Course Acronym:	ECHT
Course Number:	130
Descriptive Title:	Digital Systems and Computer Logic I
Division:	Industry and Technology
Department:	Electronics and Computer Hardware Technology
Course Disciplines:	Electronics and Computer Hardware Technology
Catalog Description:	This is an introductory course in digital logic circuit theory and practice used in contemporary computer, control, instrumentation and security systems. The course begins with the development of simple digital elements, which are combined in increasingly complex functions to perform higher-level logic functions. The laboratory exercises give the student the opportunity to verify the ideas presented in lecture and explore the capabilities and limitations of commonly used logic circuits.
Prerequisite:	
Co-requisite:	
Recommended Preparation:	Electronics and Computer Hardware Technology 11
Enrollment Limitation:	
Hours Lecture (per week):	2
Hours Laboratory (per week):	4
Outside Study Hours:	4
Total Course Hours:	108
Course Units:	3
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes, No
Effective Date:	Prior to July 1992
Transfer UC:	No
Effective Date:	
General Education: ECC	
Term:	
Other:	
CSU GE:	
Term:	

Other:	
IGETC:	
Term:	
Other:	
Student Learning Outcomes:	**SLO #1 DeMorgan's Theorem** The student will use DeMorgan's Theorem to reduce a Boolean Statement in its simplest terms. **SLO #2 Seven Basic Function Gates** The student will use discrete NOR and NAND Gates to construct all seven basic function gates (NOT, OR, NOR, AND, NAND, EXOR, and EXNOR) **SLO #3 Experimental Data and Analysis Reporting** The students will be able to incorporate experimental data and analysis reporting protocols, using either "paper" or "paperless" environments, similar to data reporting and analysis used by many Electronics Manufacturers and Service Organizations
Course Objectives:	1. Compare and contrast analog and digital parameters and systems. 2. Manipulate and convert between decimal, binary, octal and hexa-decimal number systems. 3. Assess commonly used logic operators, singly or in combination and describe their behavior with truth tables and logic expressions. 4. Synthesize combinatorial circuits using the "Sum of the Products" concept. 5. Identify by name and describe the operation of all commonly used bistable multivibrators (flip-flops). 6. Identify by name and describe the operation of all commonly used counter circuits. 7. Design, construct and test a small digital system, which may include one or more of the following functions: encoders and decoders, multiplexers and demultiplexers, parity generators and decoders and MOD n counters. 8. Design, simulate and troubleshoot digital circuits and systems using computer-based software.
Major Topics:	**I. CIRCUIT OVERVIEW (2 hours, lecture)** A. Digital and analog systems B. Digital circuits C. Parallel and serial transmission D. Introduction to circuit simulation software and applications **II. CIRCUIT OVERVIEW (4 hours, lab)** A. Digital and analog systems B. Digital circuits C. Parallel and serial transmission D. Introduction to circuit simulation software and applications

III. NUMBER SYSTEMS AND CODES (2 hours, lecture)

A. Binary number systems
B. Octal number systems
C. Hexadecimal number systems
D. Number conversions
E. Alphanumeric codes
F. Parity method for error detection
G. Checksum and CRC (Cyclic Redundancy Check) error detection

IV. NUMBER SYSTEMS AND CODES (10 hours, lab)

A. Binary number systems
B. Octal number systems
C. Hexadecimal number systems
D. Number conversions
E. Alphanumeric codes
F. Parity method for error detection
G. Checksum and CRC (Cyclic Redundancy Check) error detection

V. LOGIC GATES AND BOOLEAN ALGEBRA (10 hours, lecture)

A. Boolean constants and variables
B. Truth tables
C. Describing logic circuits algebraically
D. OR operation with OR gates
E. AND operation with AND gates
F. NOT operation
G. Evaluating logic circuit outputs
H. NOR gates and NAND gates
I. Institute of Electrical and Electronic Engineers (IEEE) / American National Standard Institute (ANSI) standard logic symbols

VI. LOGIC GATES AND BOOLEAN ALGEBRA (18 hours, lab)

A. Boolean constants and variables
B. Truth tables
C. Describing logic circuits algebraically
D. OR operation with OR gates
E. AND operation with AND gates
F. NOT operation
G. Evaluating logic circuit outputs
H. NOR gates and NAND gates
I. Institute of Electrical and Electronic Engineers (IEEE) / American National Standard Institute (ANSI) standard logic symbols

VII. COMBINATORIAL LOGIC CIRCUITS (4 hours, lecture)

A. Sum of products
B. Simplifying logic currents
C. Karnaugh maps
D. Exclusive OR and exclusive NOR operators

E. Troubleshooting digital circuits
F. Programmable logic devices

VIII. COMBINATORIAL LOGIC CIRCUITS (12 hours, lab)

A. Sum of products
B. Simplifying logic currents
C. Karnaugh maps
D. Exclusive OR and exclusive NOR operators
E. Troubleshooting digital circuits
F. Programmable logic devices

