



## UNIVERSITÀ DI PISA

# COMPLEX INFORMATION SYSTEMS AND VERTICAL APPLICATION

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**PAOLO PAGANO**

Anno accademico 2023/24  
CdS INFORMATICA E NETWORKING  
Codice 1149I  
CFU 6

| Moduli   | Settore/i  | Tipo    | Ore | Docente/i    |
|--|------------|---------|-----|--------------|
| COMPLEX INFORMATION SYSTEMS AND VERTICAL APPLICATION | ING-INF/03 | LEZIONI | 48  | PAOLO PAGANO |

### Obiettivi di apprendimento

#### *Conoscenze*

The course aims at providing a background in principles and practice of management of complex application systems in the field of vertical (maritime) applications. In detail, aspects such as communication fundamentals, modulation techniques, propagation effects, Long Range and Short Range communication protocols, cellular networks (with a focus on 5G), satellite technologies and data acquisition, custody and management will be covered in relation to connected and unmanned shipping, intermodal digital logistics in a sustainable growth perspective.

#### *Modalità di verifica delle conoscenze*

Proper instruction of the student will be verified through the final assessment methods.

#### *Comportamenti*

The student will acquire the needed knowledge at the basis of the network architecture of a complex digital infrastructure where IoT, radio networks, and data platforms are considered as enabling components.

#### *Modalità di verifica dei comportamenti*

Feedback will be required to the students at a regular basis along the duration of the courses. Exercise and demo sessions will also be organized.

#### **Prerequisiti (conoscenze iniziali)**

Fundamentals of telecommunication networks.

#### **Indicazioni metodologiche**

Delivery: face to face  
Attendance: Not mandatory  
Learning activities:

- attending lectures

Teaching methods:

- Lectures

#### **Programma (contenuti dell'insegnamento)**

Starting with:

- Radio transmission fundamentals and wireless networks
- Evolution of cellular networks
- WLAN and WPAN networks
- Fundamentals of satellite technologies and their application

and then:

- complex infrastructure for «store and share» of data
- Sensor devices and data model



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- Data custodial and virtualization
- Data trust and Blockchains
- SW development
- Multi-tenant clouds

finally considering:

- Real-world applications: Connected and Automated Vessel, eFreight and Cooperative ITS, Sustainable Growth.

### Bibliografia e materiale didattico

- Hand-outs.

Recommended textbooks:

- *"Wireless Communications & Networks,"* W. Stallings, Pearson Education Inc.
- *"Wireless Communications: Principles and Practice,"* T. S. Rappaport, Prentice Hall
- *"Satellite Communication Systems 6th edition"* by Maral / Bousquet / Sun

Suggested textbooks:

- *"Wireless Communications,"* A. Goldsmith, Cambridge University Press
- *"Fundamentals of Wireless Communications,"* D. Tse and P. Viswanath, Cambridge University Press (available for free download online)

### Modalità d'esame

- Final oral exam or project work

Pagina web del corso

<https://classroom.google.com/c/NjYxNTg3NjAxMTMx?cjc=pur6qjw>

### Note

Please subscribe to Google classroom:

<https://classroom.google.com/c/NjYxNTg3NjAxMTMx?cjc=pur6qjw>

An introductory meeting with the lecturer is scheduled on Feb 13th, 9,30 am via MS Teams (participation link is below).

See you there,

Paolo Pagano

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Riunione di Microsoft Teams

**Partecipa da computer, app per dispositivi mobili o dispositivo della stanza**

[Fai clic qui per partecipare alla riunione](#)

ID riunione: 359 914 186 064

Passcode: bbw3yY

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