230698 - OPNET - Optical Networks

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications
Academic year: 2018
Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
ECTS credits: 5
Teaching languages: English

Teaching staff

Coordinator: Comellas Colome, Jaume
Others: Junyent Giralt, Gabriel
Spadaro, Salvatore

Prior skills

Fiber optic communications fundamentals.
Computer networks fundamentals.

Degree competences to which the subject contributes

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

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.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Total learning time: 125h</th>
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<tbody>
<tr>
<td></td>
<td>Hours large group:</td>
</tr>
<tr>
<td></td>
<td>39h</td>
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<tr>
<td></td>
<td>Self study:</td>
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<tr>
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<td>86h</td>
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## Content

<table>
<thead>
<tr>
<th><strong>Introduction: Optical networks evolution</strong></th>
<th><strong>Learning time:</strong> 11h</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 3h</td>
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<tr>
<td></td>
<td>Self study: 8h</td>
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**Description:**
Fiber optic communications as well as Optical networks evolution

**Related activities:**
Personal assignment

<table>
<thead>
<tr>
<th><strong>Optical Network Enabling technologies</strong></th>
<th><strong>Learning time:</strong> 14h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 4h</td>
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<td></td>
<td>Self study: 10h</td>
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**Description:**
Basic WDM devices review (splitters, filters, switches, WSS)
ROADM and OXC

**Specific objectives:**
Comprehension of the physical technologies involved in optical networks

<table>
<thead>
<tr>
<th><strong>Traffic Engineering Basics</strong></th>
<th><strong>Learning time:</strong> 15h</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 5h</td>
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<td>Self study: 10h</td>
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**Description:**
Routing and wavelength assignment
Network performance metrics
Resiliency in optical networks

**Related activities:**
Individual assignment
## Control and Management of Optical Networks

**Description:**
ASON fundamentals. GMPLS controlled networks.

**Specific objectives:**
Main characteristics of optical networks management.

<table>
<thead>
<tr>
<th>Learning time: 13h</th>
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<tr>
<td>Theory classes: 5h</td>
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<tr>
<td>Self study : 8h</td>
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## Metro and Access Optical Networks

**Description:**
Passive optical networks  
Access networks evolution

**Specific objectives:**
Access networks characteristics.

<table>
<thead>
<tr>
<th>Learning time: 15h</th>
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<tr>
<td>Theory classes: 5h</td>
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<tr>
<td>Self study : 10h</td>
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## Packet Switched Optical Networks

**Description:**
Optical Packet and Burst Switching Technologies

**Specific objectives:**
Understanding OPS characteristics and technological requirements

<table>
<thead>
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<tr>
<td>Theory classes: 3h</td>
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<td>Self study : 8h</td>
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## Energy efficiency in Optical networks

**Description:**
Networks energy consumption. Green optical networks

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<tr>
<td>Theory classes: 3h</td>
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<tr>
<td>Self study : 8h</td>
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### Learning time:

- **Elastic/ flexgrid optical networks**: 13h
  - Theory classes: 5h
  - Self study: 8h

- **Software Defined Networks (SDN)**: 11h
  - Theory classes: 3h
  - Self study: 8h

- **Optical Networks and data centres**: 12h
  - Theory classes: 4h
  - Self study: 8h

### Description:

- **Elastic/ flexgrid optical networks**: Elastic network characteristics and Performance evaluation
- **Software Defined Networks (SDN)**: Software defined networks principles. Optical Network Virtualization
- **Optical Networks and data centres**: Cloud computing and traffic evolution. Optics in the data center

### Qualification system

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

### Bibliography

**Complementary:**