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|  | **Course:** | **ELT 147** |
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|  | **Title:** | **Digital Devices I** |
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|  | **Long Title:** | **Digital Devices I** |
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|  | **Course Description:** | **Introduces the operation and application of gates, flip-flops, counters, shift registers, encoders-decoders and LED displays. Covers binary numbers, Boolean algebra and troubleshooting.** |
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|  | **Min Credit:** | **4** |
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 STANDARD COMPETENCIES:

1. Explain the operation of gates, flip-flops, counters, shift registers, encoders-decoders and LED displays.
2. Explain the difference between TTL and CMOS devices.
3. Identify leads of digital ICs.
4. Read logic diagrams.
5. Convert between binary, octal, decimal and hexadecimal.
6. Write the Boolean expression of gates.
7. Explain the operation of an LED display circuit.
8. Test digital ICs.
9. Construct and test circuits with digital ICs.
10. Determine voltages or wave shapes at the leads of digital ICs in schematic diagrams.
11. Troubleshoot circuits with digital ICs.

 TOPICAL OUTLINE:

1. Analog vs. Digital
   1. Classify variables as continuous (analog) or discrete (digital)
   2. State advantages of analog systems
   3. State advantages of digital systems
2. Introduction to TTL Gates
   1. Identify AND, OR, NOT, NAND, and NOR logic gates in TTL
   2. Locate important specifications, such as ESD, inTTL chip data sheets
   3. Build TTL logic circuits on a breadboard
   4. Troubleshoot TTL logic circuits
3. CMOS Gates
   1. Identify AND, OR, NOT, NAND, and NOR logic gates in CMOS chips
   2. Locate important specifications, such as ESD, in CMOS chip data sheets
4. Special Purpose Gates
   1. Explain the operation of the XOR logic function
   2. Explain the operation of the XNOR logic function
   3. Implement logic circuits using AND-OR-Invert  chips
   4. Explain the purpose of Schmitt trigger circuits
5. Binary Numbers
   1. Explain numbers in unsighned and signed binary format
   2. Convert numbers between decimal, binary, octal, hexadecimal, and Binary-Coded Decimal (BCD)
   3. Represent negative binary numbers in two’s-complement form
   4. Add, subtract, multiply, and divide signed and unsigned numbers in binary format
   5. Add numbers in BCD format
   6. Build a half-adder circuit using TTL gates
   7. Build a full-adder circuit using TTL gates
   8. Build a 4-bit adder using a TTL adder chip
   9. Build a 4-bit BCD adder using a TTL adder chip
6. Boolean Algebra
   1. Write Boolean expressions for basic logic gates (AND, OR, NOT, NAND, and NOR)
   2. Write Boolean expressions for combinational logic circuits
   3. Write Boolean expressions from logic functions in truth table format
   4. Simplify Boolean expressions
7. Logic Diagrams
   1. Translate between logic functions in circuit, truth table, and Boolean form
   2. Apply DeMorgan’s Theorem to simplify logic circuits
8. Troubleshooting
   1. Use a logic probe to find open pins or traces
   2. Use a logic probe to find shorted pins or traces
9. Flip-Flops
   1. Explain the operation of an SR latch
   2. Explain the operation of a gated SR latch
   3. Explain the operation of a master-slave latch
   4. Use a state table to explain the operation of a D flip-flop
   5. Use a state table to explain the operation of a T flip-flop
   6. Use a state table to explain the operation of a JK flip-flop
   7. Implement a frequency divider circuit using JK flip-flops
10. Counters
    1. Explain the operation of synchoronous counters
    2. Construct modulus(X)  synchronous counters using JK flip-flops
    3. Explain the operation of asynchronous counters
    4. Construct asynchronous up and down counters using JK flip-flops
    5. Explain the advantages and disadvantages of synchronous and asynchorous counters
11. Shift Registers
    1. Explain the operation of a Johnson counter
    2. Explain the operation of a ring counter
    3. Explain the advantages and disadvantages of serial data transmission
    4. Explain the advantages and disadvantages of parallel data transmission
12. Encoders-Decoders
    1. Explain the operation of an 8-to-3 ocatal encoder
    2. Explain the operation of a 3-to-8 decoder
    3. Explain Gray coding
    4. Build a display ciruit using a 7-segment decoder
13. LED Displays
    1. Use a logic probe to map the pins of a 7-segment LED display
    2. Build a two-digit 7-segment display on a breadboard