University of Arkansas - Fort Smith
5210 Grand Avenue
P. O. Box 3649
Fort Smith, AR 72913-3649
479-788-7000

General Syllabus

ELEC 1863 Digital Fundamentals

Credit Hours: 3 Lecture Hours: 2 Laboratory hours: 2

Prerequisite or Corequisite: MATH 0234/0233 Beginning Algebra or higher-level mathematics course, or exemption by placement.

Effective Catalog: 2018-2019

I. Course Information

A. Catalog Description

An introductions and development of the basic concepts related to the operation of a typical microprocessor to include number systems, elementary digital circuits, and the internal structure of the INTEL 8088 microprocessor. Experience in designing and debugging computer programs at the machine level.

B. Additional Information

The current Intel family of microprocessors dominates the field of personal computers, and familiarity with this group of chips will assist the technician in many areas of electronics. This course is designed to provide the electronics students with the concepts and skills necessary for understanding the operation of a digital computer. Intel's 80888086 microprocessor was chosen for study because it is representative of the x86 family, and it is the least complicated design.

Early in the course, the students will learn to use binary and hexadecimal numbering systems and become familiar with elementary digital logic circuits. This preliminary knowledge will be the basis for beginning of study of the internal architecture of the 8088 microprocessor. In following weeks, the students will use assembly language programming techniques to explore the capabilities and limitations of this chip. Students will also have the opportunity to examine the interaction between the microprocessor and the support routines in the disk operating system and the basic input/output system.

Programming skills gained in this course build on the fundamentals provided in the prerequisite courses. These new skills are intended to aid in understanding the operation of computer systems. This understanding should directly enhance the student's performance in later courses, which involve troubleshooting complex digital circuits and personal computer systems.

II. Student Learning Outcomes

A. Subject Matter

Upon successful completion of this course, the student will be able to:

1. Perform arithmetic and logic operations with numbers expressed in binary and hexadecimal notation with at least 74% accuracy.
2. On worksheets and in textbook assignments, express signed values in two's complement form with 74% correct responses.
3. Recognize the symbols for elementary logic gates and recreate their truth tables on worksheets and in textbook assignments with a minimum of 74% correct responses.
4. Recognize the schematic symbols for elementary digital circuits by naming and accurately describing their operation on worksheet and textbook assignments.
5. Distinguish between the uses for RAM, ROM, EPROM and PLAs by listing typical applications for each.
6. Using a schematic diagram, breadboard simple digital circuits so that they operate according to written specifications.
7. With input signals provided, predict the output of elementary logic circuits by sketching the output waveforms.
8. With the aid of the logic probe, pulser, and/or oscilloscope, identify faults in elementary digital circuits with 74% correct responses.
9. Using the Debug machine language monitor, test and debug assembly language programs so that they execute without error.

B. University Learning Outcomes

This course enhances student abilities in the following areas:

Analytical Skills

Critical Thinking - The student will solve problems rationally and intuitively by comprehending information and ideas and synthesizing and interpreting results of analysis.

Quantitative Reasoning - The student will effectively apply mathematical skills.

III. Major Course Topics

A. Number Systems, Binary and Hexadecimal Arithmetic
B. Two's Complement Notation, Logic Operators AND, OR and NOT

C. Logic Gates, Enable/Inhibit Function
D. Introduction to Boolean Algebra and SOP Notation
E. Introduction to Combinational Logic
F. Adders, Comparators, Decoders and Encoders
G. Multiplexers and Demultiplexers
H. Flip-flops and Their Applications
I. Digital Counters
J. Shift Registers and Their Applications
K. Memory Concepts, RAM and ROM
L. Introduction to the 8088 Microprocessor
M. Introduction to Assembly Language Programming and the Debug Program
N. 8088 Microprocessor Instructions
O. Interrupt Vectors and DOS Function Calls
P. Completion of Laboratory Exercises