Course Unit Description - (COSAT)

(Satellite Communications)

(Mestrado em Engenharia Electrotécnica e de Computadores)

Academic year: 2009/2010

Subject group: Electrónica e Telecomunicações

	Semestral	**Compulsory**		
Mode of study	Diurno	**Hours / Week**	**T-**Teórica	2
Year	1º		**PL-**Prática-Laboratorial	2
Semester	1º		**OT-**Orientação Tutorial	1

ECTS 6

Objectives

This course provides a comprehensive introduction to satellite communications and a thorough grounding in the design issues of orbit selection, link design, and signal processing. Throughout the term references to and discussions of today's satellite systems are included.
To learn how satcom systems work and to understand the complex considerations that influence their design.
To learn how to compute link budgets for digital SatCom systems.
To understand how to choose orbits and design satellite constellations.
To learn how to link orbital parameters to pointing angles and tracking requirements.
To understand how to choose frequencies, modulation techniques, and coding and access schemes appropriate to the mission of the SatCom system.
Through a series of intensive lectures and hands-on projects the course aims to:
Provide a treatment of satellite communication systems operation.
Provide in-depth understanding of modern satellite multiple accesses, modulation schemes.
Review the state of the art in new research areas such as, satellite networking and satellite personal communications.
Students should leave the course with knowledge of:
Link budgets,
Modulation, and multiple accesses,
Satellite Networking,
Plus a good all round idea of current and emerging systems and technologies for the future.
Because the course covers the theoretical aspects of the subject students will gain a comprehensive understanding of the field.

Course Contents

After a review of basic concepts, the following topics are addressed: the distinctions between digital and nondigital communications systems; constellation design, and communications system design; the use of spread spectrum (CDMA and frequency-hopping), TDMA, and FDMA architectures; the use of geostationary satellites for mobile telephone systems; satellite television; Involves the various public and private satellite systems including very small aperture terminals (VSAT).

INTRODUCTION
Space System Engineering, Designing for Space Environment, Orbits.
Fundamentals and Application of global Satellite Navigation Systems.
Propagation, Communication Satellites.
Communications Architectures, Communications Frequencies,
THE COMMUNICATION LINK
Propagation Path Characteristics, Network Components/Ground Stations,
Link Budget, Store and forward. Link budgets
COMMUNICATION TECHNOLOGY
Fundamentals of Modulation and Coding, Baseband Signals, Multiple
Access Techniques, Information Security Aspects
Modulation and demodulation
Access schemes
Orbitology. Geostationary Orbit (GEO), Low Earth Orbit (LEO), Molniya Orbit .
Acquisition and tracking
Payload design
Cost, schedule, and mission lifetime versus revenue
Implementation aspects of satellite communication spacecraft technology.

Recommended reading

• Satellite Communications Systems. G. Maral e M. Bousquet. John Wiley & Sons, 4th Ed., 2007. ISBN 0-471-49654-5.
• Satellite Communications. Dennis Roddy, McGraw-Hill, 4th Ed. 2006, ISBN 0-07-146298-8.
• GNSS, Global Navigation Satellite Systems. Hofmann-Wellenhof, Lichtenegger, Wasle. Springer WienNewYork, 1st Ed., 2008. ISBN 978-3-211-73012-6.
• SI – Sistema Internacional de Unidades, Manuel G. Soares, ISEP, Ed. 2008.

About: 1- Satellite Communications Systems: Systems, Techniques and Technology by Gérard Maral (Author), Michel Bousquet (Author) Total Price: 95.43 EUR.
Book Description:
Satellite communications refers to the utilisation of geostationary orbiting satellites to relay the transmission received from one

earth station to one or more earth stations. This revised, updated and extended fourth edition covers the entire field of satellite communications engineering from the techniques of orbital mechanics and radio wave propagation to the design of communication links and earth stations. * Features an improved presentation of satellite applications with regards to services * Discusses the most recent developments in this evolving field, including MPEG2, concatenated coding, digital TV and examples of transmission of digital telephony * Practical approach and extensive illustrations are highly valued by student audience * A single source, comprehensive and thorough reference covering the entire field of satellite communications engineering.

About 2: "Satellite Communications, Fourth Edition (Professional Engineering)" McGraw-Hill, 4th Ed. 2006, ISBN 0-07-146298-8; Hardcover; Total Price: 92.12 EUR.
Synopsis
Master the fundamentals of satellite communications. Highly regarded for more than a decade as both a teaching text and professional tutorial, this classic guide to satellite communications has been revised, updated, and expanded to cover global wireless applications, digital television, and Internet access via satellite. In-depth, textbook-style coverage combined with an intuitive, low-math approach makes this book particularly appealing to the wireless and networking markets. New to this edition are: global wireless services, including: 3G; antenna options.

Course Notes
There are notes for this course published with Moodle.

Teaching Methods

Students are taught using the latest advances in teaching methods and ISEP electronic resources, as well as small-group and individual tuition.
Particular features include:
- innovative and engaging teaching methods
- access to many online resources
- flexibility in course content

About the lecturer:
Professor Artur Neves e Sousa is a lecturer at ISEP, since 1999. He completed his MSc studies in Non-linear FM Characteristic of Semiconductors Lasers in Low Frequencies at DETI (Aveiro) in 1996.
He was employed as a Local Telecommunication network designer Engineer at Portugal Telecom, Aveiro.

Assessment methods

Assessment is mainly by examination.
Final Examination (100 %)

Due final examinations dates are not flexible to accommodate jobs and personal situations and are scheduled by Department Office.

	Name
Teacher responsible:	Artur Neves e Sousa (ANS)
Lecturer:	Artur Neves e Sousa (ANS) Renato Roque Pinto da Silva (RRS)