METROPOLITAN STATE UNIVERSITY OF DENVER
Office of Academic and Student Affairs

# REGULAR COURSE SYLLABUS

**College of:** Professional Studies

**Department:** Engineering and Engineering Technology

**Prefix & Course Number:** CPE 2310 **Crosslisted With*:** _____

**Course Title**: Digital Systems I

**Transcript Course Title (30 characters):** Digital Systems I

**Check All That Apply:** Required for Major: X Required for Minor:_____ Specified Elective: _____

Required for Concentration: _____ Elective: ___ Service Course:

To receive Title IV financial aid funds, all institutions of higher education must comply with the federal definition of a credit hour. The Higher Learning Commission requires institutions to maintain policies and procedures for verifying compliance with this definition.

***Federal Credit Hour Definition:*** *A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than:*
*(1) one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or (2) at least an equivalent amount of work as required in paragraph (1) of this definition for other activities as established by an institution, including laboratory work, internships, practica, studio work, and other academic work leading toward to the award of credit hours. 34CFR 600.2 (11/1/2010)*

**Credit Hours**: 3 (2+2) **Schedule Type**: B **Grade Mode**: L

**Face-to-Face or Equivalent Hours per course:**

Lecture 30 Lab 30 Internship _____ Practicum _____ Other (please specify type and hours):_____

**Additional Student Work Hours per course:** 90

**Variable topics umbrella course:** **No** X **Yes** _____ If yes, number of credits/repeats allowed _____

**Specified repeatable course:** **No** X **Yes** _____ If yes, number of credits/repeats allowed _____

**Prerequisite(s):** An intermediate algebra courses or one and one-half years of secondary school algebra or equivalent and appropriate score on the mathematics pre-assessment placement test or higher level math course (with a grade of "C" or better for all prerequisites)

**Corequisite(s)**: _____

APPROVED:

Department Chair **OR** Program Director Date

Dean **OR** Associate Dean Date

Associate VP, Academic and Student Affairs Date

*If crosslisted, attach completed Course Crosslisting Agreement Form

Prefix and Course Number:
**Prerequisite(s) or Corequisite(s):** _____

**Banner Enforced Coding:**
**Prerequisite(s):** ACT Math 25 or SAT Mathematics 570 or Accuplacer Elementary Algebra 100 or Accuplacer Elem Alg. Transfer 100, or MTH 1110, or MTH 1120, or MTH 1400 or MTH 1410, or MTH 2410 (with a grade of "C" or better for all prerequisites)
**Corequisite(s):** _____
**Prerequisite(s) or Corequisite(s):** _____

**Registration restrictions: Level** _____ **Class** _____**Program/Major** _____ **Student attribute** _____

**Catalog Course Description:**
This course covers the analysis and design of logic circuits using Boolean algebra, Karnaugh maps and truth tables. It provides an introduction to the student to the basic concepts of computer architecture. In addition, it covers number systems, operation and codes. Adders, comparators, decoders, encoders, multiplexers and other logic circuits are also studied. The students will use the basic logic gates, Flip-flop, memories, etc., to design simple digital systems.

**Specific Variable Topics Course Description (if applicable, umbrella course description included above):**

**Required Reading and Other Materials will be equivalent to:**
Thomas L. Floyd, (2015) *Digital Fundamentals, 11th edition*, or latest edition, Pearson.

**Specific, *Measurable* Student Behavioral Learning Objectives:**
Upon completion of this course the student should be able to:
1. Convert and perform mathematical manipulation on decimal, binary, octal, BCD, Gray code, ASCII code and hexadecimal numbering systems, including floating numbers, signed and unsigned numbers
2. Analyze and design simple digital systems by Boolean Algebra, Karnaugh Maps and truth tables
3. Work with a team to construct, design and trouble shoot simple logic systems using digital IC chips
4. Write laboratory findings in a concise document comparing theoretical and actual data with models
5. Associate digital IC components with computer architecture components

**Detailed Outline of Course Content or Outline of Field Experience/Internship (experience, responsibilities and supervision):**

I. Introduction to Digital Logic Systems
   - A. Digital and Analog Quantities
   - B. Binary Digits, Logic Levels, and Digital Waveforms
   - C. Basic Logic Functions
   - D. Combinational and Sequential Logic Functions
   - E. Introduction to Programmable Logic
   - F. Fixed-Function Logic Devices
   - G. Test and Measurement Instruments
   - H. Introduction to Troubleshooting

II. Number Systems, Operations, and Codes
   - A. Decimal Numbers
   - B. Binary Numbers
   - C. Decimal-to-Binary Conversion
   - D. Binary Arithmetic
   - E. Complements of Binary Numbers

F. Signed Numbers
G. Arithmetic Operations with Signed Numbers
H. Hexadecimal Numbers
I. Octal Numbers
J. Binary Coded Decimal (BCD)
K. Digital Codes
L. Error Codes

III. Logic Gates
A. The Inverter
B. The AND Gate
C. The OR Gate
D. The NAND Gate
E. The NOR Gate
F. The Exclusive-OR and Exclusive-NOR Gates
G. Fixed-Function Logic Gates
H. Troubleshooting

IV. Boolean Algebra and Logic Simplification
A. Boolean Operations and Expressions
B. Laws and Rules of Boolean Algebra
C. DeMorgan's Theorems
D. Boolean Analysis of Logic Circuits
E. Logic Simplification Using Boolean Algebra
F. Standard Forms of Boolean Expressions
G. Boolean Expressions and Truth Tables
H. The Karnaugh Map
I. Karnaugh Map SOP Minimization
J. Karnaugh Map POS Minimization
K. Applied Logic

V. Combinational Logic Analysis
A. Basic Combinational Logic Circuits
B. Implementing Combinational Logic
C. The Universal Property of NAND and NOR Gates
D. Combinational Logic Using NAND and NOR Gates
E. Pulse Waveform Operation
F. Troubleshooting
G. Applied Logic

VI. Functions of Combinational Logic
A. Half and Full Adders
B. Parallel Binary Adders
C. Ripple Carry and Look-Ahead Carry Adders
D. Comparators
E. Decoders

F. Encoders
G. Code Converters
H. Multiplexers (Data Selectors)
I. Demultiplexers
J. Parity Generators/Checkers
K. Troubleshooting
L. Applied Logic

VII. Latches, Flip-flops and Basic Concepts of Sequential Circuits
A. Latches
B. Flip-Flops
C. Flip-Flop Operating Characteristics
D. Flip-Flop Applications
E. Concepts of Sequential Circuits
F. Applied Logic

**Evaluation of Student Performance**:
1. Examinations
2. Written Assignments
3. Class projects and/or presentations and/or lab reports