Course guide
230697 - OFLAB - Optical Fiber Telecommunications Lab

Last modified: 25/05/2023

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.

Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Optional subject).
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura

Others: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE1. Ability to apply information theory methods, adaptive modulation and channel coding, as well as advanced techniques of digital signal processing to communication and audiovisual systems.
CE13. Ability to apply advanced knowledge in photonics, optoelectronics and high-frequency electronic
CE3. Ability to implement wired/wireless systems, in both fix and mobile communication environments.

Transversal:
CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

TEACHING METHODOLOGY

Lectures
Laboratory classes
Laboratory practical works

LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives and results:
Learning objectives: The aim of this course is to train the students in using advanced equipment to measure, characterize and/or evaluate sophisticated fiber-optic devices and systems.

Learning results:
1.-Ability to operate, characterize and design optical transmitters, optical receivers, optical amplifiers, optical filters and multiplexers/demultiplexers.
2.-Ability to evaluate the quality of a fiber-optic digital transmission.
3.- Ability to carry out measurements of optical fiber characterization.
4.- Ability to use fiber-optic-specific software to simulate and/or design both devices and systems.

STUDY LOAD

Type	Hours	Percentage
Hours small group	39,0	31.20
Self study	86,0	68.80

Total learning time: 125 h

CONTENTS

1. Introduction to Fiber-optics Laboratory

Description:
Introduction to Fiber-optics Lab.
Description:
1.-Description of the practices to be performed
2.-Explanation of the equipment to be used
3.-Introduction to the simulation software to be used

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

Practice 1: Optical Amplifiers

Description:
Description: Operation of optical amplifiers
Characterization of:
1.-A semiconductor optical amplifier (SOA)
2.-An erbium-doped fiber amplifier (EDFA)
Design of:
1.-An EDFA (hardware)
2.-Raman optical amplifier (software)

Full-or-part-time: 20h
Laboratory classes: 6h
Self study : 14h

Practice 2: Optical Modulators

Description:
Description: Operation of optical modulators
Characterization of: A Mach-Zehnder optical modulator
Design of:
1.-An optical intensity modulator (hardware)
2.-An optical IQ modulator (software)

Full-or-part-time: 20h
Laboratory classes: 6h
Self study : 14h

Practice 3: Optical Filters, Multiplexers-Demultiplexers and Switches

Description:
Description: Operation of optical filters, multiplexers-demultiplexers and switches
Characterization of.
1.-An optical filter
2.-An optical multiplexer-demultiplexer
3.-A wavelength-selective switch (WSS)
Design of:
1.-An optical cross-connect (software)

Full-or-part-time: 20h
Laboratory classes: 6h
Self study : 14h

Practice 4: Digital Transmission System

Description:
Description:
Operation of:
1.-bit error testers
2.-optical oscilloscopes
Characterization of:
1.-An optical transmitter
2.-An optical receiver
Evaluation of: An intensity-modulation with direct detection system (hardware)
Design of: An advanced optical modulation system (software)

Full-or-part-time: 20h
Laboratory classes: 6h
Self study : 14h

Practice 5: Wavelength Division Multiplexing (WDM)

Description:
Description:
Operation of: Ethernet-SDH data generators
Evaluation of:
1.- A DWDM System (hardware)
2.- A coarse WDM system (hardware)
Design of: A flex-grid optical network (software)

Full-or-part-time: 20h
Laboratory classes: 6h
Self study : 14h

Practice 6: Control Plane-driven connectivity provisioning

Description:
Description:
Operation of: Control plane-based approach of connectivity provisioning.
Evaluation of: Connectivity provisioning according to different requirements (latency, QoS, etc).

Full-or-part-time: 20h
Laboratory classes: 6h
Self study : 14h

GRADING SYSTEM

Individual assessments: 20%
Laboratory assessments: 80%

BIBLIOGRAPHY

Basic:
- Agrawal, G.P. Fiber-optic communication systems [on line]. 4th ed. Hoboken: Wiley, 2010 [Consultation: 17/10/2016]. Available on: http://onlinelibrary.wiley.com/book/10.1002/9780470918524. ISBN 9780470505113.
- Hui, R.; O'Sullivan, M. Fiber optic measurement techniques. 2nd ed. London: Academic Press, 2023. ISBN 9780323909570.

Complementary:
- Chan, C.K. Optical performance monitoring : advanced techniques for next-generation photonic networks. 1ª edición. Amsterdam ; Boston: Academic Press, 2010. ISBN 9780123749505.
- Alwayn, V. Optical network desing and implementation. Cisco Press, 2004. ISBN 1587051052.
- Ramaswami, R.; Sivarajan, K.N. Optical networks: a practical perspective [on line]. 3rd ed. San Francisco [etc.]: Morgan Kaufmann, 2010 [Consultation: 22/09/2020]. Available on: https://www.sciencedirect.com/science/book/9780123740922. ISBN 9780123740922.
- Le Nguyen, B. Optical fiber communication systems with MATLAB and Simulink models [on line]. 2nd ed. Boca Raton: CRC Press, 2015 [Consultation: 21/04/2020]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=1680665. ISBN 9781482217513.
- Desurvire, E. Erbium-doped fiber amplifiers: principles and applications. Willey & Soncs, 1994. ISBN 0471589772.
- Agrawal, G.P. Lightwave Technology: Components and Devices. Hoboken, New Jersey: Wiley-Interscience, 2004. ISBN 0471215732.