ELETTROMAGNETISMO

E1 Corso di scrittura tecnico-scientifica (3 CFU)
Emilio Matricciani (Politecnico di Milano), gennaio-febbraio 2019 (date precise da definire)

E2 Artificial Materials, Metamaterials and Plasmonics for electromagnetic applications (3 CFU) - II sem
Professor Fabrizio Frezza (Sapienza Università di Roma)
Program: Frequency Selective Surfaces (FSS) and applications. Photonic (PBG) or Electromagnetic (EBG) Crystals and applications. Metamaterials and applications. The wire medium. Surface Plasmons and applications.

E3 Nanophotonics and Plasmonics (2 CFU) - II sem
Professor Concetta Sibilia (Sapienza Università di Roma)
The part of seminars related to Nanophotonics aims to introduce to students some exciting concepts that differ from conventional wave optics, with particular emphasis to the role of the evanescent fields in many practical applications, such as near field optical microscopy.
The field of plasmonics (interaction of light with electrons in metals) has attracted a great deal of interest over the past two decades, but despite the many fundamental breakthroughs and exciting science it has produced, it is yet to deliver on the applications that were initially targeted as most promising. The seminars proposed examine the primary fundamental hurdles in the physics of plasmons that have been hampering practical applications and highlights some of the promising areas in which the field of plasmonics can realistically deliver.

E4 Basics of Nonlinear Optics (2 CFU) - II sem.
Professor Concetta Sibilia (Sapienza Università di Roma)
Nonlinear Optics (NLO) is the study of phenomena that occur as a consequence of the modification of the optical properties of a material system by the presence of light. Basics and more recent applications of NLO to new light sources and devices will be presented in a series of seminars.

List of useful courses from the Master degree:

I Semester

Master E1 Microwaves (6 CFU), I sem.
Professors Marta Cavagnaro, Fabrizio Frezza, Alessandro Galli (Sapienza Università di Roma)

II Semester

Master E2 Advanced Electromagnetics and Scattering (6 CFU),
Professor Fabrizio Frezza (Sapienza Università di Roma)

Master E3 Nanostructured materials and components for electromagnetic applications (6 CFU) -
Professor Fabrizio Frezza (Sapienza Università di Roma)

Master E4 Laser fundamentals (6 CFU)
Professor Concetta Sibilia (Sapienza Università di Roma)

MATEMATICA PER L'INGEGNERIA

M1 On diffusion phenomena and fractional time-derivatives (3 CFU),
Planned period: 02/05/2019 – 31/05/2019 (maybe delayed to June)
Prof. Masahiro Yamamoto, (The University of Tokyo)

Program:
In many applications one can observe anomalous diffusion phenomena
in heterogeneous media and more accurate analysis is essentially demanded.
For example, the diffusion of contaminants in soil often indicates anomaly, which
cannot be described by the classical diffusion-advection equation and we crucially need a better model equation for reasonable predictions which guarantee public safety. Among them, the evolution equations with fractional time-derivatives are calling great attention. Although there have been many researches for fractional calculus since Leibniz, serious researches for time-fractional partial differential equations have been started only recently. In particular, the author and international research teams have established the foundation for the weak solution for initial-boundary value problems and applied it to the optimal control and inverse problems. The course aims at constructing the theory for time-fractional partial differential equations, and describing the applications, so that the audience can turn to new and fruitful research areas.

1. Introduction of fractional derivatives
2. Fractional calculus
3. Definition of fractional derivatives in Sobolev spaces and properties
4.-5. Unique existence of solution to the initial −boundary value problem
6. Asymptotic behavior, maximum principle
7. Non-homogeneous boundary value problems
8. Nonlinear equations
9. Optimal control problems
10.-12. Various inverse problems

M2 Four Lectures on Analysis (3 CFU), Planned period: May 2019
Prof. Vilmos Komornik, (Université de Strasbourg, France)

Program:
Research oriented lectures:
1. Fourier analysis in control theory
2. Combinatorial theory of numbers

Didactically oriented lectures:
3. A simplified introduction of the Lebesgue integral
4. Simple and not too well-known proofs of some important theorem of analysis

M3 The Total Variation Flow (3 CFU), Planned period: June 3-28, 2019
Prof. Jose M. Mazon, (University of Valencia, Spain)

Program:
We summarize in this lectures some of our results about the Minimizing Total Variation Flow, which have been mainly motivated by problems arising in Image Processing. First, we recall the role played by the Total Variation in Image Processing, in particular the variational formulation of the restoration problem. Next we outline some of the tools we need: functions of bounded variation (Section 2), pairing between measures and bounded functions (Section 3) and gradient flows in Hilbert spaces (Section 4). Section 5 is devoted to the Neumann problem for the Total variation Flow. Finally, in Section 6 we study the Cauchy problem for the Total Variation Flow.

