

AEROSPACE ENGINEERING (LM52)

(Brindisi - Università degli Studi)

Teaching SYSTEMS AND DEVICES FOR SATELLITES C.I.

GenCod A005150

Owner professor Caterina CIMINELLI

Teaching in italian SYSTEMS AND DEVICES FOR SATELLITES C.I.

Teaching SYSTEMS AND DEVICES FOR SATELLITES C.I.

SSD code ING-INF/01

Reference course AEROSPACE ENGINEERING

Course type Laurea Magistrale

Credits 4.0

Teaching hours Front activity hours: 36.0

For enrolled in 2018/2019

Taught in 2019/2020

Course year 2

Language ENGLISH

Curriculum AEROSPACE ENGINEERING SYSTEMS

Location Brindisi

Semester Second Semester

Exam type Oral

Assessment

Course timetable

<https://easyroom.unisalento.it/Orario>

BRIEF COURSE DESCRIPTION

The course aims at presenting the basic concepts and the recent advances in the field of electronic devices and systems for space. After a brief introduction on the space missions and the space environment, the fundamental building blocks and sub-systems of a satellite are discussed. The electronic systems for the satellite platform and payloads are the main topics of the course. Finally, main degradation phenomena of electronic system due to the space environment are shown.

REQUIREMENTS

Fundamentals of Chemistry, Physics, and Computer Science

COURSE AIMS

The training objectives of the course are as follows.

- 1) **KNOWLEDGE AND UNDERSTANDING** of the fundamentals of the electronic devices/systems for space at the state-of-the-art.
- 2) **APPLYING KNOWLEDGE AND UNDERSTANDING**, by designing innovative electronic systems for space.
- 3) **MAKING JUDGEMENT**, by choosing independently the most appropriate approach to implement a specific functionality.
- 4) **COMMUNICATION**, by writing proper technical reports on different topic relevant to electronic devices/systems for space, and by discussing their contents.
- 5) **LIFELONG LEARNING SKILLS**, as ability of studying and understanding autonomously new electronic devices/systems for space.

TEACHING METHODOLOGY

Classroom lectures, numerical exercises, lab exercises.

ASSESSMENT TYPE

Oral exam

FULL SYLLABUS

Chapter 1 - Introduction (0.5 CFU)

Space Missions: Space System Segments; Design of System Segments for Space Flight Missions; Space Flight Mission Classification.

The Space Environment: Spacecraft and the Space Environment; Influence of the Sun and the Space Background; Influence of the Earth; Effect on Spacecraft and Mission Design.

Satellite Classification: Classification by mass; Classification by mission; Classification by orbit.

Overview of Satellite Subsystem: Structure and Mechanisms; Electrical Power Supply; Thermal Control; Satellite Propulsion; Attitude Control; Data Management; Communication; Payload.

Chapter 2 - Electronic Systems for Satellite Platform (1.5 CFU)

Optical fiber sensors for structural health monitoring and temperature sensing; Fundamentals of optical fiber sensors; Fiber sensors for structural health monitoring; Fiber sensors for temperature sensing.

Electronic and optoelectronic devices and systems for electrical power supply: Solar cells and solar array; Power semiconductor devices and power electronic converters.

Optoelectronic and microelectromechanical sensors for satellite attitude control: Star tracker; Microelectromechanical inertial sensors for Space; Optoelectronic gyroscopes.

On-board computers: Spaceborne processors; Memories for Space; Technologies for spacecraft data buses.

Chapter 3 - Electronic Systems for Telecom and EO Payloads (1 CFU)

Electronic hardware for telecom payloads: transparent and regenerative telecom payloads; Communication receiver: block diagram. Linearizer/channel amplifiers.

Electronic and optoelectronic hardware for EO payloads: Image sensors for Space; SAR systems: operating principle, block diagram, and overview of electronic sub-systems.

Chapter 4 - Degradation phenomena of electronic system due to the space environment (1 CFU)

Resistance to radiation of electronic systems; Fault tolerance systems at the component level and at the system level; Qualification tests of technologies, components and equipment for space use.

REFERENCE TEXT BOOKS

Handbook of Space Technology

Edited by Wilfried Ley, Klaus Wittmann and Willi Hallmann © 2009 John Wiley & Sons, Ltd.

ISBN: 978-0-470-69739-9

CHAPTERS: 1, 2, 4

Photonics in space : advanced photonic devices and systems

Caterina Ciminelli, Francesco Dell'Olio, and Mario N. Armenise

© 2016 by World Scientific Publishing Co. Pte. Ltd.

ISBN: 9789814725101

CHAPTERS: 6, 7