

EL E 336 – Digital Systems Laboratory I
Spring Semester 2007

2005 Catalog Data: EL E 336. DIGITAL SYSTEMS LABORATORY I. Corequisite: EL E 335. (3 lab hours). (1).

Designation (Required or Elective): Required in semester 3 for Electrical Engineering majors

Prerequisite by Topic: None

Textbook: A. W. Glisson, *Laboratory Manual for Digital Systems Laboratory EL. E. 336*, 4th edition, Department of Electrical Engineering, University of Mississippi, January 2004.

Reference Texts: *Digital Principles and Design*, by Donald D. Givone
Logic and Computer Design Fundamentals, by M. M. Mano and C. R. Kime
Fundamentals of Logic Design, by C. H. Roth, Jr.
Digital Design Fundamentals, by K. J. Breeding

Coordinators: Allen W. Glisson, Professor of Electrical Engineering

Objectives: At the end of this course students will be able to:

Understand and use logic conventions in the implementation of combinational logic circuits.

Obtain canonical sum-of-products and product-of-sum expressions from logical truth tables.

Apply DeMorgan's theorem to convert mixed-operation logical expressions into All-Nand operation forms.

Develop and implement combinational logic circuits from truth tables or logical expressions.

Develop and implement simple code translation logic circuits.

Develop and implement programmable logic circuits.

Understand, use, and describe elementary concepts of assembly language programming.

Develop, implement, and describe the operation of simple synchronous sequential circuits.

Use a circuit capture and simulation program to design digital logic circuits.

Briefly describe in writing what is done in each part of the lab in a clear and concise manner.

Topics:

1. Logic conventions and indicators (1 class)
2. Logic gates and logic operations (1 class)
3. Min-term representations and implementation of simple logic functions (1 class)
4. Max-term representations, multiple output networks, and fan-in capability (1 class)
5. Code translation (1 class)
6. Controlled circuits, memory addressing (1 class)
7. Construction of flip-flops (1 class)
8. Registers (1 class)
9. Assembly language/Computer simulator (1 class)
10. Circuit simulation and programmable logic devices (2 classes)

Computer Usage:

One experiment on machine and assembly language programming using a RISC computer simulator, the Ole Miss Teaching Computer (OMTC), on a PC (1 class)

One experiment in circuit simulation and programming of Programmable Logic Devices using computer simulation software for digital circuits (2 classes)

Equipment and Software Usage:

Digiac 4010 Digital Logic Trainer
Personal Computer
Ole Miss Teaching Computer (OMTC) simulator
Altera MAX+plus II /Quartus

Contribution of Course to Professional Content of Programs:

This course contributes to the professional component of the degree programs by covering concepts in the area of engineering topics (engineering sciences).

Relationship of course to program educational objectives/outcomes:

This course contributes at least in part to achieving program the following program objectives and outcomes:

Objectives

- 1) *have a sound understanding of the fundamentals of engineering science, computer applications, mathematics, and physics; and have the ability to apply this knowledge in engineering practice.*
- 2) *be able to draw from physics, computer science, mathematics, and engineering science to identify, formulate, and develop practical design solutions to open-ended electrical engineering problems.*

- 3) *have experience in using different computers and operating systems for scientific computation, graphics, word-processing, data acquisition, process control, computer-aided design, and engineering communication.*
- 4) *be able to communicate effectively with adequate written and oral technical communication skills.*

Outcomes

- a) *an ability to apply knowledge of mathematics, science, and engineering.* The laboratory experiments, reports, and exams require direct application of mathematics and engineering knowledge. This includes the development of logical expressions from truth tables, manipulation of expressions using Boolean algebra, and use of logic gates and flip-flops.
- b) *an ability to design and conduct experiments, as well as to analyze and interpret data.* Students conduct experiments by connecting logic circuits, observing results, and verifying expected data. Students must develop troubleshooting skills during the course of the lab to be able to correct problems in circuits.
- c) *an ability to design a system, component, or process to meet desired needs.* Students are required to design logic circuits to achieve outcomes specified by truth tables, logic circuits, or desired results for some laboratory problems and on exams.
- g) *an ability to communicate effectively.* Students provide written experiment reports in which experiment descriptions and results are expected to be presented in a clear and concise manner.
- k) *an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.* Students are expected to use troubleshooting skills throughout the course. Algorithm development skills are required for the elementary assembly-language experiment. Students are also introduced to the use of software with industry standard schematic capture, VHDL circuit description, and digital logic simulation capability.

Prepared by: A. W. Glisson, Fall 2004

Date: January 13, 2007

Reviewed by: Digital Systems Committee