGEMENT UNIT

Students with specific learning support needs:

Curricular adaptations and adjustments for students with specific learning support needs, in order to guarantee equal opportunities, will be overseen by the Diversity Management Unit (UAD: Unidad de Atención a la Diversidad).

It is compulsory for this Unit to issue a curricular adaptation/adjustment report, and therefore students with specific learning support needs should contact the Unit at unidad.diversidad@universidadeuropea.es at the beginning of each semester.