Digital Fundamentals

COURSE DESCRIPTION

This course introduces the principles of digital logic analysis and design. Topics include logic functions, logic gates, number systems and conversions, Boolean algebra, logic simplification, combinational circuits, programmable logic devices, sequential circuits, and use of analysis and simulation software. The laboratory provides hands-on experience with devices and circuits discussed in the classroom. Multisim software is used for digital circuit analysis and simulation.

Pre-requisite
ENTC 2414 (Circuit Analysis I).

STUDENT LEARNING OUTCOMES

This course is designed to enable students to:

- Convert between decimal, binary, and hexadecimal numbers.
- Perform arithmetic functions in the bases studied.
- Understand and use basic digital gates.
- Apply the basic laws and rules of Boolean algebra and Karnaugh mappings.
- Analyze combinational logic circuits and write their Boolean output expressions.
- Design and simplify a combinational logic circuit for a given Boolean expression or truth table.
- Understand basic sequential logic elements.
- Design and simplify a sequential logic circuit.

Required or Recommended Readings

Textbook:

Recommended or Supplemental Reading:
4. Digital Design with CPLD Applications and VHDL, Dueck, Delmar, 2001
11. Digital Electronics, Bignell and Donovan, Delmar, 1994

NOTE: Most are available in the University library.
INSTRUCTIONAL METHODS AND ACTIVITIES
Methods and activities for instruction include the following: lectures, group discussions, homework assignments/solutions, lab experiments/exercises, software simulation, and a project.

ENGINEERING LIBRARY RESOURCES
The Mary and Jeff Bell Library houses substantial engineering reference materials available for research and coursework support. Designated coursework will require access and use of these resources as a portion of the grade for assigned work.

EVALUATION AND GRADE ASSIGNMENT
Evaluation of student performance is based on homework assignments, two midterms, lab experiments/exercises, quizzes, and a final exam. Tests, except the final, are graded and returned within a week from the date they are taken. No makeup exams are given in this course. You may examine the final exam within four weeks after the final grades are mailed to you. The final grade is assigned as follows.

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<thead>
<tr>
<th></th>
<th>Percentage</th>
<th>If</th>
<th>Tentative Grade</th>
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<tbody>
<tr>
<td>Midterm 1</td>
<td>15</td>
<td>90 &gt; Total</td>
<td>A</td>
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<tr>
<td>Midterm 2</td>
<td>15</td>
<td>80 &lt; Total &lt; 90</td>
<td>B</td>
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<tr>
<td>Quizzes</td>
<td>10</td>
<td>70 &lt; Total &lt; 80</td>
<td>C</td>
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<tr>
<td>Homework</td>
<td>10</td>
<td>60 &lt; Total &lt; 70</td>
<td>D</td>
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<tr>
<td>Labs</td>
<td>15</td>
<td>Total &lt; 60</td>
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<td>Attendance/Participation</td>
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<tr>
<td>(Organized &amp; Complete)</td>
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<tr>
<td>Final exam</td>
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SAFETY
The safety of students, faculty, staff and visitors to the ET laboratories is of paramount importance to the ET programs. You must follow safety procedures and use personal protective equipment as required in each laboratory. Any student that attempts to use equipment without authorization or that violates any safety policy or regulation will be immediately removed from the laboratory.

FOOD AND DRINKS
Eating/drinking is not permitted in the LAB.

Cell Phone/Electronic Device Usage
Any cell phone and electronic device usage during the class times is not allowed.

SUPPORT SERVICES FOR STUDENTS WITH DISABILITY
Refer to the University Catalog.

ATTENDANCE POLICY
You must attend all classes. You are responsible for any materials covered or handed out or announcements made in your absence. Records of your attendance will be maintained. Students missing classes without the instructor's permission may be withdrawn from the course. Tardiness without the prior consent of the instructor is not accepted.
ACADEMIC HONESTY
University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) The instructor reserves the right not to grade, or grade only partially any of the submitted assignment. During an assignment you are allowed to have only what is permitted by instructor, anything else (cell, notebook, book etc) encounter in your possession will be considered cheating and a proceeding to penalized and document such an act will take place.

Classroom/professional and ethical behavior
Students are expected to behave in an ethical and professional manner in all class and lab activities. If you feel uncertain about a particular activity, please speak to me BEFORE problems arise. Ethical behavior is a requirement for passing this course.

