UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

TELECOMMUNICATION SYSTEMS

Enrollment year	2019/2020
Academic year	2021/2022
Regulations	DM270
Academic discipline	ING-INF/03 (TELECOMMUNICATIONS)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	ELECTRONIC AND COMPUTER ENGINEERING
Curriculum	Elettronica
Year of study	3°
Period	2nd semester (07/03/2022 - 17/06/2022)
ECTS	9
Lesson hours	78 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	FAVALLI LORENZO (titolare) - 9 ECTS
Prerequisites	Signal theory, modulations, protocols. Although a general introduction is given in the first part of the course, topics form the courses of Comunicazioni elettriche e Reti di Calcolatori are assumed to be in the students' background.
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. 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 wired systems. Propagation phenomena and how to design efficient transmission techniques to counteract transmission impairments. 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 bandwidth efficiency. Introduction to traffic theory for performance characterization and 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. Sample systems: PDH (alignment, justification), SDH (justification), WDM, OVSF codes. Packet switched networks. The data Link Layer: 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 Area Networks (LAN) in the IEEE 802 set of standards. Short range and sensor networks. Wide area packet networks. Historical perspective, Frame relay and ATM networks. Quality of service concepts. Evolution and convergence to IP based networks. Mobile radio systems. Network architecture, sample operational procedures. Evolution (2G, 3G, 4G). Coding and transmission of digital video. Fundamentals of compression techniques, network architectures for video distribution (DVB, CDN).
Teaching methods	Theoretical lessons given with support of slides and blackboard description of specific topics. Exercises in class to show single applications and solution of exams questions.
Reccomended or required readings	A. Pattavina, "Reti di Telecomunicazioni." McGrawHill - J. Kurose, K. Ross, "Computer Networking: A Top-Down Approach." Pearson

	O. Bertazioli, L. Favalli, "GSM-GPRS:" Hoepli
Assessment methods	Exam is composed by a written and an oral test: the written part is composed by numerical exercises and short specific theoredtical questions while the oral starts with a discussion of the writte part and tends to verify the more general understanding of the relationship between the different topics. Grade is sum of grades in oral and written parts (max grade written 17, max grade oral 17). Admission to oral exam is subject to a grade ≥8 in the written test. Note that oral must also be ≥8 to pass.
Further information	The course is also offered in the Informacs branch as a 6 CFU course. In this versio, the program is basically the same but with a reduced emphasys on radio transmission and mobile radio systems. These aspects are usually given in the last part of the course.
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile