




5.00 credits

22.5 h + 22.5 h

Q1

Teacher(s)	Cortina Gil Eduardo ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	No pre-requisites. However, having followed LPHY2103 is an asset.
Main themes	This teaching unit is designed to introduce the student to digital electronics and data acquisition systems with special emphasis in a practical work through a personal project.
Learning outcomes	<p><b>At the end of this learning unit, the student is able to :</b></p> <p><b>1. Contribution of the teaching unit to the learning outcomes of the programme (PHYS2M and PHYS2M1)</b> AA1: A1.1, A1.5 AA2: A2.5</p> <p><b>1. Specific learning outcomes of the teaching unit</b> At the end of this teaching unit, the student will be able to :</p> <ol style="list-style-type: none"> <li>1. Describe how digital devices works in terms of the fundamental logical operations ;</li> <li>2. Analyze and design a finite state machine ;</li> <li>3. Use a simple communication protocol (I2C, USB, OneWire, ...) to readout a sensor.</li> <li>4. Program an FPGA using VHDL (or Verilog)</li> <li>5. Link a FPGA to a computer.</li> </ol>
Evaluation methods	The evaluation is based on: <ul style="list-style-type: none"> <li>- laboratory work. Continuous evaluation (25%)</li> <li>- Weekly exercices and assignments. Continuous evaluation (25%)</li> <li>- presentation of an acquisition project : oral questioning (50%).</li> </ul> All three parts should be passed with more than 50% each.
Teaching methods	Lectures and exercises sessions in auditorium. Directed practical work (compulsory) : <ul style="list-style-type: none"> <li>- experimental study of basic circuits;</li> <li>- simulation of circuits;</li> <li>- weekly assignments.</li> </ul> Project : developing an acquisition system with an FPGA and/or RaspberryPi : <ul style="list-style-type: none"> <li>- implementation of a serial reading protocol (type I2C, USB, ...);</li> </ul>
Content	<ol style="list-style-type: none"> <li>1. Digital and analog signals and systems.</li> <li>2. Number systems, operations and codes.</li> <li>3. Logic gates and gate combinations.</li> <li>4. Combinational logic : adders, decoders, comparators, multiplexers, ...</li> <li>5. Sequential logic : flip-flops, timers, shift registers, counters, ...</li> <li>6. Counters : finite state machines.</li> <li>7. Programmable logic : VHDL.</li> <li>8. Data transmission.</li> <li>9. Signal conversion : ADC, DAC, ...</li> <li>10. Buses and interfaces : serial and parallel buses, USB, I2C, ethernet.</li> </ol>
Bibliography	<ol style="list-style-type: none"> <li>1. Digital Fundamentals, 11th Edition (<a href="http://www.pearsonglobaleditions.com/Sitemap/Floyd/">http://www.pearsonglobaleditions.com/Sitemap/Floyd/</a>), Thomas Floyd, Ed. Pearson.</li> <li>2. Acquisition de Données. Du Capteur à l'Ordinateur, Georges Asch et collaborateurs, Ed. Dunod.</li> </ol>
Faculty or entity in charge	PHYS

<b>Programmes containing this learning unit (UE)</b>				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Additionnal module in Physics	<a href="#">APPHYS</a>	5		
Master [60] in Physics	<a href="#">PHYS2M1</a>	5		
Master [120] in Physics	<a href="#">PHYS2M</a>	5		
Master [120] of Education, Section 4 : Physics	<a href="#">PHYS2M4</a>	5		