1. BASIC INFORMATION

Course	Mechanics
Degree program	Grado en Ingeniería Aeroespacial en Aeronaves
School	Architecture, Engineering and Design
Year	2
ECTS	6 ECTS
Credit type	Compulsory
Language(s)	English and Spanish
Delivery mode	Campus Based
Semester	1
Academic year	2025 – 2026
Coordinating professor	José Manuel López López, PhD

2. PRESENTATION

This is a self-contained course about statics and dynamics for engineers. Nevertheless, many concepts discussed in the first-year courses of “Physical Foundations of Engineering I & II” are applied and extended here. The course is a suitable starting point for incoming subjects within the degree, such as "Aeronautical Structures" and "Flight Mechanics". The contents are also related with “Resistance and Elasticity of Material”, although in that case they are arranged in such a way that both courses can be taken at the same time.

"Mechanics" will be also useful for the student in a company environment; it will provide them a wide range of tools to develop design and engineering problems in an autonomous manner.

3. KNOWLEDGE, SKILLS, AND COMPETENCES

Knowledge

- **CON13 CO09** - Adequate knowledge applied to Engineering: The principles of continuum mechanics and techniques for calculating its response. Specific knowledge of the subject:
    - Identify the basic concepts of classical mechanics: postulates, kinematics, statics, mass geometry, and dynamics of solids.
    - Describe the principles of orbital mechanics (applied to satellite design).

Skills

- **HAB04** Use computer tools to search for bibliographic or information resources (Information Search). Specific skills of the subject:
    - Based on a set of requirements and previous information, conceptualize an engineering problem, outline the approach to solving it, and find the optimal solution. All of this is relative to the competencies of this module.

- Transfer parts of an engineering problem to the laboratory and use this resource as support for resolution.
- Analyze the motion of material systems: Newtonian and Lagrangian formulation.

Competencies

- **CP03 CO13**. 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.

4. CONTENT

The contents are grouped into three parts for convenience. **Part I** and **Part II** comprise the core of the course: these are the contents covered by tests, exams and problem-solving sessions. **Part III**, on the other hand, deals with applications and additional topics which are more suitable to be covered mainly in flipped-classroom activities, masterclasses and seminars, reinforcing the autonomous work of students.

Part I: Statics

a. Introduction: Postulates and Statics of a Point Particle
b. Equivalent Systems of Forces
c. Equilibrium of Rigid Solids: reactions at connections and supports

Part II: Dynamics

a. Kinematics of a Point Particle
b. Kinetics of a Point Particle
c. Plane Kinematics of Solids
d. Plane Kinetics of Solids

Part III: Applications

a. Lagrangian Dynamics
b. Distributed Forces
c. Orbital Mechanics (applied to satellite design)

5. TEACHING-LEARNING METHODOLOGIES

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

- Survey of objectives and interests
- Master class
- Laboratory practices / computer simulations
- Group research or group problem solving
- Field experiences, conferences, visits to companies and institutions

6. LEARNING ACTIVITIES

The following table shows, for each learning activity: ***i*)** the total time the student will spend, ***ii*)** the time distribution between in-class and off-class time, and ***iii*)** the course policy about the use of artificial intelligence (AI) in that activity.

Learning activity	Total time	In-class Time	Use of AI
Lectures / masterclasses	30 hours	30 hours (100%)	Allowed
Laboratory / problem-solving workshops	12 hours	12 hours (100%)	Not Allowed
Group research and integrative group work	50 hours	18 hours (47%)	Assessed
Self-study	70 hours	0 hours (0%)	Promoted
TOTAL	**150 hours**	**60 hours (40%)**	

Further details about the AI-use policy will be published through the virtual campus platform once the course has started.

7. ASSESSMENT

Listed below are the assessment systems used, and the weights each one carries towards the course grade:

Assessment system	Weight
SE01 – Exams and objective tests	35%
SE02 – Articles, essays and reports	25%
SE03 – Peer-evaluation, auto-evaluation, portfolio production and other alternative assessment procedures	20%
SE04 – Off-class events, conferences and seminars (*)	10%
SE05 – Core/cross-curricular competences (performance)	10%

(*) If these activities could not be carried out, the corresponding weight would split evenly between systems SE02 and SE03.

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

To pass the course in the first exam period, you must meet **all of** the following requirements:

- Obtain a final grade (weighted average) of, at least, 5 out of 10.
- Obtain a mark, at least, of 4 out of 10 in the final exam.
- Comply with the minimum attendance regulations stablished by the STEAM School, whenever applicable.

In the event that **any** of the above requirements were not met, the final grade may not exceed 4.0 in a scale up to 10, failure.

7.2. Second exam period

To pass the course in the second exam period, you must meet **both of** the following requirements:

- Obtain a final grade (weighted average) of, at least, 5 out of 10.
- Obtain a mark, at least, of 4 out of 10 in the final exam.

In the event that **any** of the above requirements were not met, the final grade may not exceed 4.0 in a scale up to 10, failure.

The student must deliver the activities not successfully completed in the first exam period, or those that were not delivered in the first place. Further details will be given through virtual campus.

8. SCHEDULE

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

Assessable activities	Deadline (weeks)
AE01, AE02 – Solving-problem sessions [Part I] (**SE03**, **SE05**)	3rd to 7th
AE03, AE04 – Solving-problem sessions [Part II] (**SE03**, **SE05**)	8th to 15th
AE05 – Group project [Part III] (**SE02**, **SE05**)	16th to 17th
AE06 – Final exam (**SE01**)	17th or 18th
AE07 – Off-class events, conferences, seminars (**SE04**, **SE05**)	To be determined

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

The main reference handbooks for this subject are:

1. Beer F.P., Johnston E.R. & Mazurek D.F., "Vector Mechanics for Engineers: Statics" 12th ed. (2018), Ed. McGraw-Hill.
2. Beer F.P., Johnston E.R. & Cornwell P.J., "Vector Mechanics for Engineers: Dynamics" 12th ed. (2018), Ed. McGraw-Hill.
3. Meriam J.L. & Kraige L.G. "Engineering Mechanics. Statics", 9th ed. (2018), Ed. Wiley.
4. Meriam J.L. & Kraige L.G. "Engineering Mechanics. Dynamics", 9th ed. (2018), Ed. Wiley.

The recommended bibliography also includes:

5. Hibbeler R.C. "Engineering Mechanics. Statics", 14th ed. (2015), Ed. Pearson.
6. Hibbeler R.C. "Engineering Mechanics. Dynamics", 14th ed. (2015), Ed. Pearson.
7. Goldstein H., Poole C.P. & Safko J. "Classical Mechanics", 3rd ed. (2011), Ed. Pearson.
8. Marion J.B., "Classical Dynamics of Particles and Systems", 5th ed. (2003), Ed. Cengage Learning.

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.