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: 2019
Degree: MASTER’S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Teaching unit Optional)
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 fixed 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.

Study load

| Study load | Total learning time: 125h | Hours large group: 39h | 31.20% |
| Self study: | 86h | 68.80% |
## Content

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<tr>
<th>Topic</th>
<th>Learning time</th>
<th>Description</th>
<th>Related activities</th>
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<tbody>
<tr>
<td><strong>Introduction: Optical networks evolution</strong></td>
<td>11h</td>
<td>Fiber optic communications as well as Optical networks evolution</td>
<td>Personal assignment</td>
</tr>
<tr>
<td><strong>Optical Network Enabling technologies</strong></td>
<td>14h</td>
<td>Basic WDM devices review (splitters, filters, switches, WSS)</td>
<td></td>
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<td>ROADM and OXC</td>
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<tr>
<td><strong>Traffic Engineering Basics</strong></td>
<td>15h</td>
<td>Routing and wavelength assignment</td>
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<td>Network performance metrics</td>
<td></td>
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<td></td>
<td></td>
<td>Resiliency in optical networks</td>
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<td>Individual assignment</td>
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</tbody>
</table>
### Control and Management of Optical Networks

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

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

**Learning time:** 13h
- Theory classes: 5h
- Self study: 8h

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### Metro and Access Optical Networks

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

**Specific objectives:**
Access networks characteristics.

**Learning time:** 15h
- Theory classes: 5h
- Self study: 10h

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### Packet Switched Optical Networks

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

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

**Learning time:** 11h
- Theory classes: 3h
- Self study: 8h

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### Energy efficiency in Optical Networks

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

**Learning time:** 11h
- Theory classes: 3h
- Self study: 8h
### Elastic/ flexgrid optical networks

<table>
<thead>
<tr>
<th>Description:</th>
<th>Elastic network characteristics and Performance evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning time:</td>
<td>13h</td>
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<tr>
<td>Theory classes:</td>
<td>5h</td>
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<td>Self study:</td>
<td>8h</td>
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</table>

### Software Defined Networks (SDN)

<table>
<thead>
<tr>
<th>Description:</th>
<th>Software defined networks principles. Optical Network Virtualization</th>
</tr>
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<tbody>
<tr>
<td>Learning time:</td>
<td>11h</td>
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<tr>
<td>Theory classes:</td>
<td>3h</td>
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<tr>
<td>Self study:</td>
<td>8h</td>
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### Optical Networks and data centres

<table>
<thead>
<tr>
<th>Description:</th>
<th>Cloud computing and traffic evolution. Optics in the data center</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning time:</td>
<td>12h</td>
</tr>
<tr>
<td>Theory classes:</td>
<td>4h</td>
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<tr>
<td>Self study:</td>
<td>8h</td>
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</tbody>
</table>

### Qualification system

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

### Bibliography

#### Complementary: