UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

WIRED AND WIRELESS COMMUNICATION SYSTEMS

Enrollment year	2020/2021
Academic year	2021/2022
Regulations	DM270
Academic discipline	ING-INF/03 (TELECOMMUNICATIONS)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	INDUSTRIAL AUTOMATION ENGINEERING
Curriculum	Robotics and Mechatronics
Year of study	2°
Period	1st semester (27/09/2021 - 21/01/2022)
ECTS	6
Lesson hours	45 lesson hours
Language	English
Activity type	ORAL TEST
Teacher	FAVALLI LORENZO (titolare) - 6 ECTS
Prerequisites	None specific
Learning outcomes	Give students the knowledge to understand problems and technical solutions to operate a communication system. Impact of the environment and of the service type on the preferable solution. Description of the main commercial systems with reference to the studied techniques. It is assumed that students don't have any background in telecommunications, and will be more interested in their exploitation in industrial environments. As a consequence, the theoretical aspects will be limited and focus will be on application examples. At the end of the course, it is expected that the student will know: - The physical principles that affect a transmission system - The transmission techniques and their effectiveness in presence of above mentioned phenomena

- Effects of the interaction between different users and services
- The reasons behind the choices of different techniques in different systems
- The performance that can be achieved and the factors influencing them
All this with the final aim to give students the tools to analyze requirements and consequently adopt a conscious choice based on the requested service.

Course contents

Characterization of signals:
- Characterization in time
- Characterization in frequency
- Statistical properties
Characterization of transmission impairments. Propagation phenomena and how to design efficient transmission techniques. Transmission over radio channels. Attenuation, multipath, fading, doppler effect, crosstalk.

Review of transmission techniques (analog and digital) analog to digital conversion, transmission of baseband digital data: robustness to noise and bandidth efficiency.

Introduction to traffic theory for performance characterization and system planning. Kendall's notation, Little's result, transition matrix and state probabilities for Markov systems, birth death processes, examples.

Circuit switched networks: space, time and hybrid circuit switched nodes. Minimization of crosspoints. Blocking probability. Signaling, in-band, out-of band, common channel. Multiplexing in circuit switched networks frequency (FDM), time (TDM) and code (CDM). Duplexing.

Packet switched networks. The ISO/OSI reference model, protocols and interfaces. Line management, link configuration, packet extraction, error control (FEC and ARQ). Sample protocols: HDLC, PPP.
Distributed multiplexing in packet networks: Aloha, Slotted-Aloha, CSMA/*, Token passing.

Local packet based systems. Wired and Wireless Local Arean Networks (LAN) in the IEEE 802 set of standards.
Short range and sensor networks.
Networks and applications in industrial environments

Wide area packet networks. Historical perspective, Frame relay and ATM networks. Quality of service concepts. Internet architecture and protocols (IP, TCP, UDP). Evolution and convergence to IP based networks.

Teaching methods

Class talks given with the support of slides and integrated with the use of blackboard for specific topics.

Reccomended or required readings

Slides, Links, selected papers and book chapters.
Useful texts:
-William Stallings, DATA AND COMPUTER COMMUNICATIONS

	Eighth Edition, Pearson Prentice Hall - J. Kurose, K. Ross, "Computer Networking: A Top-Down Approach." Pearson
Assessment methods	Oral exam. The students are offered the opportunity to select a topic to study in depth and provide a presentation.
Further information	
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile