



[30h+30h exercises] 5 credits

This course is taught in the 1st semester

**Teacher(s):** Christophe Craeye  
**Language:** french  
**Level:** 2nd cycle course

#### Aims

This course is devoted to electrical engineering students going for a specialization in Telecommunications. It is intended to give an education in the fields of antennas and propagation, mainly for terrestrial and satellite links.

At the end of the course the students will be able to

- compute the field radiated by an antenna and by an array of antennas, based on wire or aperture elements
- describe the effect of troposphere and of the ground on the propagation of electromagnetic waves
- calculate a link budget taking into account the different features of propagation, and to compute the signal-to-noise ratio for a terrestrial or satellite link

#### Content and teaching methods

- Summary on electromagnetic fields, power transfer, reciprocity, characteristics of transmitting and receiving antennas, noise
- Array antennas : array factor and applications to linear arrays with uniform and non-uniform amplitude distribution, optimisation
- Linear antennas : integral representation, application to slots and wire antennas. Progressive-wave and standing-wave antennas, input impedance
- Aperture antennas : radiation by a plane aperture, general properties, rectangular and circular apertures, reflector antennas, horn feeds, polarisation characteristics of reflector antennas
- Planar antennas, mainly microstrip antennas
- Propagation of electromagnetic waves in troposphere : physical description of the medium, refraction of waves and application to terrestrial and satellite link, attenuation by atmospheric gases, diffraction by atmospheric particles
- Propagation of electromagnetic waves in ionosphere : physical characteristics, propagation in plasmas, link by reflection on the ionosphere or through the ionosphere
- Propagation of electromagnetic waves above the ground : reflexion, surface waves, diffraction by spherical earth, effect of obstacles

Teaching methods

Courses and exercises (in classroom or using MATLAB) and a laboratory on radiation patterns. A project consisting of studying in more depth one of the subjects of the course (realization of an antenna, simulation of propagation effects ...) followed by an oral presentation

**Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)**

Prerequisites :

ELEC 2350 : Electromagnetism

ELEC2360 and ELEC2795 : Telecommunications I and II

Assessment :

Written exam and project (evaluation based on report) and oral examination

Could be given in English

**Other credits in programs**

<b>ELEC22</b>	Deuxième année du programme conduisant au grade d'ingénieur civil électricien	(5 credits)
<b>ELEC23</b>	Troisième année du programme conduisant au grade d'ingénieur civil électricien	(5 credits)