AEROSPACE ENGINEERING (LM52)

(Brindisi - Università degli Studi)

Teaching SPACECRAFT ARCHITECTURE AND SYSTEMS ENGINEERING

GenCod A008254

Owner professor Giulio CAMPITI

Teaching in italian SPACECRAFT ARCHITECTURE AND SYSTEMS

Teaching SPACECRAFT ARCHITECTURE AND SYSTEMS ENGINEERING

SSD code ING-IND/05

Reference course AEROSPACE ENGINEERING

Course type Laurea Magistrale

Credits 6.0

Teaching hours Front activity hours: 54.0

For enrolled in 2024/2025

Taught in 2024/2025

Course year 1

Language ENGLISH

Curriculum SPACE TECHNOLOGY

Location Brindisi

Semester First Semester

Exam type Oral

Assessment Final grade

Course timetable https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION

The course introduces students to the design and engineering of spacecraft, exploring both theoretical foundations and practical applications. It begins with an overview of space vehicles and their subsystems, including structural, thermal, and propulsion systems. Emphasis is placed on understanding the challenges posed by the space environment, such as radiation, microgravity, and thermal extremes.

The second part of the course focuses on systems engineering methodologies, covering the project life cycle, requirements analysis, system architecture, and trade studies. Students will learn to apply techniques such as functional analysis, interface management, and risk assessment to spacecraft design. Additionally, the course addresses cost estimation, technical reviews, and reliability verification.

Special attention is given to modern space architectures, including CubeSats and constellations, as well as mission analysis concepts, enabling students to plan and evaluate space missions effectively. A brief introduction to Mission Analysis is provided, including some case studies where specialized software are used to plan and evaluate space missions.

REQUIREMENTS

Fundamentals of mathematics, physics, and mechanics, as well as basic knowledge of aerospace engineering. Familiarity with programming and basic software tools is recommended but not mandatory.

COURSE AIMS	At the end of the course, the student is expected to be able to: 1. Understand the classification of space vehicles and their subsystems, and identify their roles in space missions; 2. Analyze the challenges posed by the space environment and their impact on spacecraft design and operation; 3. Apply systems engineering principles, including requirements definition, Concept of Operations (ConOps), functional analysis, and trade studies, to spacecraft design; 4. Assess spacecraft costs, risks, and technical performance, and understand the project life cycle phases;
TEACHING METHODOLOGY	The course is delivered through **standard class lectures**, where the teacher presents key concepts, methods, and models related to spacecraft architecture and systems engineering. Students are encouraged to actively participate through discussions and questions, fostering a deeper understanding of the topics presented. Examples and case studies are integrated into the lectures to connect theoretical concepts to real-world applications. Specific attention is given to illustrating the use of systems engineering methodologies through practical examples.
ASSESSMENT TYPE	Written or oral exam, depending on student preference
ASSESSMENT SESSIONS	Examination dates are scheduled in accordance with current University regulations. Specific dates will be published on the University website as they are announced
FULL SYLLABUS	Introduction to space vehicles The space environment Spacecraft subsystems Space Architectures Constellations Systems Engineering (SE): Introduction SE: Project life cycle SE: System architecture SE: Scope and ConOps SE: System hierarchy SE: Analytical Hierarchy Process SE: Requirements SE: Functional analysis, synthesis and design SE: Interfaces, margins and Technical Performance Measures SE: Costs and risks SE: TRL SE: Trade studies SE: Reliability and verification SE: Technical reviews SE: Schedule and management Introduction to Mission Analysis

REFERENCE TEXT BOOKS

- Fortescue P., Swinerd G., Stark J., Spacecraft Systems Engineering (Fourth Edition), Hoboken, N.J.: John Wiley & Sons, 2011
- NASA, NASA Systems Engineering Handbook (NASA/SP-2016-6105 Rev 2), Washington, D.C.: NASA, 2016
- Wertz J. R., Everett D. F., Puschell J. J. (Eds.) Space Mission Engineering: The New SMAD (vol. 28), Hawthorne, CA: Microcosm Press, 2011