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></td>
<td>125h</td>
<td></td>
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<tr>
<td></td>
<td>39h</td>
<td>86h</td>
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<tr>
<td></td>
<td>31.20%</td>
<td>68.80%</td>
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</tbody>
</table>
# Content

## 1. Introduction to Fiber-optics Laboratory

**Description:**
Introduction to Fiber-optics Lab.

- Description of the practices to be performed
- Explanation of the equipment to be used
- Introduction to the simulation software to be used

**Learning time:** 5h  
- Laboratory classes: 3h  
- Self study: 2h

## Practice 1: Optical Amplifiers

**Description:**
Operation of optical amplifiers

- A semiconductor optical amplifier (SOA)
- An erbium-doped fiber amplifier (EDFA)

**Characterization of:**
- An EDFA (hardware)
- Raman optical amplifier (software)

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

## Practice 2: Optical Modulators

**Description:**
Operation of optical modulators

- A Mach-Zehnder optical modulator

**Characterization of:**
- An optical intensity modulator (hardware)
- An optical IQ modulator (software)

**Learning time:** 20h  
- Laboratory classes: 6h  
- Self study: 14h
**Practice 3: Optical Filters, Multiplexers-Demultiplexers and Switches**

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

**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)

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**Practice 4: Digital Transmission System**

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

**Description:**
- Operation of:
  1. Bit error testers
  2. Optical oscilloscopes
- Characterization of:
  1. An optical transmitter
  2. An optical receiver
- Evaluation of:
  1. An intensity-modulation with direct detection system (hardware)
  2. An advanced optical modulation system (software)
- Design of:
  1. An advanced optical modulation system (software)

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**Practice 5: Wavelength Division Multiplexing (WDM)**

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

**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)
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: