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Programme of "CAMPI ELETTROMAGNETICI"
(ELECTROMAGNETIC FIELDS:

I0652, COMPULSORY 1ST CYCLE IN **INFORMATION ENGINEERING**, 3RD YEAR , 2ND SEMESTER

NUMBER OF ECTS CREDITS: 9 (WORKLOAD IS 225 HOURS; 1 CREDIT = 25 HOURS)

Teachers: Prof. Piero TOGNOLATTI, Prof. Piero CIOTTI

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)**	- 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	**Prerequisites and learning activities**	The student must know Calculus and Electrical Circuit Theory.
4	**Teaching methods and language**	**Lectures and exercises language**: Italian / English A report is required for the laboratory activity **Ref. Text books:** Fawwaz T. Ulaby , Eric Michielssen , Umberto Ravaioli :"Fundamentals of Applied Electromagnetics", Prentice Hall Simon Ramo, John R. Whinnery, Theodore Van Duzer :"Fields and Waves in Communication Electronics", Wiley
5	**Assessment methods and criteria**	Written and oral exam