# Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)

## ECTS credits: 5  
**Teaching languages:** English

### Teaching staff
- **Coordinator:** Gabriel Junyent Giralt
- **Others:** José A. Lázaro, Jaume Comellas, Salvatore Spadaro and Joan M. Gené

### Opening hours
- **Timetable:** Any time is possible by appointment email

### 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**

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours small group: 39h</th>
<th>31.20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study:</td>
<td>86h</td>
<td>68.80%</td>
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</table>

# Content

<table>
<thead>
<tr>
<th>1. Introduction to Fiber-optics Laboratory</th>
<th>Learning time: 5h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Laboratory classes: 3h</td>
</tr>
<tr>
<td>Introduction to Fiber-optics Lab.</td>
<td>Self study : 2h</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
<tr>
<td>1.-Description of the practices to be performed</td>
<td></td>
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<tr>
<td>2.-Explanation of the equipment to be used</td>
<td></td>
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<tr>
<td>3.-Introduction to the simulation software to be used</td>
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<table>
<thead>
<tr>
<th>Practice 1: Optical Amplifiers</th>
<th>Learning time: 20h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Laboratory classes: 6h</td>
</tr>
<tr>
<td>Description: Operation of optical amplifiers</td>
<td>Self study : 14h</td>
</tr>
<tr>
<td>Characterization of:</td>
<td></td>
</tr>
<tr>
<td>1.-A semiconductor optical amplifier (SOA)</td>
<td></td>
</tr>
<tr>
<td>2.-An erbium-doped fiber amplifier (EDFA)</td>
<td></td>
</tr>
<tr>
<td>Design of:</td>
<td></td>
</tr>
<tr>
<td>1.-An EDFA (hardware)</td>
<td></td>
</tr>
<tr>
<td>2.-Raman optical amplifier (software)</td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>Practice 2: Optical Modulators</th>
<th>Learning time: 20h</th>
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</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Laboratory classes: 6h</td>
</tr>
<tr>
<td>Description: Operation of optical modulators</td>
<td>Self study : 14h</td>
</tr>
<tr>
<td>Characterization of:</td>
<td></td>
</tr>
<tr>
<td>A Mach-Zehnder optical modulator</td>
<td></td>
</tr>
<tr>
<td>Design of:</td>
<td></td>
</tr>
<tr>
<td>1.-An optical intensity modulator (hardware)</td>
<td></td>
</tr>
<tr>
<td>2.-An optical IQ modulator (software)</td>
<td></td>
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</tbody>
</table>
## 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)

**Learning 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)

**Learning 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)

**Learning time:** 20h
- Laboratory classes: 6h
- Self study: 14h
Practice 6: Control Plane-driven connectivity provisioning

**Learning time:** 20h
- Laboratory classes: 6h
- Self study: 14h

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

**Qualification system**

Individual assessments: 20%
Laboratory assessments: 80%

**Bibliography**

**Basic:**

**Complementary:**