EET 251

DIGITAL CIRCUIT FUNDAMENTALS

COURSE DESCRIPTION

Introduces the basic theory, concepts and devices behind digital circuitry and computers, including gates, registers, flip-flops, counters, decoders and encoders, half-adders and full-adders, clocks. The electrical characteristics, limitations and connections of digital integrated circuit packages are explored. Corresponding labs reinforce lecture materials through practical examples.

<table>
<thead>
<tr>
<th>Text(s):</th>
<th>Digital Fundamentals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Textbook</td>
<td>By Thomas L. Floyd</td>
</tr>
<tr>
<td></td>
<td>Publisher: Pearson/Prentice Hall</td>
</tr>
<tr>
<td>Lab Manual</td>
<td>Experiments in Digital Fundamentals</td>
</tr>
<tr>
<td></td>
<td>By David M. Buchla</td>
</tr>
<tr>
<td></td>
<td>Publisher: Pearson/Prentice Hall</td>
</tr>
</tbody>
</table>

| Prerequisites:   | EET 139                                  |
| Co-requisites:   | None                                     |
| Credits:         | 4                                        |
| Lecture Hours:   | 3                                        |
| Studio/Lab Hours:| 3                                        |
| Coordinator      | Dominick T. Defino                       |
| Latest Review:   | Spring 2014                              |

Instructor:       Office Hours:
Office No.:       Email: xxxx@mccc.edu

Attendance Policy

Mercer County Community College does not have a “cut system.” Students are expected to attend all classes of every course on their schedules. Only illness or serious personal matters may be considered adequate reasons for absence.

It is the prerogative of the instructor to excuse absences for valid reasons, provided the student will be able to fulfill all course requirements.

Student performance in classes is formally verified at the middle of each full semester. If a student’s attendance has been infrequent or performance unsatisfactory, he or she may receive notification in the mail. At any time, the instructor may withdraw the student from class for insufficient attendance.
Academic Integrity

Students are required to perform all the work specified by the faculty and are responsible for the content and integrity of all academic work submitted, such as papers, reports, and examinations. A student will be guilty of violating the Rule of Academic Integrity if he or she:

Knowingly represents the work of others as his or her own;
Uses or obtains unauthorized assistance in any academic work;
Gives fraudulent assistance to another student.
Intentionally damages any contents of the lab or classroom
Is found to have stolen anything from the lab or classroom

Penalty
First violation for stealing or damaging is F in the course.
First violation on test or project is an “F” grade for the test or project.
Second violation is “F” in the course.

Temporary Grade Policy

If you do not complete the course requirements by the end of the semester, and you have a prior agreement with the instructor, you may be given an INC (incomplete). INC indicates that the instructor is affording extra time to earn a grade in the course. The amount of extra time is determined by the instructor, up to a maximum of 16 calendar weeks after grades are submitted. An INC grade which has not been resolved within 16 calendar weeks is changed to an F or NC (no credit) grade, as appropriate to the course.

Audit

If you audit the course, you will receive an “AU” grade—this cannot be changed to a letter grade.

Withdrawal Course Requirements:  Deadline: See Campus Calendar

To receive a W grade for any course, a student must consult with the course instructor or an appropriate division representative and then withdraw officially before two-thirds of the course has been completed by submitting a withdrawal form to the Office of Student Records. Withdrawal after this point results in a grade other than W (usually F). At any time before two-thirds of the course has been completed, the instructor may also withdraw with a W grade any student who has been absent excessively. A student thus withdrawn will not be entitled to any refund of tuition or fees. The student may appeal this action.
Method of Instruction

Learning will take place via classroom instruction, demonstrations, and student activities, as well as through textbook reading and homework assignments. Lab activities will augment this.

Use of equipment and manual skills will be developed in the lab.

Grading

The final grade will be based on three test grades, lab report grades and class participation.

