Physique des technologies de l'information

Lecturer
Philippe EMPLIT (Coordinator)

Course mnemonic
PHYS-S201

ECTS credits
5 credits

Language(s) of instruction
French

Course period
Second term

Campus
Solbosch

Course content

This course contributes to the "Energy pathway" of the “Sustainable Development Initiative @ SBSEM” that seeks to provide an integrated training in sustainability.

This applied physics course is mostly about electromagnetism and its applications in the field of information technology.

It covers the basics of electricity and circuit theory, semiconductors and electronics, propagation of electromagnetic waves and guided wave optics, principles of analog and digital telecommunication, as well as a brief overview of recent development in ultra-high repetition rates photonic communication systems. LED light sources and their applications beyond data transmission are studied with a particular focus on their impact with respect to UNO sustainable development goals.

Temporal description and spectral analysis are both used for modelling physics of information technology, in order to underline and optimize their complementarity.

The table of content and its structuration in thematic modules are the following:

- [Module 1] General introduction: the course syllabus
- [Module 2] Time-dependent signals: temporal and spectral descriptions
- [Module 3] Electricity, circuits and filters
- [Modules 4 to 8] Analog electronics: semiconductor materials and components (rectifiers, transistors, ...)
- [Module 9] Electromagnetism et waves
- [Module 10] Elements of telecommunication
- [Module 11] The LED technology and its environmental impact
- [Module 12] General conclusion

[A module is a thematic set of learning activities, including typically one or two lectures, one exercise tutorial session, and one open tutoring session; practical work (laboratories) cover modules 2 to 8]

Objectives (and/or specific learning outcomes)

At the end of this course, the student will be able to :

- Describe the links between some fundamental properties of mathematics and physics, and their implication in the field of information technologies.
- Use a carefully appropriate formalism -the spectral analysis of signals- in the modelling process of complex physical phenomena in some elements of telecommunication systems.
- Explain the principal properties of basic electronic circuits used in the processing of elementary signals of telecommunication; realize and characterize some of those circuits.
- Critically analyse the contribution of emerging efficient semiconductor technologies, as LED-based devices, to UNO sustainable development goals

Pre-requisits and co-requisits

Pre-requisites courses

PHYS-S1001 | Connaissances fondamentales et éléments de physique | 10 crédits

Required knowledge and skills

Mastering the following items is helpful:

- Logarithm
- Complex numbers
- Basic analysis of electrical circuits (Kirchhoff laws)

Teaching method and learning activities

Besides 40h of traditional lecturing, PHYS-S201 includes 18h classes of exercise tutorial sessions, 2h of virtual laboratory simulation sessions and 3 half-days laboratory practical work sessions aimed at the realization of a mini-project in electronics.

Contribution to the teaching profile

This course contributes, entirely (or partially), to the development of the following learning outcomes of the bachelor degrees in Business engineering and in Economics:

- LO 1.1 Apply fundamental concepts, tools and models (in economics and management) to formulate a well-defined problem and propose a multidisciplinary solution.
- LO 1.2 Understand the scientific and technological principles (and their impact on managerial analysis).

- LO 1.3 Integrate sustainable development in analyses.
- LO 2.1 Adopt a scientific approach to data collection, research and analysis and communicate results with clear, structured and sophisticated arguments.
- LO 2.2 Display critical thinking, logical and abstract reasoning and develop an independent approach to learning.
- LO 3.1 Apply quantitative and qualitative techniques to support problem solving using standard office and scientific software.
- LO 4.1 Work and communicate effectively as part of a team (in an international and multicultural environment).
- LO 4.2 Recognize ethical dilemmas (and contribute to solving them).

References, bibliography and recommended reading

The following 3 textbooks could constitute a support to help study PHYS-S201 (a list of concerned chapters is given in the corresponding slides of the course):

- Eugene Hecht - Physique : 2. Electricité et magnértisme - De Boeck Université (2007) - ISBN 978-2-8041-51818-6 [tel:978-2-8041-51818-6] /
- Eugene Hecht - Physique : 3. Ondes, optique et physique moderne - De Boeck Université (2007) - ISBN 978-2-8041-5182-6 [tel:978-2-8041-5182-6] /
- Albert P. Malvino and David J. Bates - Principes d'électronique : cours et exercices corrigés - Dunod (2008) 7e ed. - ISBN 978-2-10-051613-1

Further readings are mentioned in an appropriate section of the course space, on the Université virtuelle, the learning management system of ULB.

Course notes

Université virtuelle, Podcast and Syllabus

Other information

Place(s) of teaching

Solbosch

Contact(s)

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Evaluation method(s)

written examination, Written report and Other

written examination

Closed question with Multiple Answers (MAQ) and Open question with developed answer

Evaluation method(s) (additional information)

Students are offered self-assessment through:

- Online self-assessment quizzes organized during the term on the Université virtuelle course space.
- Taking part to on-site exam simulation(s).

The mark of this course is based on:

- The term activity during exercise tutorial sessions.
- The term compulsory laboratory activity and report.
- The result of written examination(s).

Except indication to the contrary, an absence to one of the marked activities results in the absence of mark for the entire course.

Determination of the mark (including the weighting of partial marks)

The term laboratory mark represents 20% of the global mark of PHYS-S201. The result of written examination(s) represents 80% of the global mark

The term mark for activity during exercise tutorial sessions represents an additional bonus/malus.

Both term marks are part of the final mark of both sessions (end of 2nd and 3rd term-quadrimester). :

Main language(s) of evaluation

French

Programmes

Programmes proposing this course at the Solvay Brussels School of Economics and Management

BA-ECON | Bachelor in Economics : General | unit 3 and BA-INGE | Bachelor in Business engineering | unit 2