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| **EECE 4740: Advanced VHDL and FPGA Design**  |
| **Course Description**: |
| Present the background, abstractions, and techniques for advanced digital circuits design and optimization. Emphasis is placed on specification and synthesis using VHDL and on prototyping using FPGAs of complex systems. Such systems represent examples from various application domains, including processors, image and video processing, filtering and other DSPs, and power electronics.  |
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| **Required or Elective**: | Elective |
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| **Prerequisites**: | EECE-2030, EECE 3015 |
| **Selected Elective** in the ELEN Electronic Devices and Systems area, COEN Hardware area (breadth & depth)  |
| **Course Materials** |
| **Required**: | Research papers, lecture notes, and other teaching materials will be distributed during classes. No specific textbook is required.  |
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| **Course Goals:** |
| To provide students the ideas and concepts required to understand the design of modern complex digital circuits, including VHDL specification and debug, FPGA implementation and testing, and design optimization techniques for performance, power, and area.  |
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| **Course Objectives:** |
| *By the end of this course you should be able to perform the following tasks:* 1. Describe Field Programmable Gate Array (FPGA) technologies.
2. Describe typical design methods of digital circuits implemented as FPGA circuits.
3. Utilize VHDL to specify complex circuits and synthesize these circuits with CAD tools (e.g., Altera and/or Xilinx tools).
4. Describe and utilize simulation tools for measuring and reporting performance of complex digital systems.
5. Conduct experiments using an evaluation board to confirm the analysis done in class.
6. Prepare informative and organized written and video reports that describe the methodologies employed, the results obtained, and the conclusions made in simulation and hardware experiments.
7. Prepare review-type reports of selected technical research articles.
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| **Course Topics:** |  |
| 1. Introduction
2. VHDL concepts and programming
3. Field Programmable Gate Array (FPGA) technologies
4. Design methods for FPGA circuits
5. Specification, synthesis, and FPGA implementation of selected complex systems, e.g. digital camera, network-on-chip, video game, video encoders and decoders, and processors.
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| **Contribution to Professional Component**: | Engineering Science 40% |
|  | Engineering Design 60% |
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| **Contribution to Program Outcomes:** | *Partial fulfillment of ABET Criterion 3 outcomes A, C, E, I* |
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| **Course Coordinator**: | Cristinel Ababei, Ph.D., Assistant Professor |
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| **Last Modified**:  | Nov.13.2017  |