IX. MULTIVIBRATORS AND RELATED DEVICES (6 hours, lecture)

A. NAND and NOR latches
B. Clocked flip-flops
C. Asynchronous inputs
D. Timing considerations and problems
E. Data storage and transfer
F. Frequency division and counting
G. Microcomputer applications
H. Monostable and astable multivibrators

X. MULTIVIBRATORS AND RELATED DEVICES (10 hours, lab)

A. NAND and NOR latches
B. Clocked flip-flops
C. Asynchronous inputs
D. Timing considerations and problems
E. Data storage and transfer
F. Frequency division and counting
G. Microcomputer applications
H. Monostable and astable multivibrators

XI. ALGEBRAIC OPERATIONS AND CIRCUITS (2 hours, lecture)

A. Binary addition
B. Signed numbers
C. Operations using the 2's complement system
D. Multiplication and division of binary numbers
E. Integrated circuit arithmetic logic units
F. The programmable logic operator

XII. ALGEBRAIC OPERATIONS AND CIRCUITS (8 hours, lab)

A. Binary addition
B. Signed numbers
C. Operations using the 2's complement system
D. Multiplication and division of binary numbers
E. Integrated circuit arithmetic logic units
F. The programmable logic operator

	XIII. COUNTERS AND REGISTERS (10 hours, lecture) A. Asynchronous counters B. Up/down counters C. Synchronous counters D. Programmable logic devices as counter circuits **XIV. COUNTERS AND REGISTERS (10 hours, lab)** A. Asynchronous counters B. Up/down counters C. Synchronous counters D. Programmable logic devices as counter circuits
Total Lecture Hours:	36
Total Laboratory Hours:	72
Total Hours:	108
Primary Method of Evaluation:	3) Skills demonstration
Typical Assignment Using Primary Method of Evaluation:	Given a combinatorial circuit of moderate complexity, develop a Boolean logic expression for the circuit, apply Boolean logic theorems or utilize Karnaugh maps (as specified by instructor) to reduce the expression to its simplest form and sketch the logic diagram for the simplified expression**.** Submit diagram to the instructor for evaluation.
Critical Thinking Assignment 1:	Given a 3 bit binary number, design, build and test a 7-Segment dice decoder. Numbers 1 through 6 must be properly decoded into the correct 7 segment logic. Numbers 0 and 7 are don't care states. Submit decoder to the instructor for evaluation.
Critical Thinking Assignment 2:	Using the power line frequency as a time base, design and build a frequency counter, using design guidelines supplied by the instructor. The completed circuit will be demonstrated to the instructor using a recently calibrated commercial frequency counter as a standard.
Other Evaluation Methods:	Class Performance Laboratory Reports Multiple Choice Other Exams Performance Exams Quizzes
Instructional Methods:	Demonstration Lab Lecture Multimedia presentations Role play/simulation
If other:	
Work Outside of Class:	Answer questions Problem solving activitities Required reading Skill practice Study

If Other:	
Up-To-Date Representative Textbooks:	Jr. Charles H. Roth, Larry L. Kinney, Eugene B. John, Fundamentals of Logic Design, 7th edition, Cengage Learning, 2020 There is second edition of the same book which is free for download. Mano Morris, Digital Design, 6 th Edition, Pearson Publication, 2018 (Discipline Standard)
Alternative Textbooks:	
Required Supplementary Readings:	
Other Required Materials:	
Requisite:	
Category:	
Requisite course(s): List both prerequisites and corequisites in this box.	
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	
Requisite Skill:	
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	
Requisite course:	Electronics and Computer Hardware Technology 11
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	**Ability to use a digital multimeter and oscilloscope.** ECHT 11 -Demonstrate the use of various types of test equipment, including Digital Multimeter (DMM), signal generators, power supplies and oscilloscope to make various circuit measurements. **Understanding of wiring and electronic components.** ECHT 11 - Recognize dangerous situations in handling electric circuits and chemicals, used in normal electronic work environment. ECHT 11 - Demonstrate the use of various types of test equipment, including Digital Multimeter (DMM), signal generators, power supplies and oscilloscope to make various circuit measurements. ECHT 11 -Differentiate color codes and component symbols to build a circuit. ECHT 11 - Differentiate color codes and component symbols to build a circuit.
Requisite Skill:	

Requisite Skill and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s). If applicable	
Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	Alfred Johnson
Date:	02/01/1978
Original Board Approval Date:	
Last Reviewed and/or Revised by:	Supriya Bhargave
Date:	04/08/2023
Last Board Approval Date:	07/17/2023 effective FALL 2024