

1. BASIC INFORMATION

Course	Space Vehicles and Missiles
Degree program	Degree in Aerospace Engineering of Aircraft
School	Architecture, Engineering and Design
Year	3
ECTS	6 ECTS
Credit type	Mandatory
Language(s)	English
Delivery mode	Face to face
Semester	First semester
Academic year	2023/2024
Coordinating professor	Julio Gallegos Alvarado

2. PRESENTATION

The course “Space Vehicles and Missiles” is a mandatory requirement in the learning plan for the degree in Aerospace and Aircraft Engineering at Universidad Europea de Madrid. This course belongs to the “Space Vehicles II” module:

- Aeronautic structures (third year)
- Aerodynamics (third year)
- Space Vehicles and Missiles (third year)
- Flight mechanics (third year)
- Maintenance and certification of Aerospace Vehicles (third year)
- Aircraft design (fourth year)
- Aeroelasticity and vibrations (fourth year)

The topics in the first part of the course are linked to subjects on the design considerations from environment, mission analysis and control of spacecrafts; the second part covers launch vehicles and missiles, covering the main characteristics relative to design, control and performance.

3. COMPETENCIES AND LEARNING OUTCOMES

Core competencies:

- CB2: That students can apply their knowledge to their work or vocation in a professional manner and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study.

Cross-curricular competencies:

- CT15: Compile and interpret data to make judgments that include relevant social, scientist, and ethical issues, taking fundamental rights respect into consideration, as well as the democratic principles, gender equality, solidarity, environment protection, universal accessibility and design for all, and culture of peace (consultancy).
- CT16: 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).

Specific competencies:

- CE24: Adequate knowledge and applied to Engineering of: aircraft systems, and automatic flight control systems of aerospace vehicles.
- CE25: Adequate knowledge and applied to Engineering of: Calculation methods Design and Program Management of aircraft; the use of experimental aerodynamics and the most significant parameters in the theoretical application; the management of experimental techniques, equipment and measuring instruments discipline; the simulation, design, analysis and interpretation of experimental and flight operations; the maintenance systems and certifications of aircraft.

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:

LO27: To design diverse parts and elements of aerospace vehicles.

The following table shows the relationship between the competencies developed during the course and the learning outcomes pursued:

Competencies	Learning outcomes
CB2, CT15, CT16, CE24, CE25	LO27

4. CONTENT

- Introduction to space vehicles
- Mission Analysis
- Space environment
- Astrodynamics
- Spacecraft systems engineering
- Launch Vehicles and Missiles

5. TEACHING-LEARNING METHODOLOGIES

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

- Survey of goals and interests of the students
- Master classes
- Laboratory practices
- Research and problem solving as teamwork
- Designs
- Simulation
- Practical cases study
- Field experiences, conferences, visits to companies and institutions

6. LEARNING ACTIVITIES

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

Learning activity	Number of hours
Lectures / masterclasses	20 hours
Integration of team work	60 hours
Self-study	50 hours
Mentoring, academic monitoring and assessment	20 hours
TOTAL	150 hours

7. ASSESSMENT

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

Assessment system	Weight
Exams, mid-term and end of term, 20% each	40%
Homeworks and SW development	20%
Project	40%

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 obtain a final course grade of at least 5 out of 10 (weighted average).

In any case, you will need to obtain a grade of at least 5.0 in the average of the mid-term and final exams for it to count towards the final grade along with all the grades corresponding to the other activities. You need to deliver the SW and HW projects at obtain at least 50% of the corresponding grade. Additionally, you must deliver at least 2 items of the homework.

Unjustified late deliveries will not receive credit. Justification shall be provided according to the University rules and procedures

7.2. Second exam period

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 any case, you will need to obtain a grade of at least 5.0 in the final exam for it to count towards the final grade along with all the grades corresponding to the other activities. The requirement of the minimum grades on the SW and HW are also applicable to the second exam period. Additionally, you must deliver any missing homework.

The student must deliver the activities not successfully completed in the first exam period after having received the corresponding corrections from the professor, or those that were not delivered in the first place. The activities that have a passing grade during the regular period, will be kept and added to the second exam period activities in the corresponding percentages to complement the grade.

8. SCHEDULE

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

Assessable activities	Deadline
Introduction to Space Vehicles	Week 1
Space environment	Week 2
Astroynamics – orbits in time	Week 3-4
Astroynamics – orbits in space	Week 5-6
Initial Orbit Determination	Week 7
Orbital Maneuvers	Week 8
Review and Mid-term Exam	Week 9
Interplanetary trajectories	Week 10
Spacecraft Systems Engineering	Week 11-12
Attitude Control	Week 13-14

Launch vehicles and missiles	Week 15-16
Final Project presentation	Week 17
Final exam	Week 18

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

Here is the recommended bibliography:

- Orbital Mechanics for Engineering Students, 3rd edition, Howard D. Curtis, Elsevier/BH, 2014
- Spacecraft Systems Engineering, 4th Edition, Peter Fortescue, Graham Swinerd, John Stark, Wiley 2011
- Space Mission Engineering, The New SMAD, Wertz, Everett, Puschell, Microcosm Press 2011
- Space Vehicle Design, 2nd Edition, Michael D. Griffin, James R. French, AIAA Education Series, 2004
- Spacecraft Dynamics & Control: A practical Engineering Approach, Marcel J. Sidi, Cambridge 2006 (reprint)
- Rocket Propulsion Elements, 7th Edition, George P. Sutton, Oscar Biblarz, John Wiley and Sons Inc., 2001
- Satellite Technology: Principles and Applications, 2nd Edition, Anil K. Maini, Varsha Agrawal, Wiley, 2011

10. DIVERSITY MANAGEMENT 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.