CENG 244/244L – INTRODUCTION TO DIGITAL SYSTEMS

Catalog Data: Introduction to Digital Systems
(3-1) 4 Credits. Prerequisite: Completion of college algebra or equivalent. This course is designed to provide Computer Engineering, Electrical Engineering, and Computer Science students with an understanding of the basic concepts of digital systems and their hardware implementation. Topics covered include combinational logic circuits, sequential logic circuits, and CPU control.


Coordinator: Elaine Linde, Instructor
Office: EP 316; Phone: 394-5196, E-mail: Elaine.Linde@sdsmt.edu
Office Hours: 10:00 – 10:50 MWF, 12:00-1:50 MWF

Lecture: Monday/Wednesday/Friday 3:00-3:50 a.m. EP 254
Lab: Tuesday 12:00-1:50 p.m. EP 336
       Tuesday 2:00-3:50 p.m. EP 336

Objectives: The objective of this course is to provide students with an understanding of the basic concepts associated with the analysis and design of combinational circuits and sequential circuits. Combinational circuits include AND, OR, NOT, NAND, and NOR logic gates, adders, code converters, and memory devices. Sequential circuits include flip-flops, registers, counters, and programmable logic devices.

Topics:
Binary Systems
   Binary, Hexadecimal, Decimal, and Binary Coded Decimal Numbers
   Number Conversion
   Signed and Unsigned Binary Numbers
   Two’s Complement
   Binary Logic
Boolean Algebra
   Postulates and Theorems
   Logic Gates
   Truth Tables
   Implementation of Boolean Functions with Logic Gates
   Integrated Circuits
Boolean Function Simplification
   Karnaugh Maps
   Product of Sums
   Sum of Products
Combinational Logic
   Design Procedure
   Adder Circuits
   Analysis Procedure
   Truth Tables
   Decoders and Encoders
   Demultiplexers and Multiplexers
   Read Only Memory & Random Access Memory
Students use Protei 99 SE to program EPROMs and PALs. Students use Xilinx ISE Foundation to perform schematic entry and simulation.

Outcomes: Upon completion of this course, students should demonstrate the ability to:

1. Convert numbers between binary and decimal, binary and hexadecimal, and decimal and binary coded decimal notation.
2. Perform the mathematical operations of addition, subtraction, multiplication, and division using signed and unsigned binary numbers.
3. Analyze combinational logic circuits using AND, NOT, OR, NOR, NAND, and XOR logic gates.
4. Design combinational logic circuits using truth tables and Karnaugh maps.
5. Program EPROMs and PALs using Protei software.
6. Analyze sequential logic circuits and prepare timing diagrams using Flip-Flop Characteristic Tables.
7. Design sequential logic circuits using state diagrams, state tables, and Flip-Flop Excitation Tables.
8. Construct logic circuits in the laboratory using student trainer boards.
9. Design and construct digital control and data processing circuits using ASM charts to define digital hardware algorithms.

Relation of Course to Program Objectives:
These course outcomes fulfill the following program objectives:

(a) An ability to apply knowledge of mathematics, science, and engineering.
(b) An ability to design and conduct experiments, as well as to analyze and interpret data.
(c) An ability to design a system, component, or process to meet desired needs.
(e) An ability to identify, formulate, and solve engineering problems.
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The following table indicates the relative strengths of each course outcome in addressing the program objectives listed above (on a scale of 1 to 4 where 4 indicates a strong emphasis):

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<th>Outcomes</th>
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Lab Projects: A number of laboratory assignments will be conducted throughout the course. The laboratory sections will meet every week for two hours each. Most labs will have preliminary work that needs to be done ahead of time and documented in a suitable log book. All log book entries should be made in ink. Demonstration of your lab work and documentation is expected.

Grading: The following grading scheme is tentatively planned. Adjustments may be made depending on the actual amount of material covered.

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<th>Component</th>
<th>Weight</th>
<th>Range</th>
<th>Grade</th>
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<tr>
<td>3 1-Hour Exams</td>
<td>30%</td>
<td>90-100%</td>
<td>A</td>
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<tr>
<td>Homework</td>
<td>15%</td>
<td>80-89%</td>
<td>B</td>
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<tr>
<td>Quizzes</td>
<td>10%</td>
<td>70-79%</td>
<td>C</td>
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<tr>
<td>Labwork</td>
<td>20%</td>
<td>60-69%</td>
<td>D</td>
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<tr>
<td>1 2-Hour Final</td>
<td>25%</td>
<td>0-59%</td>
<td>F</td>
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You must earn at least a 60% exam average to pass the class.

Late Policy: Assignments which are not turned in by the announced deadline will be assessed a -10% per day late penalty (not counting weekends and holidays). All lab projects must be completed to pass the course. The grade F will be assigned if lab projects are not completed.

Integrity Policy: You are expected to do your own work (as an individual or as a team as the case may be); however, one can learn by consulting with others. If you receive help from others on assignments, acknowledge that assistance appropriately. Understand that there is a significant difference between consulting or asking someone a question versus outright copying or plagiarism. If individuals or teams turn in assignments that are clearly not their own work, all parties involved can expect to receive no credit for that assignment.

ADA Policy: Students with special needs or requiring special accommodations should contact the instructor, Elaine Linde, at 394-5196 and/or the campus ADA coordinator, Dr. Jolie McCoy, at 394-1924 at the earliest opportunity.

Freedom In Learning: Students are responsible for learning the content of any course of study in which they are enrolled. Under Board of Regents and University policy, student academic performance shall be evaluated solely on an academic basis and students should be free to take reasoned exception to the data or views offered in any course of study. Students who believe that an academic evaluation is unrelated to academic standards but is related instead to judgment of their personal opinion or conduct should contact the dean of the college which offers the class to initiate a review of the evaluation.

Examinations
- No electronic device can be present during an exam. All cell phones, audio players, calculators (unless specified by instructor), PDA, computer, etcetera must be turned off and put away during exams.
- No beverage containers are allowed in the exam.
- All hats must be removed and put away.
- Random seating will be assigned at the time of the examination.
- Different versions of the examination may be used.
- The penalty for cheating on an exam will be failure from the class. The student has the option appeal this decision.