

Course guide 230055 - COMOPT - Optical Communications

Last modified: 24/05/2024

Academic year: 2024	ECTS Credits: 6.0 Languages: Catalan, Spanish, English		
Degree:	BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).		
Teaching unit:	739 - TSC - Department of Signal Theory and Communications.		
Unit in charge:	Barcelona School of Telecommunications Engineering		

LECTURER

Coordinating lecturer:	M. JOSE SONEIRA FERRANDO
Others:	Primer quadrimestre: ROSANNA PEREZ PUEYO - 41 JOSEP JOAN PRAT GOMA - 41 M. JOSE SONEIRA FERRANDO - 41
	Segon quadrimestre: JAUME COMELLAS COLOME - 11, 13 ROSANNA PEREZ PUEYO - 11, 13 JOSEP JOAN PRAT GOMA - 11, 13

PRIOR SKILLS

Fundamentals on quantum physics, semiconductors and transmission systems.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Generical:

10 ECI N3. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.

TEACHING METHODOLOGY

Theoretical lectures, application sessions, personal work, laboratory sessions

LEARNING OBJECTIVES OF THE SUBJECT

Fundamental understanding of fiber optic communications, both theoretical as well as experimental.



STUDY LOAD

Туре	Hours	Percentage
Hours large group	39,0	26.00
Hours small group	26,0	17.33
Self study	85,0	56.67

Total learning time: 150 h

CONTENTS

(ENG) Chapter 1. Introduction

Description:

Optical communications technology evolution. Evolution from point-to-point fiber optic systems to all-optical networks. Block diagram of an optical communications system. Introduction to optical networks.

Specific objectives:

Historical evolution of optical communications. Introductory session, showing the block diagram of a fiber optcs communication system.

Full-or-part-time: 4h 55m Theory classes: 2h Self study : 2h 55m

(ENG) Chapter 2. Fiber Optics

Description:

Fiber Optics description. From geometric optics to Maxwell equations. Signal propagation in optical fibers, Dispersion: -Modal dispersion -Chromatic dispersion -Waveguide dispersion -Polarization mode dispersion. Attenuation. Optical fiber types Multi-mode: main characteristics. Single-mode: main characteristics. Non-linear effects in fiber optics propagation. Optical fiber for WDM systems. Dispersion compensation fibers. Special fiber optics. Fiber optics connection. Optical fiber cables: types and characteristics.

Specific objectives:

Understanding fiber optics principles and signal propagation in optical fibers.

Full-or-part-time: 27h Theory classes: 9h Self study : 18h



(ENG) Laboratory: Optical fiber and devices measures

Description:

Measuring fiber optic core diameter, numerical aperture, characterizing attenuation by using an OTDR. Optical coupler measures.

Specific objectives: Fiber optics hands-on. OTDR measurements.

Related activities: Chapter 2

Full-or-part-time: 11h Laboratory classes: 6h Self study : 5h

(ENG) Chapter 3. Optical sources

Description:

LED: basic concepts, types and characteristic parametres. Laser Diode: basic concepts, types and characteristic parametres. Single and multi-mode LDs. Tunable lasers. Lasers in telecom systems.

Specific objectives:

Understanding the light emission processes (spontaneous and stimulated), the laser diode and its main characteristics, with special emphasis in lasers utilized for fiber optic telecom systems.

Full-or-part-time: 24h Theory classes: 8h Self study : 16h

Chapter 4. Optical detection.

Description:

Opto-electronic conversion. Photodetector types. Shot noise in optical communications. Ideal receiver. Avalanche and thermal noises. Direct Detection receiver. Signal to noise ratio. Coherent detection: heterodyne, homodyne. Principles, scheme, advantages.

Specific objectives:

Understanding the light to current conversion in different types of photo-detectors as well as the different detection techniques. Review of the optical receiver elements and its behavior.

Full-or-part-time: 19h 30m Theory classes: 6h 30m Self study : 13h



Chapter 5. Optical amplifiers

Description:

Semiconductor optical amplifier. Doped fiber optical amplifier. Noise in optical amplifiers. Optically pre-amplified receivers.

Specific objectives: Understanding optical amplifiers and their characteristics.

Full-or-part-time: 7h 30m Theory classes: 2h 30m Self study : 5h

Chapter 6. IM-DD optical communications systems.

Description:

Block diagram. System model. BER calculation. System performance as a fuinction of type of fiber, bit rate, modulation format, receiver type, amplification.

Specific objectives:

Understanding the performance of the whole system after reviewing its components in previous chapters. Design and dimensioning of a practical system with current components.

Full-or-part-time: 24h Theory classes: 8h Self study : 16h

(ENG) Laboratory: Optical Sources

Description:

LED: characteristic parameters measurement. Laser Diode: characteristic parameters measurement. LED based optical transmitter: digital transmission main parameters measurement. LD based optical transmitter: digital transmission main parameters measurement.

Full-or-part-time: 9h 50m Laboratory classes: 6h Self study : 3h 50m

Laboratory: Optical receivers

Description: Digital transmission system optical receiver measures.

Full-or-part-time: 4h Laboratory classes: 3h Self study : 1h



Laboratory: Transmission systems modeling and simulation

Description: Fiber optics digital transmission system simulations.

Full-or-part-time: 5h Laboratory classes: 3h Self study : 2h

GRADING SYSTEM

Continuous evaluation (40%) -includes controls/exercises-Laboratory (20%) Final Exam (40%)

BIBLIOGRAPHY

Basic:

- Senior, J.M. Optical fiber communications: principles and practice. 3rd ed. New York: Prentice Hall, 2008. ISBN 9780130326812.