JEFFERSON COLLEGE
COURSE SYLLABUS

ETC255
INTRODUCTION TO DIGITAL CIRCUITS
4 Credit Hours

Prepared By:
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ETC255 Introduction to Digital Circuits

I. CATALOGUE DESCRIPTION

A. Prerequisite: ETC132 Semiconductors I and Reading Proficiency

B. Credit Hour Award: 4

C. Introduction to Digital Circuits will involve a study of basic logic circuit design and specific operating characteristics of commonly used integrated circuit technologies. Sequential and combinational logic circuits are developed, implemented, and analyzed in detail. (F)

II. EXPECTED LEARNING OUTCOMES/CORRESPONDING ASSESSMENT MEASURES

| Demonstrate the ability to identify and represent basic logic gates using ANSI/IEEE std. 91-1984 | Written Exams, Quizzes, Observation of Lab Performance |
| Demonstrate knowledge and understanding of the truth tables for the basic logic gates | Written Exams, Quizzes |
| Demonstrate ability to write, reduce, and implement Boolean expressions | Written Exams, Quizzes |
| Demonstrate knowledge and understanding of the static and dynamic characteristics of the basic logic | Written Exams, Quizzes, Observation of Lab Performance |
| Demonstrate ability to represent numbers and perform basic arithmetic operations using binary, octal, hexadecimal, numbering systems and 8421 | Written Exams, Quizzes |
| Demonstrate knowledge and understanding of basic digital devices such as buffers, inverters, comparators, multivibrators, display devices, counters, and arithmetic circuits | Written Exams, Quizzes, Observation of Lab Performance |
| Demonstrate skill in constructing digital circuits from a logic diagram | Written Exams, Quizzes, Observation of Lab Performance |
| Demonstrate ability to successfully analyze and troubleshoot basic asynchronous and synchronous logic devices and circuits | Written Exams, Quizzes, Observation of Lab Performance |

III. OUTLINE OF TOPICS

A. Unit 1 - Introduction to Digital Circuits

1. Intro to digital electronics
   a. Define the term “digital”
   b. Describe the types of wave shapes used in digital electronics
   c. State the difference between positive and negative logic
   d. Describe the basic digital gates and how they are used
e. Describe the advantages and disadvantages of the following gates:
   i. RTL
   ii. DTL
   iii. TTL
   iv. ECL
f. Observe the operation of various logic gates.

2. Digital hardware
   a. Define an integrated circuit
   b. Describe in basic terms, how integrated circuits are manufactured
   c. Identify different types of integrated circuit packaging
   d. Describe the four classifications of integrated circuits
   e. Explain the purpose of integrated circuit data sheets

3. Digital test equipment
   a. Define the types of test equipment used in digital electronics and identify the types of signals they measure
   b. Describe how to use a logic probe
   c. Observe signals in a digital circuit using a multi-meter, oscilloscope, logic probe

4. Buffers and inverters
   a. Define the functions of buffers and inverters
   b. Recognize the logic symbol for buffers and inverters
   c. Construct a truth table for buffers and inverters
   d. State the Boolean expression for buffers and inverters
   e. Measure input and output signals of a digital buffer and inverter

B. Unit 2 - Digital Logic Functions
   1. AND gates
      a. Define the AND function
      b. Describe a discrete component AND gate
      c. Recognize the logic symbol for the AND gate
      d. Construct a truth table for the AND gate
      e. Describe the AND gate timing diagrams
      f. State the Boolean expression for the AND gate
      g. Measure input and output signals of a digital logic AND gate
   2. OR gates
      a. Define the OR function
      b. Describe a discrete component OR gate
      c. Recognize the logic symbol for the OR gate
      d. Construct a truth table for the OR gate
      e. Describe the OR gate timing diagrams
      f. State the Boolean expression for the OR gate
      g. Measure input and output signals of a digital logic OR gate
   3. NAND gates
      a. Define the NAND function
      b. Describe a discrete component NAND gate
      c. Recognize the logic symbol for the NAND gate
d. Construct a truth table for the NAND gate
  e. Describe the NAND gate timing diagrams
  f. State the Boolean expression for the NAND gate
  g. Measure input and output signals of a digital logic NAND gate

4. NOR gates
   a. Define the NOR function
   b. Describe a discrete component NOR gate
   c. Recognize the logic symbol for the NOR gate
   d. Construct a truth table for the NOR gate
   e. Describe the NOR gate timing diagrams
   f. State the Boolean expression for the NOR gate
   g. Measure input and output signals of a digital logic NOR gate

5. XOR gates
   a. Define the XOR function
   b. Describe a discrete component XOR gate
   c. Recognize the logic symbol for the XOR gate
   d. Construct a truth table for the XOR gate
   e. Describe the XOR gate timing diagrams
   f. State the Boolean expression for the XOR gate
   g. Measure input and output signals of a digital logic XOR gate

C. Unit 3 - Combination Logic Functions

1. Introduction to combinational circuits
   a. Describe how combinational circuits are used
   b. Describe why the NAND gate is a universal gate
   c. Recognize NAND gate circuits configured for NOT, AND, OR, NOR, and XOR gates

