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.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours small group</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time</strong>: 125h</td>
<td>39h</td>
<td>86h</td>
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<tr>
<td></td>
<td><strong>31.20%</strong></td>
<td><strong>68.80%</strong></td>
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</tbody>
</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>
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<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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### Practice 1: Optical Amplifiers

<table>
<thead>
<tr>
<th>20h</th>
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<tbody>
<tr>
<td>Learning time: 20h</td>
</tr>
<tr>
<td>Laboratory classes: 6h</td>
</tr>
<tr>
<td>Self study: 14h</td>
</tr>
</tbody>
</table>

**Description:**

Description: Operation of optical amplifiers
Characterization of:
1.-A semiconductor optical amplifier (SOA)
2.-An erbium-doped fiber amplifier (EDFA)
Design of:
1.-An EDFA (hardware)
2.-Raman optical amplifier (software)

### Practice 2: Optical Modulators

<table>
<thead>
<tr>
<th>20h</th>
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<tr>
<td>Learning time: 20h</td>
</tr>
<tr>
<td>Laboratory classes: 6h</td>
</tr>
<tr>
<td>Self study: 14h</td>
</tr>
</tbody>
</table>

**Description:**

Description: Operation of optical modulators
Characterization of: A Mach-Zehnder optical modulator
Design of:
1.-An optical intensity modulator (hardware)
2.-An optical IQ modulator (software)
## Practice 3: Optical Filters, Multiplexers-Demultiplexers and Switches

**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:**
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:**
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: