

UNMANNED AIRCRAFT SYSTEMS

SSD	CFU	Anno (I o II)		Semestre (I o II)		Lingua	
		I	II	I	II	Italiano	Inglese
ING-IND/05	9		✓	✓			✓

Insegnamenti propedeutici previsti: Nessuno

Classi				
Docenti				

OBIETTIVI FORMATIVI

The course is intended to provide a basic knowledge about architecture and operation of Unmanned Aircraft Systems (UAS), dealing in particular with UAS classification, regulations, sensors and data fusion algorithms, autonomous guidance, navigation and control, communication and data links, ground stations. Special emphasis is given to enabling technologies for autonomous flight and UAS integration in the civil airspace, such as ground-based and airborne sense and avoid systems.

PROGRAMMA

Introduction. Definitions and principles.
 UAS Configurations and Applications: Military & Civilian Roles. Evolution, current and future systems.
 UAS Onboard Systems:
 - Overview of UAS payloads
 - Onboard navigation systems and landing aids
 - Vision-based applications and techniques, vision-aided navigation
 - Basics of data fusion and airborne tracking systems
 - UAS planning, guidance, and control
 o fixed wing - architecture and algorithms of UAS autopilots: path planning, path management, guidance (trajectory tracking, path following), autopilot control loops
 o rotary wing - dynamics and control of multirotor systems, planning and guidance approaches
 o exercises and practical examples of small UAS guidance navigation and control with ad hoc software tools
 UAS communications and data links.
 UAS ground stations and human factors, levels of automation, mission planning systems.
 Regulations and airspace integration: current UAS operations, cooperative and non cooperative separation assurance and collision avoidance systems, ground-based and airborne sense and avoid systems and algorithms.
 Practical anti-collision system design examples.

MODALITA' DIDATTICHE

Lectures, tutorials, exercises

MATERIALE DIDATTICO

Slides, lecture notes, technical papers.
 Textbooks:
 J. Gundlach, Designing Unmanned Aircraft Systems: A Comprehensive Approach, AIAA Education Series, 2012
 R. Austin, Unmanned Aircraft Systems: UAVs Design, Development and Deployment, Wiley, 2010
 R.W. Beard, T.W. McLain, Small Unmanned Aircraft: Theory and Practice, Princeton University Press, 2012
 R.W. Beard, Quadrotor dynamics and control, lecture notes, 2008
 S. Blackman, R. Popoli, Design and analysis of modern tracking systems, Artech House, 1999.
 R.C. Nelson, Flight Stability and Automatic Control, McGraw Hill, 1998

MODALITA' DI ESAME

L'esame si articola in prova	Scritta e orale	<input type="checkbox"/>	Solo scritta	<input type="checkbox"/>	Solo orale	<input checked="" type="checkbox"/>
In caso di prova scritta i quesiti sono	A risposta multipla	<input type="checkbox"/>	A risposta libera	<input type="checkbox"/>	Esercizi numerici	<input type="checkbox"/>
Altro						