

Course title:

Electromagnetic Fields at PhD

Duration [number of hours]: 24**PhD Program [MERC/MPS/SPACE]: SPACE****Name and Contact Details of Unit Organizer:**

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Course Description [max 150 words]:

The course provides the Engineering perspective to support comprehension and exploitation of Electromagnetic Fields.

Lectures are conducted at PhD level, but the module is conceived as an introduction to electromagnetics and can be also well attended by PhD students in STEM area that do not studied electromagnetics at BSc and MSc Level.

Theory is presented to provide an overall mathematical background to electromagnetic phenomena. Techniques are illustrated to address problems that involve electromagnetic problems. Methods are presented for conceiving solutions to specific problems. Some algorithms and engineering applications are finally presented.

Syllabus [itemized list of course topics]:

Electromagnetic Fields from physics to engineering through mathematics. Maxwell's equations in integral and differential form, the inductive approach, physics as semantic for electromagnetic fields, energy and electromagnetic fields. Deductive approach, mathematics as syntax of electromagnetic fields, from Maxwell equations to the theorems, validity limits and meanings.

Engineering and representations of electromagnetic fields in the various domains: time, phasor, frequency and wave number domain. Constitutive relations: models, formulation and meaning. Canonical solutions for the various domains. Source free solutions: propagation. Solutions in the presence of sources: Green's method, radiation.

Engineering parameters and paradigms for propagation and radiation.

Deterministic and stochastic approaches to the solution of electromagnetic field problems in engineering.

Approximate and asymptotic solutions to the propagation and radiation.

Solutions in engineering of electromagnetic field problems: methods, validity, reliability.

Assessment [form of assessment, e.g. final written/oral exam, solutions of problems during the course, final project to be handed-in etc.]:

The assessment is provided according to the PhD student proficiency and interest by means of an appropriate combination of written/oral exam, solutions of problems during the course, final project to be handed-in.

Suggested reading and online resources:

1. Lectures notes.
2. Lectures slides
3. G. Franceschetti, " Electromagnetics: theory, techniques and engineering paradigms" Plenum Press, USA, 1997.