The subject will address the basics of geometrical optics, intermediate topics of electromagnetic optics, polarization of light and anisotropic media, the fundamentals of light beam propagation and elements of Fourier optics, including concepts of digital holography. The aim is to develop several topics (which are key for the future subjects of the Master) that usually are not covered in previous physics or engineering courses.

BIBLIOGRAPHY:
# 230553 - BEAMFO - Beam Propagation and Fourier Optics

- Keigo Iizuka, Elements of Photonics Volume I. John Wiley & Sons. 2002

## Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group:</th>
<th>37h 30m</th>
<th>30.00%</th>
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<tr>
<td></td>
<td>Hours medium group:</td>
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<tr>
<td></td>
<td>Hours small group:</td>
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</tr>
<tr>
<td></td>
<td>Guided activities:</td>
<td>3h 45m</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>83h 45m</td>
<td>67.00%</td>
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</table>
## Content

### 1.- Geometrical optics.

#### Degree competences to which the content contributes:

**Description:**
1.1.- Basic concepts. Ray tracing.
1.3.- Review of image forming instruments.

### 2.- Electromagnetic optics.

#### Degree competences to which the content contributes:

### 3.- Polarization of light and anisotropic media.

#### Degree competences to which the content contributes:

**Description:**
3.3.- Anisotropic media: Susceptibility of an anisotropic media. Wave propagation, normal modes. Index ellipsoid.
3.4.- Distortion of the index ellipsoid. Pockels effect. Liquid crystals.

### 4.- Fourier Transform.

#### Degree competences to which the content contributes:

**Description:**
4.1.- Definition and FT of some functions.
4.2.- The FT as a decomposition. Wave Packets. 2D FT of images.
4.3.- Convolution and correlation between two functions.
4.4.- Linear systems. Impulse response. Transfer function.

### -5.- Beam propagation and focalization.

#### Degree competences to which the content contributes:
6.- Fourier optics.

Degree competences to which the content contributes:

Description:
6.1.- Far fields in the angular spectrum representation.
6.2.- Coherent optical processing. Point spread function and optical transfer function. Resolving power of optical instruments.
6.3.- Holography (basic concepts). Digital holography.

Qualification system

- Homework + exam (>70%).
- Attending seminars, lab visits, class attendance (<20%)
To pass the course will require a quite accessible level of knowledge but high final grades will be obtained only by demonstrating enough proficiency.

Bibliography