ADVANCED ELECTROMAGNETICS

1. KEY INDICATORS

CFU/ECTS: 6
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2. OBJECTIVES OF THE COURSE

The course is aimed to present an overview of some advanced topics in Electromagnetics, of considerable importance for the applications. Key instruments extensively used for their physical intuition and representative power are the modal expansion with the relevant equivalent distributed circuits, and the plane-wave spectra. The concepts of Green's function and integral representation are also studied in depth. Scattering problems are finally presented.

3. ACQUIRED ABILITIES

Knowledge and understanding: successful students will be able to have an overall vision of modern electromagnetics, with particular reference to the unifying methodological aspects and to the mathematical techniques employed, which will allow them to easily find their bearings in successive study or in job positions, due to the great generality of the faced themes. In particular, the students will have understood in depth the principal concept of guided and free propagation, as well as the approach to the scattering problem, solved both in closed form (canonical problems) and numerically.

4. PROGRAM OF THE COURSE

Planar guiding structures, equivalent transmission lines for two-dimensional waveguides. Dispersion relation, discrete spectrum of the guided modes, graphical resolution. Radiation modes, continuous spectrum. Beams with finite cross section: use of the angular spectrum, the Goos-Hänchen shift. The transverse-resonance method, elementary applications. Dielectric-slab waveguides, geometrical-optics approach. The parallel-plate waveguide partially filled with dielectric. The non-radiative dielectric (NRD) waveguide. The effective-dielectric-constant method for three-dimensional waveguides. The slot line. The spectral-domain method for the study of planar stratified structures. Elementary application of the method to the slot line. Recalls on dyadic algebra and analysis in electromagnetic problems. Spectral dyadic Green's functions. Integral equations: numerical solution with the method of moments. Application of the method to the microstrip. Spectral decomposition of the fields radiated from an aperture. Asymptotic evaluation of integrals: integration by parts, the stationary-phase method. Computation of the far field.

5. REFERENCES

C.A. Balanis, Advanced engineering electromagnetic, 2nd ed., Wiley, 2012
C.A. Balanis, Antenna Theory: Analysis and Design, 3rd ed., Wiley, 2005
Materiale integrativo (lucidi/diapositive del corso, articoli) disponibili sul sito web http://151.100.120.244/personale/frezza.

6. COURSE WEBSITE

http://151.100.120.244/personale/frezza , http://labcem2.diet.uniroma1.it