Electromagnetism I

PROF. FAUSTO BORGONOVI

COURSE AIMS

To teach the basics of electrostatics in free space and in matter (conductors and dielectrics). At the end of the course the student should be able to explain the physical contents of the first two Maxwell equations.

COURSE CONTENT AND STRUCTURE

Vector algebra. Gradient. Divergence. Curl. The fundamental theorem of gradients, divergences and curls. The Dirac delta function.
The electric field. Coulomb' slaw. Field lines. Flux. Gauss' law. The curl of E. Electric Potential. Poisson's equation. Laplace's equation. Electrostatic boundary conditions. Non existence of local maxima and minima for potential. Work and energy in electrostatics. Conductors. Induced charges. Coulomb's theorem. Faraday cage. Surface charge and force on a conductor. Capacitors. Boundary conditions and uniqueness theorems. The method of images.
Electric fields in matter. Multipole expansion. The electric dipole. The dipole moment. Electric field of a dipole. Force and torque on a dipole in an electric field. Energy of a dipole in an electric field. Polarization. Induced dipoles. The field of a polarized object. Physical interpretation of bound charges. Gauss' law in the presence of dielectrics. Linear dielectrics. Boundary value problems with linear dielectrics.
Energy in dielectric systems. Forces on dielectrics.

READING LIST

D.J. GRIFFITHS, *Introduction to electrodynamics,* Prentice Hall, USA (1999)

TEACHING METHOD

Theory lectures and class exercises.
Students may also find a lot of useful questions at the following address:
http://www.dmf.bs.unicatt.it/~borgonov/DIDATTICA/ELETTROMAGN/elet1.html.

COURSE ASSESSMENT

The examination consists of:

a written test with two or more exercises. Textbooks or exercise books, but the ones available at the address: (http://www.dmf.bs.unicatt.it/~borgonov/DIDATTICA/fo.html" are not allowed.

An oral examination.

A sample of past written tests is available at:

http://www.dmf.bs.unicatt.it/~borgonov/DIDATTICA/dida3.html

Students are kindly requested to look at them before the test.

Students are also kindly requested to answer to the questions at :

http://www.dmf.bs.unicatt.it/~borgonov/DIDATTICA/ELETTROMAGN/elet1.html)

before the oral examination.

NOTES

In order to attend the lessons some preliminary concepts are required: mechanics (vectors, coordinate systems, forces, torques and energy) and analysis (functions, integrals and derivatives).

The professor receives students after the lectures. For an appointment or other questions write to

f.borgonovi@dmf.unicatt.it.