

Electromagnetism and electrical circuits for mathematician

HECTOR FREYTES

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Suitable for Ph.D students in mathematics, this course provides the basic notions about electromagnetism and electrical circuits. The first part of the course includes notions about electromagnetism in order to understand how basic electrical components (resistor, capacitor, inductor) work. The second part of the course deals with the mathematical tools used to represent and analyze passive electrical circuits.

- Course duration: 20 hours
- Class schedule: To agree with students
- Date: May 2018
- Evaluation: Monographic work
- Contact: hfreytes@gmail.com
- Prerequisites: Prior to attending this course, students should have basic knowledge on vectorial calculus and differential equations.
- **Program**

1. Elements of electromagnetism

Electric charge
Coulomb's law
Electric field
Electric flux and Gauss's law

Electric potential
Electromotive force
Capacitance and Dielectrics
Current and resistance
Magnetic Field
Ampère's law
Biot-Savart's law
Faraday's law of induction
Lenz' law
Inductance

2. Direct Current (DC) Circuits

Ohm's law
Nodes, branches and loops
Kirchhoff's law
Resistive circuit analysis
Power in resistive circuits
RC-circuits
RL-circuits

3. Alternating current (AC) circuits

Sinusoids and phasors
Impedance
Kirchhoff's law in frequency
Power in reactive circuits

References

- [1] C. Alexander, M, Sadiku: *Fundamentals of Electric Circuits*; McGraw-Hill 5th edition (2012).
- [2] J. Nilsson, S. Riedel: *Electric Circuits*; Prentice Hall, 7th edition (2004).
- [3] D. Cheng: *Fundamentals of Engineering Electromagnetics*; Prentice Hall, 1st edition (1992).