

DEA-GITT-314 Electromagnetic Waves

SEMESTER: Fall
CREDITS: 6 ECTS (4 hrs. per week)
LANGUAGE: Spanish
DEGREES: GITT

Course overview

This is a course on radiation, wave propagation and introduction to antennas. Knowledge of physics on transmission lines as well as wave propagation in the air are introduced. The course focuses on basic elements and typical parameters used in RF as S parameters. Besides, applications will be analyzed and experimented in the lab to illustrate solutions to real problems.

Prerequisites

Previous knowledge that students must have for the smooth and efficient use of the course are: Electromagnetic fields, knowledge of complex algebra, differential and integral calculus. Power and electromagnetic energy. Log units; decibel. Circuit analysis and frequency response. Knowing of resonant circuits.

Course contents

Theory..

1. **Transmissions Line.** Transmission line theory; ideal and lossy lines, reflection, impedance adaption, and "S" parameters. Smith chart calculations. Principal kinds of transmission lines.
2. **Planar Waves.** Fundamentals. Reflection, polarization and losses.
3. **Guided Waves.** Theory of waveguides, modes of propagation, phase and group velocity, rectangular and circular waveguides. Upper modes in coaxial lines.
4. **Propagation.** Basic propagation, earth and atmospheric effects, rain and gases losses. Ionospheric propagation, ground wave. Other types of propagation (Meteor scatter, transequatorial, aurora etc...)
5. **Antennas.** Antennas basic theory, linear antennas, arrays and aperture antennas. Diversity, smart antennas and MIMO.

Laboratory:

There are two laboratory practices (2 hours each)

- P1.** Use of vector network analyzer and “S” parameters measurement.
Characterization of passive circuits and transmission lines.
- P2.** Design and measurement of antennas.

Textbook

- Electromagnetic Waves and Antennas. Sophocles J. Orfanidis, ECE Department Rutgers University. <http://www.ece.rutgers.edu/~orfanidi/ewa>
- Propagation of radio waves. M. Dolukhanov. Moscow 1995.
- Antenna theory. Analysis and design. Constantine A. Balanis.
- Radio System Design for Telecommunications (1-100 GHz). Roger L. Freeman. Ed: John Willey and Sons Inc.
- Class notes on Moodle.

Grading

The following conditions must be accomplished to pass the course:

- Final exam accounts for 50% of the final grade (50% corresponding to the theoretic part (without any books or notes) and 50% corresponding to the problems part (with class slides)).
- Two exams during the course account for 22.5% each one.
- Lab reports. They account for 5% of the grade.