Introduction to Digital Logic

ECE 2060

Credit Hours:
3.00

Course Coordinator:

Course Length:
14 weeks (autumn or spring)
12 weeks (summer only)

Representative Textbooks and Other Course Materials:

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Year</th>
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<tbody>
<tr>
<td>Fundamentals of Logic Design</td>
<td>Roth, Jr. and Kinney</td>
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Course Description:
Introduction to the theory and practice of combinational and clocked sequential networks.

Designation:
Required
Elective

Course Goals / Objectives:
Master the number representations used in today's digital systems and their arithmetic properties and conversion techniques
Master analyzing, synthesizing, and designing networks of combinational, digital logic elements
Be competent to analyze, design and synthesize digital clocked sequential circuits
Be familiar with modern computer tools for digital design, verification and simulation
Be familiar with how to implement their design schematics to hardware using modern FPGAs
Be familiar with digital circuit design methods
Be competent in reporting standards
Be competent in using laboratory instruments and laboratory methodology
Exposure to methodology for critical troubleshooting skills
**ABET-EAC Criterion 3 Outcomes:**

<table>
<thead>
<tr>
<th>Significant contribution (7+ hours)</th>
<th>1</th>
<th>an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics</th>
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</thead>
<tbody>
<tr>
<td>Substantial contribution (3-6 hours)</td>
<td>3</td>
<td>an ability to communicate effectively with a range of audiences - pre-2019 EAC SLO (g)</td>
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<tr>
<td>Substantial contribution (3-6 hours)</td>
<td>5</td>
<td>an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives</td>
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<tr>
<td>Substantial contribution (3-6 hours)</td>
<td>6</td>
<td>an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions</td>
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**Course Topics:**

- Number systems and conversion
- Boolean algebra
- Karnaugh maps
- Multi-level gate circuits and combinatorial logic.
- Multiplexers, decoders and PLDs
- Latches and flip-flops
- Registers and counters
- Timing (delays, timing diagrams)
- Analysis of clocked sequential circuits (general models for sequential circuits, timing charts, state tables, graphs)
- Design of clocked sequential circuits
- Finite state machines, flow diagrams, mapping to flip-flop circuits with logic gates.

Introduction to the Audio Synthesizer: build a synthesizer, Students also learn how to use Matlab to create memory contents for ROM look-up tables. Finally students are introduced to bit shifting as a means of scaling signed and unsigned numbers.

Simon Logic Game: Students build a state machine based logic game that presents a sequence of 4 lights and 4 audio tones that must be matched in sequence. This project incorporates all aspects of the course.