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Nominal %</th>
<th>Definition</th>
<th>QPA quality points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>93-100</td>
<td>Superior achievement</td>
<td>4.0</td>
</tr>
<tr>
<td>A-</td>
<td>90-92</td>
<td></td>
<td>3.7</td>
</tr>
<tr>
<td>B+</td>
<td>87-89</td>
<td>Above average achievement</td>
<td>3.4</td>
</tr>
<tr>
<td>B</td>
<td>83-86</td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>B-</td>
<td>80-82</td>
<td></td>
<td>2.7</td>
</tr>
<tr>
<td>C+</td>
<td>77-79</td>
<td>Average achievement</td>
<td>2.4</td>
</tr>
<tr>
<td>C</td>
<td>70-76</td>
<td></td>
<td>2.0</td>
</tr>
<tr>
<td>D</td>
<td>60-69</td>
<td>Minimally passing</td>
<td>1.0</td>
</tr>
<tr>
<td>F</td>
<td>0-59</td>
<td>Academic failure</td>
<td>0.0</td>
</tr>
</tbody>
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Student Evaluation

Students’ achievement of the course objectives will be evaluated through the use of the following:

Three unit tests assessing students’ comprehension of terminology, calculations and practices related to the unit objectives.

Lab grade based on individual reports on experimental results
In class participation, homework and attendance.

<table>
<thead>
<tr>
<th>Evaluation Tools</th>
<th></th>
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<tbody>
<tr>
<td>3 Unit Tests</td>
<td>50%</td>
</tr>
<tr>
<td>Lab Experiments and Reports</td>
<td>25%</td>
</tr>
<tr>
<td>Homework / In-Class Assignments</td>
<td>25%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
GENERAL OBJECTIVES

Course Competencies/Goals

Students will be able to:
1. Describe the operations of any of the basic building blocks of a digital circuit, including the various gates, adder/subtractor circuits, flip-flops, counters and registers.
2. Describe component parameters using a datasheet.
3. Work with fellow students to properly wire and troubleshoot basic digital components given a schematic diagram and/or datasheet.
4. Properly implement a reduced sum of products circuit given input and output conditions.

General Education Knowledge Goals [GEKG]

Goal 1. Communication. Students will communicate effectively in both speech and writing.
Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.
Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

MCCC Core Skills [CS]

Goal A. Written and Oral Communication in English. Students will communicate effectively in speech and writing, and demonstrate proficiency in reading.
Goal B. Critical Thinking and Problem-solving. Students will use critical thinking and problem solving skills in analyzing information.
Goal D. Information Literacy. Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.
Goal E. Computer Literacy. Students will use computers to access, analyze or present information, solve problems, and communicate with others.
Goal F. Collaboration and Cooperation. Students will develop the interpersonal skills required for effective performance in group situations.
Unit Objectives

Unit I  Number Systems, Codes and Gates
The student will be able to:

1. Count in the binary, octal, decimal and hexadecimal number systems.
2. Convert between the binary, octal, decimal and hexadecimal number systems.
3. Identify the seven basic logic gates and describe their operation and identify each gate’s truth table and Boolean expression.
4. Show the truth table and Boolean equation for a given logic circuit.
5. Convert AND/OR gate to its equivalent using DeMorgan’s Theorem.
6. Convert basic text to ASCII code and ASCII code to basic text given the ASCII code chart.
7. Properly wire a TTL IC into a circuit using the datasheet or pin-out diagram for that device.

Unit II  TTL Device Characteristics, Boolean Algebra, Karnaugh Maps and Arithmetic Logic Units
The student will be able to:

1. Describe operating characteristics of a TTL device given a datasheet including pinout, power dissipation, input/output voltage and current parameters, and propagation delay.
2. Identify a commercial vs. a military TTL device.
3. Identify the various series of devices within the TTL family of devices (regular TTL, Schottky, low powered Schottky, etc.).
4. Describe the flow of current (sinking and sourcing) between interconnected TTL gates based on the output condition of the driving gate.
5. Build a reduced logic circuit using Boolean algebra and/or Karnaugh maps given the truth table for the circuit.
6. Perform binary addition, subtraction and 2’s complement subtraction.
7. Wire a binary circuit that will add or subtract binary numbers.
8. Identify the input states that cause a decoder circuit output to have a true response.

Unit III  Flip-flops, Registers and Counters
The student will be able to:

1. Understand terminology used to describe the operation of a flip-flop circuit including propagation delay time, hold time and setup times.
2. Use a datasheet to properly wire a flip-flop, register or counter into a circuit
3. Draw a timing diagram for an RS latch, D latch or JK flip-flop.
4. Describe the operation of a register given its datasheet.
5. Identify the basic types of counters.