



## Course guides

# 230255 - FIBSYS - Optical-Fiber Telecommunication Systems for Internet (IP Over Wdm)

Last modified: 29/04/2020

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

**Degree:** BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Optional subject).  
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Optional subject).  
BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Optional subject).  
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

**Academic year:** 2020    **ECTS Credits:** 6.0    **Languages:** Catalan, English, Spanish

## LECTURER

**Coordinating lecturer:** José A. Lázaro  
**Others:** José A. Lázaro, Jaume Comellas.  
Junyent Giralt, Gabriel

## PRIOR SKILLS

Basic background on communications

## TEACHING METHODOLOGY

In the fall classes taught in English, and Spanish and Catalan in the spring.

- Lectures.
- Group work (distance).
- Individual work (distance).
- Exercises.
- Oral presentations.
- Short answer test (Control).
- Extended answer test (Final Exam).

## LEARNING OBJECTIVES OF THE SUBJECT

The aim of this course is to provide to the students a global vision of optical-fiber networks and their main application as back-bone of Internet. It will be provided a vision of the different methods of analysis, design, dimensioning, and performance evaluation of optical fibre based networks and WDM. First, we consider the parameters of interest for systems planning using tutorial software. Then, using this knowledge, we will study the design and evaluation of optical fibre based networks.

## STUDY LOAD

Type	Hours	Percentage
Hours large group	52,0	34.67
Self study	98,0	65.33

**Total learning time:** 150 h

## CONTENTS

### 1. Introduction

**Description:**

- Historical evolution of Internet infrastructure.
- State of the art.

**Full-or-part-time:** 17h 30m

Theory classes: 6h

Self study : 11h 30m

### 2. Internet Core and access networks

**Description:**

- Evolution of Internet core networks.
- Internet access technologies.

**Full-or-part-time:** 17h 30m

Theory classes: 6h

Self study : 11h 30m

### 3. High capacity telecommunication systems ' the optical layer

**Description:**

- Optical-fiber core networks evolution.
- High capacity telecommunication systems by WDM technology.
- Introduction of current WDM networks standards.

**Full-or-part-time:** 17h 30m

Theory classes: 6h

Self study : 11h 30m

### 4. WDM telecommunication systems elements

**Description:**

- Optical devices for WDM communications.
- Optical amplification in WDM communication systems.

**Full-or-part-time:** 13h 45m

Theory classes: 5h

Self study : 8h 45m

### 5. WDM network design and analysis

**Description:**

- Long haul WDM systems.
- Regional and Metropolitan WDM networks.
- WDM systems analysis, design and performance evaluation.

**Full-or-part-time:** 13h 45m

Theory classes: 5h

Self study : 8h 45m



## 6. Optical-fiber network fundamentals

### Description:

- Routing and wavelength assignment (unicast, broadcast, multicast).
- Wavelength conversion.
- Fault management, protection and survivability.

**Full-or-part-time:** 17h 30m

Theory classes: 6h

Self study : 11h 30m

## 7. Traffic grooming: IP over WDM

### Description:

- Standardized traffic grooming.
- Traffic grooming evolution.

**Full-or-part-time:** 17h 30m

Theory classes: 6h

Self study : 11h 30m

## 8. Network control and management

### Description:

- Basic functions of network control and management.
- Dynamic routing and wavelength-flexible spectrum assignment.

**Full-or-part-time:** 17h 30m

Theory classes: 6h

Self study : 11h 30m

## 9. Introduction to advanced topics

### Description:

- Introduction to optical packet and burst switching (OPS and OBS).
- Introduction GMPLS and Software Defined Networks.
- Introduction to virtual-topology design and optimization.

**Full-or-part-time:** 17h 30m

Theory classes: 6h

Self study : 11h 30m

## ACTIVITIES

### EXERCISES

### Description:

During the course it will be proposed several exercises, from the simplest towards the analysis and design of optical fiber networks for several implementation scenarios.



### ORAL PRESENTATION

**Description:**

The students will show the results of their personal and team work obtained at the most ambitious exercises of analysis and design of optical fiber networks at different scenarios.

### SHORT ANSWER TEST (CONTROL)

**Description:**

It will be proposed optional short answer controls during the course, so that students can check their progress. Some of these controls will allow reducing the topics of the subject to be assessed at the final control.

### EXTENDED ANSWER TEST (FINAL EXAMINATION)

**Description:**

At the end of the course, it will be proposed a control based on long answers that will allow to the students to show their knowledge and skills acquired in this course. This control can be alternatively evaluated by a personal and/or group work for those students showing good marks at the optional controls of short answers.

## GRADING SYSTEM

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Final examination: 50%

Partial examinations and controls: 30%

Exercises: 20%

## BIBLIOGRAPHY

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**Basic:**

- Ramaswami, R.; Sivarajan, K.N.; Sasaki, G.H. Optical networks: a practical perspective [on line]. 3rd ed. San Francisco: Morgan kaufmann, 2010 [Consultation: 29/07/2013]. Available on: <http://www.sciencedirect.com/science/book/9780123740922>. ISBN 9780123740922.
- Mukherjee, B. Optical WDM networks. New York: Springer, 2006. ISBN 978-0387-29055-3.

**Complementary:**

- Sivalingam, K.M.; Subramaniam, S.. Optical WDM networks: principles and practice [on line]. New York: Kluwer Academic Publishers, 2000 [Consultation: 10/10/2014]. Available on: <http://link.springer.com/book/10.1007/b115953>. ISBN 0306470217.
- Iniewski, K. Internet networks: wired, wireless, and optical technologies [on line]. BGoa Raton, FL: CRC, 2009 [Consultation: 01/04/2020]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=565923>. ISBN 9781439808573.

## RESOURCES

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**Other resources:**

Tutorial material on basic topics about optical communications, as the basic structure of optical fibers, etc. will be offered to those students who may request it.