

Waveguides and Antennas

1. **Course number and name:** 020PGAES3 Waveguides and Antennas
2. **Credits and contact hours:** 4 ECTS credits, 35 contact hours + 5 lab hours
3. **Instructor's or course coordinator's name:** Elias Rachid
4. **Text book:**
 - a. **Other supplemental materials:**
Professor textbook and course material
5. **Specific course information**
 - a. **Catalog description:**
Transmission line theory – Lines in sinusoidal and transient regimes – Smith chart – TOS and stub adaptation – Waveguides (parallel plate, rectangular, cylindrical and dielectric) – General solutions for TEM, TE and TM waves – Fundamental parameters of antennas, gain and power directivity – Dipole antenna and linear wire antennas. Array antennas – Horn and reflector antennas (terrestrial antenna) – Smart antennas – Adaptive and switched-beam antennas.
 - b. **Prerequisites:** 020EMENI3 Electromagnetism or 020EMECI3 Electromagnetism
 - c. **Required:** Elective for CCE students; required for CCE telecommunication networks option students
6. **Specific goals for the course**
 - a. **Specific outcomes of instruction:**
 - Study and analyze the lines in sinusoidal and transient regimes
 - Analyze and calculate the nature and the type of defaults encountered on a transmission line
 - Use SMITH chart to solve line problem and adapt any line with a stub
 - Analyze and familiarize with the Maxwell equations and propagation in the different guides
 - Determine the expressions of the electromagnetic fields in the waveguides Calculate the near and far fields, the gain and the equivalent area of any dipole, half-wave doublet and of the horn and reflector antennas.
 - Find the antenna radiation pattern and antenna array
 - Recognize intelligent antenna techniques
 - Synthesizing adaptive printed antennas

b. KPI addressed by the course:

KPI	a1	a2	b2	b3	e3	k2	k3	a1	a2
Covered	x	x	x		x	x		x	x
Assessed	x	x	x	x	x	x	x	x	x
Give Feedback									

7. Topics and approximate lecture hours:

- Guided propagation: Study of the lines in sinusoidal and transient regimes: Telegraph equations, calculation of impedances, lossless lines, Stationary wave rate (3 lectures)
- Study of Smith's chart and applications: construction of the chart, impedance calculation, TOS calculation, stub adaptation (3 lectures)
- Rectangular waveguide: TE and TM waves, reflection on a conductor plane, propagation in parallel plate and rectangular waveguide: field expressions for TE and TM modes, wave unit. Losses in a guide, cavities and applications (4 lectures)
- Cylindrical waveguide TE and TM waves, EM-field expressions for (2 lectures)
- Dielectric waveguide: TE and TM wave, EM-field expressions for TE and TM modes (1 lecture)
- Antennas: Antennas parameters, isotropic source, image theory, radiation pattern, gain, directivity, radar equation (3 lectures)
- Wire antennas: near and far fields of wire antenna, input impedance, effects of capacitors and inductances in an antenna, line wire antennas, bandwidth. (3 lectures)
- Antenna alignment: N-points source grouping, alignment factor, reflector, dipole, Yagi antenna, AM, FM and TV antennas (3 lectures)
- Microwave antennas: Parabolic and reflector antennas, inclined beam on a parabolic (3 lectures)
- Intelligent antennas: adaptive and switched beam (2 lectures)
- Laboratory experiments (4 lectures)