1. BASIC INFORMATION

Course	Thermodynamics and Heat transfer
Degree program	Degree in Aerospace Engineering of aircrafts
School	Arquitectura, Ingeniería y Diseño
Year	Second
ECTS	6
Credit type	Compulsory
Language(s)	English
Delivery mode	Face to face
Semester	First
Academic year	2025-26
Coordinating professor	Jose Omar Martinez Lucci

2. PRESENTATION

This course belongs to the “Motopropulsion I” module:

- Thermodynamics and Heat transfer 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, the following topics are covered: First and second law of thermodynamics, entropy, exergy, internal combustion engine and an introduction to heat transfer and its application to thermal control y satellites. The subject of thermodynamics 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 doing research and real projects in the field of thermodynamics. This subject is a great value for the field of aeronautical propulsion. Aeronautical engineers, in designing the aircraft engines or components of the engines, must apply the thermodynamics concepts.

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 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.

3.- 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.

4.- To understand the thermodynamic model of internal combustion engines, gas turbine power plants.

5.- To learn the basic mechanism of heat transfer.

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

3. KNOWLEDGE, SKILLS, AND COMPETENCES

Knowledge

CON06 CO02. Understanding the thermodynamic cycles generating mechanical power and thrust.

CON 19. Identify the 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).

Specific knowledge of the subject:

Describe the principles of thermodynamics and their application to control volumes.

Identify the behavior of gases, thermodynamic potentials, and generalized thermodynamic relationships.

Describe the equilibrium of systems and phase transitions.

Identify the basic principles of combustion.

HAB01 FB01. Ability to solve mathematical problems that may arise in engineering. Aptitude to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential and partial differential equations; numerical methods; numerical algorithms; statistics, and optimization.

Specific skills of the subject:

Conduct studies involving technologies and engineering procedures related to the competencies of this module.

Conceptualize an engineering problem, outline the approach to solving it, and find the optimal solution based on a set of requirements and previous information, all related to the competencies of this module.

Transfer parts of an engineering problem to the laboratory and use this resource as support for resolution.

Evaluate the maintenance and selection of power plants.

Evaluate heat transfer processes by conduction, radiation, and convection.

Evaluate heat transfer processes applied to satellite design (Thermal control)

CP03 CO13. Applied knowledge of: the science and technology of materials, mechanics and 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.

CP12. Generate new ideas and concepts from known ideas and concepts, reaching conclusions or solving problems, challenges, and situations in an original way in the academic and professional environment.

CP13. Convey messages (ideas, concepts, feelings, arguments), both orally and in writing, strategically aligning the interests of the various parties involved in communication in the academic and professional environment in the field of aerospace engineering.

CP14. Employ information and communication technologies for data search and analysis, research, communication, and learning in the field of aerospace engineering.

CP15. Influence others to guide and lead them towards specific objectives and goals, taking into consideration their viewpoints, especially in professional situations arising from the volatile, uncertain, complex, and ambiguous (VUCA) environments of the current world.

CP16. Collaborate with others in achieving a shared academic or professional objective, actively participating, demonstrating empathy, and practicing active listening and respect for all team members.

CP17. Integrate analysis with critical thinking in an evaluation process of different ideas or professional possibilities and their potential for error, relying on evidence and objective data that lead to effective and valid decision-making.

CP18. Adapt to adverse, unexpected situations that cause stress, whether personal or professional, overcoming them and even turning them into opportunities for positive change.

CP19. Demonstrate ethical behavior and social commitment in the performance of professional activities, as well as sensitivity to inequality and diversity.The table below shows the relation between the competencies developed during the course and the envisaged learning outcomes:

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.
- Introduction to combustion process.
- Introduction to heat transfer mechanism, conduction, convection and radiation.
- 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	USE of IA
Lecture-based class	20 h	Allowed
Integration of team work	60 h	Promoted
Self-study	50 h	Promoted
Mentoring, academic monitoring and assessment	18 h	Allowed
Assessment	2h	Not Allowed
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

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 does not reach the minimum grade to pass any evaluable activity. The final grade will be 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 does not reach the minimum grade to pass any evaluable activity. The final grade will be 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	USE of IA
Activity 1 .Self-study – Introduction to the	Week 3-4	promoted

thermodynamics and First law of thermodynamics		
Activity 2 Self-study - Definition of the substance properties and application, second law of the thermodynamics.	Week 6-7	Promoted
Activity 3 Self-study- Power plants and heat transfer	Week 9-10	Promoted
Activity 4 Integration of teamwork and Mentoring, academic monitoring and assessment - laboratories and team project	Week 13	Promoted
Activity 5 Final exam	Last week	No allowed

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
- Fundamentals in Heat and Mass Transfer, Frank P. Incropera 6th edition 2006,

10. EDUCATIONAL GUIDANCE AND DIVERSITY UNIT

From the Educational Guidance and Diversity Unit we offer support to our students throughout their university life to help them reach their academic achievements. Other main actions are the students inclusions with specific educational needs, universal accessibility on the different campuses of the university and equal opportunities.

From this unit we offer to our students:

1. Accompaniment and follow-up by means of counselling and personalized plans for students who need to improve their academic performance.
2. In terms of attention to diversity, non-significant curricular adjustments are made in terms of methodology and assessment for those students with specific educational needs, pursuing an equal opportunities for all students.
3. We offer students different extracurricular resources to develop different competences that will encourage their personal and professional development.
4. Vocational guidance through the provision of tools and counselling to students with vocational doubts or who believe they have made a mistake in their choice of degree.

Students in need of educational support can write to us at:
orientacioneducativa@universidadeuropea.es

11. ONLINE SURVEYS

Your opinion matters!

The Universidad Europea encourages you to participate in several surveys which help identify the strengths and areas we need to improve regarding professors, degree programs and the teaching-learning process.

The surveys will be made available in the “surveys” section in virtual campus or via e-mail.

Your assessment is necessary for us to improve.

Thank you very much for your participation.