



## Course guides

# 230698 - OPNET - Optical Networks

**Last modified:** 29/04/2020

**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:** 2020    **ECTS Credits:** 5.0    **Languages:** English

### LECTURER

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**Coordinating lecturer:** Comellas Colome, Jaume

**Others:** Junyent Giralt, Gabriel  
Spadaro, Salvatore

### PRIOR SKILLS

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Fiber optic communications fundamentals.  
Computer networks fundamentals.

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**Specific:**

CE4. Ability to design and dimension transport, broadcast and distribution networks for multimedia signals  
CE3. Ability to implement wired/wireless systems, in both fix and mobile communication environments.  
CE6. Ability to model, design, implement, manage, operate, administrate and maintain networks, services and contents  
CE8. Ability to understand and to know how to apply the functioning and organization of the Internet, new generation Internet technologies and protocols, component models, middleware and services  
CE7. Ability to plan networks and decision-making about services and applications taking into account: quality of service, operational and direct costs, implementation plan, supervision, security processes, scalability and maintenance. Ability to manage and assure the quality during the development process

**Transversal:**

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

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

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Lectures, application classes, workgroup assignments, individual assignments



## LEARNING OBJECTIVES OF THE SUBJECT

The aim of this course is to give insight of modern techniques used in broadband optical communications networks. Main concepts about key devices involved, traffic engineering, control and management of optical networks, as well as resiliency, will be given considering both, backbone and access networks.

## STUDY LOAD

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

**Total learning time:** 125 h

## CONTENTS

### Introduction: Optical networks evolution

**Description:**

Fiber optic communications as well as Optical networks evolution

**Related activities:**

Personal assignment

**Related competencies :**

CE8. Ability to understand and to know how to apply the functioning and organization of the Internet, new generation Internet technologies and protocols, component models, middleware and services

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

**Full-or-part-time:** 11h

Theory classes: 3h

Self study : 8h

### Optical Network Enabling technologies

**Description:**

Basic WDM devices review (splitters, filters, switches, WSS)

ROADM and OXC

**Specific objectives:**

Comprehension of the physical technologies involved in optical networks

**Related competencies :**

CE4. Ability to design and dimension transport, broadcast and distribution networks for multimedia signals

CE3. Ability to implement wired/wireless systems, in both fix and mobile communication environments.

**Full-or-part-time:** 14h

Theory classes: 4h

Self study : 10h



### Traffic Engineering Basics

**Description:**

Routing and wavelength assignment  
Network performance metrics  
Resiliency in optical networks

**Related activities:**

Individual assignment

**Related competencies :**

CE7. Ability to plan networks and decision-making about services and applications taking into account: quality of service, operational and direct costs, implementation plan, supervision, security processes, scalability and maintenance. Ability to manage and assure the quality during the development process  
CE6. Ability to model, design, implement, manage, operate, administrate and maintain networks, services and contents  
CE4. Ability to design and dimension transport, broadcast and distribution networks for multimedia signals  
CE8. Ability to understand and to know how to apply the functioning and organization of the Internet, new generation Internet technologies and protocols, component models, middleware and services  
CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

**Full-or-part-time:** 15h

Theory classes: 5h

Self study : 10h

### Control and Management of Optical Networks

**Description:**

ASON fundamentals. GMPLS controlled networks.

**Specific objectives:**

Main characteristics of optical networks management.

**Related competencies :**

CE7. Ability to plan networks and decision-making about services and applications taking into account: quality of service, operational and direct costs, implementation plan, supervision, security processes, scalability and maintenance. Ability to manage and assure the quality during the development process  
CE8. Ability to understand and to know how to apply the functioning and organization of the Internet, new generation Internet technologies and protocols, component models, middleware and services  
CE3. Ability to implement wired/wireless systems, in both fix and mobile communication environments.  
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.

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

Theory classes: 5h

Self study : 8h



### Metro and Access Optical Networks

**Description:**

Passive optical networks  
Access networks evolution

**Specific objectives:**

Access networks characteristics.

**Related competencies :**

CE6. Ability to model, design, implement, manage, operate, administrate and maintain networks, services and contents

CE3. Ability to implement wired/wireless systems, in both fix and mobile communication environments.

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

**Full-or-part-time:** 15h

Theory classes: 5h

Self study : 10h

### Packet Switched Optical Networks

**Description:**

Optical Packet and Burst Switching Technologies

**Specific objectives:**

Understanding OPS characteristics and technological requirements

**Related competencies :**

CE6. Ability to model, design, implement, manage, operate, administrate and maintain networks, services and contents

CE8. Ability to understand and to know how to apply the functioning and organization of the Internet, new generation Internet technologies and protocols, component models, middleware and services

**Full-or-part-time:** 11h

Theory classes: 3h

Self study : 8h

### Energy efficiency in Optical networks

**Description:**

Networks energy consumption. Green optical networks

**Related competencies :**

CE8. Ability to understand and to know how to apply the functioning and organization of the Internet, new generation Internet technologies and protocols, component models, middleware and services

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

**Full-or-part-time:** 11h

Theory classes: 3h

Self study : 8h



### Elastic/flexgrid optical networks

**Description:**

Elastic network characteristics and Performance evaluation

**Related competencies :**

CE4. Ability to design and dimension transport, broadcast and distribution networks for multimedia signals

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

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.

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

Theory classes: 5h

Self study : 8h

### Software Defined Networks (SDN)

**Description:**

Software defined networks principles. Optical Network Virtualization

**Full-or-part-time:** 11h

Theory classes: 3h

Self study : 8h

### Optical Networks and data centres

**Description:**

Cloud computing and traffic evolution. Optics in the data center

**Related competencies :**

CE8. Ability to understand and to know how to apply the functioning and organization of the Internet, new generation Internet technologies and protocols, component models, middleware and services

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

**Full-or-part-time:** 12h

Theory classes: 4h

Self study : 8h

## GRADING SYSTEM

Lectures attendance (10%), Workgroup assignments (20%), Individual work (30%), Exam (40%)



## BIBLIOGRAPHY

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### Complementary:

- Liu, K.H.. IP over WDM. Chichester: John Wiley and Sons, 2002. ISBN 0470844175.
- Ramaswami, R.; Sivarajan, K.N. Optical networks : a practical perspective [on line]. 3rd ed. San Francisco: Morgan Kaufman, 2010 [Consultation: 22/09/2020]. Available on: <https://www.sciencedirect.com/science/book/9780123740922>. ISBN 9780123740922.