Università degli Studi di L'Aquila - Dipartimento di Ingegneria e Scienze dell'Informazione e Matematica

Course catalogue

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Programme of Course "Electromagnetic Fields"

- Code: I0652
- Type of course unit: Elective (Laurea in Ingegneria dell'Informazione curriculum Elettronica)
- Level of course unit: Undergraduate Degrees
- Semester: 2

Number of ects credits: (Laurea in Ingegneria dell'Informazione) 9 (workload 225 hours)

Teachers: Piero Ciotti, Piero Tognolatti

1	**Course objectives**	The objective of this course is to introduce to the students the basics of Theory of Electromagnetic Fields. This course represents a bridge between the courses on Electrical Circuits, which the student has already taken, and all the Electromagnetic Systems he/she will encounter in the 2nd Cycle. On successful completion of this module, the student should be able to describe, using proper mathematical models, wave propagation, wave sources, transmission lines, media properties and energy exchange
2	**Course content and learning outcomes (dublin descriptors)**	Topics of the module include: • Fundamentals: Electromagnetic Field, Maxwell equations, Constitutive Equations, Boundary Conditions • Time-varying Fields: Poynting and Unicity Theorems, Complex Vectors and Field polarization, Wave equation, Electrodynamical potentials • Plane wave: Propagation vector, uniform and non-uniform plane wave, TE, TM and TEM waves, reflection and refraction of plane waves, under perpendicular or oblique incidence • Transmission Lines: transmission line equations, wave impedance and characteristic impedance, forward and backward waves, reflection coefficient and VSWR, Smith diagram, impedance-matching circuits. • Free-Space Radiation: Green Function, Vector Potentials, Radiation Condition, Equivalence and Reciprocity Principles, Fundamentals on Antennas • Guided Waves: Fields in metallic or dielectric waveguides, Propagation Modes, Eigenvalues and Eigenvectors, Cutoff in a waveguide, Rectangular and Circular Waveguides • Laboratory: Experiments and measurements on wave propagation in rectangular waveguide On successful completion of this module, the student should : • have profound knowledge of fundamentals of Electromagnetic Fields • have knowledge and understanding of the electromagnetic behavior of media and media interfaces and how time-varying fields and waves can be described • be able to select the appropriate equations to describe the system under study • understand and explain the characteristics of some basic system based on electromagnetic wave propagation (radio link, waveguide, optical fiber) • demonstrate skill in analyzing engineering problems referring to electromagnetic waves; demonstrate capacity to read and understand text on Electromagnetics and on related topics
3	**Course prerequisites**	The student must know Calculus and Electrical Circuit Theory
4	**Teaching methodsand language**	Lectures and exercises. A report is required for the laboratory activity. **Language**: English **Reference textbooks** • Simon Ramo, John R. Whinnery, Theodore Van Duzer, ***Fields and Waves in Communication Electronics***. Wiley. • Fawwaz T. Ulaby , Eric Michielssen , Umberto Ravaioli, ***Fundamentals of Applied Electromagnetics***. Prentice Hall.
5	**Assessment**	Written and oral exam

	methods	