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<tr><th>PHYSICS_S5A
Fall Semester
Undergraduate/Junior</th><th>Physics 1A</th><th>4 credits
Case study: 50%
Final exam: 50% (3h)</th></tr>
<tr><td colspan="3">This course aims at providing the basic notions in physics. At the outcome, the student will :
- Acquire the general knowledge needed for the ENSEA curriculum and the understanding of emerging technologies (spintronics…)
- Master the fundamental concepts of quantum physics (postulates) and electromagnetism
- Modelize a simple physical problem to analyze it and infer its properties.
- Acquire a general scientific methodology</td></tr>
<tr><td colspan="3">Prerequisite: None</td></tr>
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<tr><th>DEP_1312</th><th>Electromagnetism 1A</th><th>Language</th></tr>
<tr><td>Lecture: 12</td><td>Tutorials: 4</td><td></td></tr>
<tr><td colspan="3">Maxwell equations in vacuum and media
- Electromagnetic wave propagation, free propagation in particular media, guided propagation, radiation, reflection, transmission and diffraction
Light sources
- Ideal light sources, imperfection and coherence of a real light source, dispersion, temporal coherence and interferences, coherency improvement, LASER sources.
Wave optics
- Diffraction and Fourier's optics, diffraction theory, applications.</td></tr>
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<tr><th>DEP_1312</th><th>Quantum electronics 1A</th><th>Language</th></tr>
<tr><td>Lecture: 12</td><td>Tutorials: 4</td><td></td></tr>
<tr><td colspan="3">Introduction to quantum physics: general principles and applications.
- Highlight of the need of quantum physics with historical experiments (matters wave diffraction, Stern & Gerlach, photoelectric effect…)
- Recent technological advances: quantum computer, quantum cryptography, spintronics, tunnel-effect components
- General principles: superposition, entanglement, uncertainty
Fundamental tools
- Wave & matrix formulation: postulates, state vector/wave function, physical quantity measurement (results, possible state, statistics…)
- Uncertainty principle, Schrodinger equation
- Stationary states theory, tensor product, perturbations theory
Spin, magnetism and applications
- Magnetism fundamentals (magnetic moment, interaction energy)
- Electron spin quantum description (Stern & Gerlach, Pauli matrices…) and generalization (light polarization)
- Applications (MRI, spintronics)
Case study: Potential well and potential step, Quantum tunnelling, harmonic oscillator, atom…</td></tr>
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<tr><th>DEP_1313</th><th>Physics: case study</th><th>Language</th></tr>
<tr><td></td><td>Tutorials: 18</td><td></td></tr>
<tr><td colspan="3">Case study of a complex system in Physics, using notions learnt in this module. Students have to associate literature search, system analysis and modelisation, numerical simulation and experimentation potentially. The flipped classroom model is used and results are to be presented (possibly in English) in front of the class and summarized in a written report.</td></tr>
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