2. Number systems
   a. Define the terms associated with number systems
   b. Determine the radix of the binary, octal, decimal, and hexadecimal number systems
   c. Recognize the basic symbols associated with the binary, octal, decimal, and hexadecimal number systems
   d. Select numbers from the binary, octal, decimal, and hexadecimal number systems
   e. Observe the operation of an IC decoder in base 8, 10, and 16 number systems

3. Base 10 to binary conversion
   a. Convert base 10 numbers to binary numbers
   b. Convert binary numbers to base 10 numbers
   c. Convert base 10 numbers to binary coded decimal
   d. Convert binary coded decimal numbers to decimal
   e. Measure and verify the signals in a decimal to BCD encoder combinational circuit
4. Binary to 7 segment conversion
   a. Describe the purpose of binary to seven segment conversion circuits
   b. Describe the operation of binary to seven segment conversion circuits
   c. Observe the operation of binary to seven segment conversion circuits

5. Bit comparator
   a. State the purpose of magnitude comparators and the process of comparison
   b. Describe the operation of a digital 1 bit A-B comparator circuit
   c. Describe the operation of a 2 bit comparator circuit
   d. Describe the MSI 7485 4 bit A-B comparator IC
   e. Observe the normal operation of the 7485 4 bit A-B comparator

D. Unit 4 – Flip-Flop Circuits
   1. Introduction to flip-flops
      a. Define the terms and characteristics associated with multivibrators and flip-flops
      b. Describe the Eccles-Jordan discrete component multivibrator
      c. Describe the major types of digital flip-flops
      d. Identify the logic box symbols for the five major types of digital flip-flops
   2. RS flip-flops
      a. Define the operation of RS flip-flops
      b. Construct a truth table for RS flip-flops
      c. Describe RS flip-flop timing diagrams
      d. Describe RS flip-flop circuits constructed from transistors, NOR gates, and NAND gates
      e. Measure input and output signals of a NOR gate RS flip-flop
   3. JK flip-Flops
      a. Define the operation of JK flip-flops
      b. Construct a truth table for JK flip-flops
      c. Describe JK flip-flop timing diagrams
      d. Measure input and output signals of JK flip-flops

E. Unit 5 – Registers and Memory Circuits
   1. Introduction to registers and memory
      a. Describe the purpose of registers
      b. Describe the operation of registers
      c. Describe the purpose of memory
      d. Describe the operation of memory
F. Unit 6 – Arithmetic Counting Circuits
   1. Introduction to arithmetic counting circuits
      a. Define arithmetic counting circuits
      b. State the purpose of arithmetic counting circuits
      c. List types of arithmetic counting circuits
   2. Ripple counters
      a. Describe the purpose of ripple counters
      b. Describe the operation of ripple counters
      c. Observe the operation of ripple counters
   3. Up counters
      a. Describe the purpose of up counters
      b. Describe the operation of up counters
      c. Observe the operation of up counters

G. Unit 7 – Digital Troubleshooting
   1. Exploring digital troubleshooting techniques
      a. Digital Circuit Troubleshooting
      b. Digital Logic Gate Troubleshooting
      c. Combinational Circuit Troubleshooting
      d. Flip-Flop Circuit Troubleshooting
      e. Arithmetic Counting Circuit Troubleshooting

IV. METHOD(S) OF INSTRUCTION

A. NIDA Electronics Training Software

B. Lab Exercises

C. Class Lecture

V. REQUIRED TEXTBOOK(S)


VI. REQUIRED MATERIALS

A. Paper
B. Folders
C. Pens
D. Pencils

VII. SUPPLEMENTAL REFERENCES

Class Handouts

VIII. METHODS OF EVALUATION

A. Attendance
B. Lab Exercises
C. Homework
D. Exams

IX. ADA AA STATEMENT

Any student requiring special accommodations should inform the instructor and the Coordinator of Disability Support Services (Library; phone 636-797-3169).

X. ACADEMIC HONESTY STATEMENT

All students are responsible for complying with campus policies as stated in the Student Handbook (see College website http://www.jeffco.edu).

XI. ATTENDANCE STATEMENT

Regular and punctual attendance is expected of all students. Any one of these four options may result in the student being removed from the class and an administrative withdrawal being processed: (1) Student fails to begin class; (2) Student ceases participation for at least two consecutive weeks; (3) Student misses 15 percent or more of the coursework; and/or (4) Student misses 15 percent or more of the course as defined by the instructor. Students earn their financial aid by regularly attending and actively participating in their coursework. If a student does not actively participate, he/she may have to return financial aid funds. Consult the College Catalog or a Student Financial Services representative for more details.
XII. OUTSIDE OF CLASS ACADEMICALLY RELATED ACTIVITIES

The U.S. Department of Education mandates that students be made aware of expectations regarding coursework to be completed outside the classroom. Students are expected to spend substantial time outside of class meetings engaging in academically related activities such as reading, studying, and completing assignments. Specifically, time spent on academically related activities outside of class combined with time spent in class meetings is expected to be a minimum of 37.5 hours over the duration of the term for each credit hour.