FSAB1202 Physics 2

[30h+30h exercises] 6 credits

This course is taught in the 2nd semester

Teacher(s):	Guy Campion, Jean-Claude Samin, Piotr Sobieski (coord.)
Language:	French
Level:	First cycle

Aims

Introductory course to electromagnetics and mechanics of rigid bodies.
At the end of the course, students are expected to be able:
1. to express the movement equations of a rigid body supporting various forces in the vectorial form (Newton-Euler equations); to derive system motion equations in terms of generalized coordinates and their derivatives, for a system of interconnected rigid bodies;
2. to use a cutting method to compute a force (or torque) inside an internal link;
3. to use the basic laws of electromagnetism in order to solve simple electromagnetical or electromechanical problems;
4. to integrate the various electromagnetical phenomena in the Maxwell equations formalism.

Main themes

The course is divided in two parts. The first one (3ECTS) deals with the mechanics of rigid bodies; the second one (3ECTS) introduces the fundamentals of electromagnetism. Both parts extend the skills acquired previously by the students during course FSAB1201 Physics 1.
The first part starts with elements of 3D vector geometry needed to represent the instantaneous configurations of one or several interconnected rigid bodies. Next its derives the equations describing the dynamics of a single rigid body (Newton-Euler equations), and then it deals with the tools necessary to modelize rigid bodies dynamics (by means of generalized coordinates). Finally, it briefly presents some elements of rigid bodies static's (cutting method, iso- and hyper-static configurations,#).
The second part introduces basic laws of electromagnetism, and their applications in vacuum and matter as well (Biot-Savart & Ampere laws; magnetic induction, simple magnetic circuits). Induction phenomena due to variable magnetic fields (Lenz-Faraday laws, inductance) are then treated. This part concludes through an integrated approach of electromagnetical phenomena within the formalism of Maxwell equations.
3. Summary: content and methods
Part 1. Mechanics of rigid bodies
- Vectorial geometry and kinematics in 3D
- Dynamic characterization of a rigid body (mass center, inertia, #)
- Dynamics of a system of interconnected rigid bodies
- Static of a system of rigid bodies
Part 2. Magnetostatics - induction - electromagnetic field
- Magnetostatics in vacuum
- Magnetostatics in matter
- Electromagnetic induction phenomena
- Electromagnetic field
Methods: Problem-based learning, exercises, lectures, practical classes

Content and teaching methods

Part 1. Mechanics of rigid bodies
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Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

The evaluation has 2 components: an intermediary evaluation during the quadrimester and a final exam at the end of the quadrimester (written exam). The final mark is a combination of the scores in these two evaluations
- Workfiles for each of the parts (available on the website and in
printed version); Reference book: University Physics (Freedman and Young)

Other credits in programs

ARCH11BA	Première année de bachelier en sciences de l'ingénieur, orientation ingénieur civil architecte	(6 credits)	Mandatory
ARCH12BA	Deuxième année de bachelier en sciences de l'ingénieur, orientation ingénieur civil architecte	(6 credits)	
FSA11BA	Première année de bachelier en sciences de l'ingénieur, orientation ingénieur civil	(6 credits)	Mandatory