M4 Lectures on Fractional Calculus and Singular Equations (4 CFU) Planned period: January -February 2019
Prof. Mirko D'Ovidio, Tommaso Leonori Francesco Petitta (SBAI, Sapienza)

M5 Lectures on Mean Field Games (2 CFU) Planned period: January -February 2019
Prof. Fabio Camilli (SBAI, Sapienza)

M6 Four Lectures on Homogenization (3 CFU), period to be defined
Prof. Claudia Timofte (University of Bucharest)

List of useful courses from the Master degree:

Master M1 Mathematical Methods for Information Engineering (3 CFU) (Corso di Laurea in Ingegneria delle Comunicazioni)
Prof. Paola Loreti (SBAI, Sapienza)

February-May 2019

Master M2 Metodi Matematici per l'Ingegneria (3 CFU) (Corso di Laurea in Ingegneria Meccanica)
Prof. Daniele Andreucci (SBAI, Sapienza)
November-December 2018

Master M3 Discrete Mathematics (3 CFU) (Corso di Laurea in Ingegneria Elettronica)
Prof. Stefano Capparelli (SBAI, Sapienza)
February-May 2019

Master M4 Metodi Numerici per l'Ingegneria Biomedica (4 CFU) (Corso di Laurea in Ingegneria Biomedica)
Prof. Francesca Pitolli (SBAI, Sapienza)
November-December 2018

SCIENZA DEI MATERIALI

S1 Experimental Methods for the Determination of the Structure and the Electronic Properties of Low-Dimensional Solid Systems (from February to June 2019)
Prof.Carlo Mariani (Sapienza Università di Roma) and Proff. Settimio Mobilio / Francesco Offi / Alessandro Ruocco (Roma Tre)

Basic Module (mandatory) 32 hours (4 CFU):
Interaction of Electromagnetic Radiation with Matter and Photoelectron Spectroscopy and Resonant Photoemission
Program
Introduction to the photoelectron spectroscopy: theoretical background, the three-step model, atoms and molecules, low-dimensional solid systems, experiments with angular resolution, time-resolved experiments. Instrumentation: charged particles, Auger electron spectroscopy and resonant photoemission. Theoretical background of absorption. Multiple scattering theory: a method for the observation of the electronic states and spectroscopy measurements. Surfaces and low-dimensional systems, electronic properties. Core-level photoemission and surface core-level shifts. Angular resolved photoemissione, electronic band structure. Band structure of exemplary 1D and 2D systems. Electromagnetic radiation sources, synchrotron radiation. Introduction to the free-electron laser: a coherent source of radiation from UV to X rays.

Optional Specialistic Modules (2 CFU)
a) Professor Paolo Postorino (Sapienza): Spettroscopia Raman in sistemi di bassa dimensionalità

b) Dr. Alberto Bravin (European Synchrotron Radiation Facility, ESRF): Metodi sperimentali di imaging tomografico con luce di sincrotrone: sorgente, strumentazione ed acquisizione dati

c) Dr. Vittorio Foglietti (CNR - Roma Tre): Tecniche di micro e nanofabbricazione

List of useful courses from the Master degree:

I semester

Master S1 Surface Physics and Nanostructure , 48 ore (6 CFU) (Corso di Laurea Magistrale in Fisica), M.G. Betti

Master S2 Chimica Fisica dello Stato Solido e dei Materiali Nano-strutturati, 48 ore (6 CFU) (Corso di Laurea Magistrale in Chimica Industriale),
D. Dini

Master S3 Sistemi di produzione ed accumulo dell'energia, 48 ore (6 CFU) (Corso di Laurea Magistrale in Chimica Industriale),
S. Panero

II semester

Master S4 Fisica dei sistemi a molti corpi, 48 ore (6 CFU) (Corso di Laurea Magistrale in Fisica), M. Grilli

Master S5 Tecnologie di fabbricazione di nanostrutture e processi di auto-assemblaggio , 48 ore (6 CFU) (Corso di Laurea Magistrale in Ingegneria delle nanotecnologie)
C. Mariani

Master S6 Laboratorio Macromolecole, 90 ore (9 CFU) (Corso di Laurea Magistrale in Chimica Industriale),
A. Martinelli

Master S7 Microscopie e tecniche di nano-caratterizzazione , 90 ore (9 CFU) (Corso di Laurea Magistrale in Ingegneria delle nanotecnologie),
M. Rossi

Master S8 Chimica dei materiali polimerici, 48 ore (6 CFU), (Corso di Laurea Magistrale in Chimica Analitica),
I. Fratoddi