

**ELN 133**  
**DIGITAL ELECTRONICS**

**COURSE DESCRIPTION:**

Prerequisites: ELC 112 or ELC 131 and MAT 145

Corequisites: None

This course covers combinational and sequential logic circuits. Topics include number systems, Boolean algebra, logic families, medium scale integration (MSI) and large scale integration (LSI) circuits, analog to digital (AD) and digital to analog (DA) conversion, and other related topics. Upon completion, students should be able to construct, analyze, verify, and troubleshoot digital circuits using appropriate techniques and test equipment. Course Hours Per Week: Class, 3. Lab, 3. Semester Hours Credit, 4.

**COURSE OBJECTIVES:**

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

- a. Perform decimal, octal, hexadecimal, and binary conversions.
- b. Apply Boolean algebra to solve logic functions.
- c. Identify, select, and handle display devices.
- d. Analyze pulse circuits.
- e. Analyze digital multiplexing circuits.
- f. Analyze logic family interfaces.
- g. Analyze logic switching circuits.
- h. Analyze memory storage devices.
- i. Select and apply signal generators.
- j. Select and apply function generators.
- k. Plan and execute projects.
- l. Interpret catalogs to select equipment and components.
- m. Interpret schematics to determine principal circuit functions.
- n. Prepare parts list.
- o. Prepare detailed circuit diagrams.
- p. Layout wiring diagrams.
- q. Sketch electrical drawings.
- r. Prepare documentation for experiment and test procedures.
- s. Prepare logic diagrams.
- t. Understand VHSIC Hardware Description Language
- u. Apply logic design circuits with Programmable Logic Devices

## OUTLINE OF INSTRUCTION:

- I. Logic families and their characteristics
  - A. Evaluation of IC families
  - B. TTL
  - C. Characteristics of TTL gates
  
- II. Basic TTL gate
  - A. Open and unused inputs
  - B. Wire-ANDing and open collector gates
  - C. Three-state devices
  - D. Strobed gates, expandable gates, and expanders
  - E. A AND-OR-INVERT gates
  - F. The EXCLUSIVE-OR / NOR gate
  
- III. Parity checking
  - A. Comparison circuits
  - B. Parity checking and generation
  - C. More sophisticated error-correcting routines
  
- IV. Multiplexers and demultiplexers
  - A. Multiplexers
  - B. Demultiplexers
  - C. Practical applications
  
- V. Flip flops
  - A. The basic flip-flop
  - B. NOR gate flip-flops
  - C. NAND gate flip-flops
  - D. D-type flip-flops
  - E. Bistable latches
  - F. J-K master-slave flip-flops
  - G. Edge-triggered flip-flops
  - H. Timing charts
  - I. Direct SETS and direct CLEARS
  - J. Race conditions
  - K. Flip-flops parameters
  - L. Uses of flip-flops
  - M. Synchronizing flip-flops
  - N. Glitches
  
- VI. Counters
  - A. Divide by N-counters
  - B. Ripple counters
  - C. Synchronous counters
  - D. Irregulars and truncated count sequences
  - E. IC counters

- F. UP-DOWN counters
  - G. Divide by N-circuits using counters
- VII. Shift registers
- A. Basic shift register
  - B. Serial inputs and parallel output shift registers
  - C. Parallel input and serial output shift registers
  - D. Parallel input and parallel output shift registers
  - E. Serial input and serial output shift registers
  - F. Universal shift registers
  - G. Applications
- VIII. Computer Aid Design tools for the digital circuits
- A. VHSIC Hardware Description Language
  - B. Design circuits with Programmable Logic Devices

**REQUIRED TEXTBOOKS AND MATERIALS:**

Floyd, Thomas. Digital Fundamentals. 8<sup>th</sup> ed.

Dueck, Robert. Digital Design with CPLD Application and VHDL.

**STATEMENT FOR STUDENTS WITH DISABILITIES:**

Students who require academic accommodations due to any physical, psychological, or learning disability are encouraged to request assistance from a disability services counselor within the first two weeks of class. Likewise, students who potentially require emergency medical attention due to any chronic health condition are encouraged to disclose this information to a disability services counselor within the first two weeks of class. Counselors can be contacted by calling 919-536-7207, ext. 1413 or by visiting the Student Development Office in the Phail Wynn Jr. Student Services Center, room 1209.