ASSIGNMENTS
Late assignments are not normally accepted. The student will receive a zero on assignments that are turned in after the due date unless a written permission (by email) is secured (from the instructor) prior to the due date. Assignments may be turned in before the due date (they may be left in my mailbox, sent with a classmate, mailed, etc.). Note that hardware or software failure or machine unavailability does not merit an extension on the assignment.

LAB EXPERIMENTS
The goal of the laboratory sessions is to analyze and verify the theoretical ideas learned in the classroom. Most experiments require written reports. The report is typically due one week after the experiment is performed if no due date given. Late reports are not normally accepted. Reports, however, may be turned in before the due date (they may be left in my mailbox, sent with a classmate, mailed, faxed, etc.). Students are expected to work more hours than scheduled to finish the experiments.

EMAIL ADDRESS
When necessary I will be sending information to your e-mail address as written in your Islander Blackboard. If you prefer you may change this to a personal address. It is your duty to update this and to check your e-mail daily.

Dropping a Class
I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with me before you decide to drop to be sure it is the best thing to do. Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class.
TENTATIVE WEEKLY SCHEDULE

<table>
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<tr>
<th>WK</th>
<th>Week of</th>
<th>Readings</th>
<th>Topics</th>
<th>Exams</th>
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<tr>
<td>1</td>
<td>8/22</td>
<td>Ch. 1</td>
<td>Digital concepts</td>
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<tr>
<td>2</td>
<td>8/29</td>
<td>Ch. 2</td>
<td>Number systems and codes</td>
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<tr>
<td>3</td>
<td>9/5</td>
<td>Ch. 3</td>
<td>Logic gates</td>
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<td>4</td>
<td>9/12</td>
<td>Ch. 4</td>
<td>Boolean algebra</td>
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<td>5</td>
<td>9/19</td>
<td>Ch. 4</td>
<td>Logic simplification</td>
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<td>6</td>
<td>9/26</td>
<td>Ch. 5</td>
<td>Combinational logic</td>
<td>MID 1</td>
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<td>7</td>
<td>10/3</td>
<td>Ch. 5</td>
<td>NAND and NOR circuits</td>
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<tr>
<td>8</td>
<td>10/10</td>
<td>Ch. 6</td>
<td>Functions of combinational logic</td>
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<tr>
<td>9</td>
<td>10/17</td>
<td>Ch. 6</td>
<td>Functions of combinational logic</td>
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<tr>
<td>10</td>
<td>10/24</td>
<td>Ch. 7</td>
<td>Latches, flip-flops, one-shots and timers</td>
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<td>10/31</td>
<td>Ch. 8</td>
<td>Counters</td>
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<tr>
<td>12</td>
<td>11/7</td>
<td>Ch. 9</td>
<td>Shift registers</td>
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<td>13</td>
<td>11/14</td>
<td>Ch. 10</td>
<td>Memory and Storage</td>
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<td>14</td>
<td>11/21</td>
<td>Ch. 11</td>
<td>Programmable Logic and Software</td>
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<tr>
<td>15</td>
<td>11/28</td>
<td>Ch. 12-13</td>
<td>Intro. to Computers and DSPs</td>
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<td>16</td>
<td>12/5</td>
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<td>Review</td>
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Date: Monday, December 12, Time: 4:30-7:00 p.m. FINAL

Tentative Laboratory Schedule (Subject to change)

EXP. #       TITLE
1    Lab Instruments
2    Constructing a Logic Probe
3    Number Systems
4    Logic Gates
7    Boolean Laws & DeMorgan's Theorem
8    Logic Circuit Simplification
9    The Perfect Pencil Machine –Design
9    The Perfect Pencil Machine - Build and Demo
11   Adder and Magnitude Comparator
12   Combinational Logic Using Multiplexers
13   Combinational Logic Using Demultiplexers
14   The D Latch and D Flip-Flop
16   The J-K Flip-Flops
17   One-Shots and Astable Multivibrators
20   Design of Synchronous Counters
21   The Traffic Light Controller
22   Shift Register Counters
25   Semiconductor Memories
26   Introduction to Intel Processors
28   D/A and A/D Conversion

* Changes, if any, will be announced in class

NOTE1: Campus is closed for Labor Day 9/5
NOTE2: Campus is closed for Thanksgiving, 11/24-11/25
NOTE3: Last day of classes 12/6