## CENG 3312 DIGITAL CIRCUITS Spring 2019

Quality Enhancement Plan (QEP) Applied Critical Thinking for Lifelong Learning and Adaptability



**Applied Critical Thinking Statement**: This course has been authorized by UHCL as an Applied Critical Thinking (ACT) Course, which means that in addition to learning about the specified course content, students will be engaged with some or all of the Elements of Thought and Universal Intellectual Standards of critical thinking. The objective of an ACT course is to develop the student's ability to become skilled at analysis and evaluation by applying a set of intellectual tools that may be effectively used across all disciplines (as well as to the student's personal life). Based on the Foundation for Critical Thinking model (http://www.criticalthinking.org/), critical thinking involves thinking for a *purpose*, asking *questions*, using *information*, applying *concepts*, drawing *inferences* and *conclusions*, identifying *assumptions*, anticipating *implications* and *consequences*, and recognizing *points of view*. The Universal Intellectual Standards that are applied to these Elements of Thought of critical thinking in order to develop Intellectual Traits include *clarity, accuracy, precision, relevance, depth, breadth, logic, significance, and fairness*.

CLASS TIME:	5:30-6:50 PM AM MW DELTA 136 Lecture Section 02		
<b>INSTRUCTORS:</b>	Bryant, Vernon		
OFFICE:	Bryant Delta 109, Phone 281-283-3733 e-mail bryant@uhcl.edu NOTE. When leaving voice mail make sure that you speak slowly and clearly spell out your name and telephone numbers. Also provide your student ID number.		
<b>OFFICE HOURS:</b>	MW 4:00-5:00PM, others by appointment		
TEXT:	Roth, Charles. <u>Fundamentals of Logic Design 7th Edition.</u> St. Paul: West, 2009.		
PREREQUISITES:	Calculus II, PHYS II		

# The Fundamental and Powerful Concepts in Engineering and how critical thinking is utilized in this course include the following:

 ABET Definition of Engineering Design 2019-2020: Engineering design is a process of devising a system, component, or process to meet desired needs and specifications within constraints. It is an iterative, creative, decisionmaking process in which the basic sciences, mathematics, and engineering sciences are applied to convert resources into solutions. Engineering design involves identifying opportunities, developing requirements, performing analysis and synthesis, generating multiple solutions, evaluating solutions against requirements, considering risks, and making trade- offs, for the purpose of obtaining a high-quality solution under the given circumstances.

For illustrative purposes only, examples of possible constraints include accessibility, aesthetics, codes, constructability, cost, ergonomics, extensibility, functionality, interoperability, legal considerations, maintainability, manufacturability, marketability, policy, regulations, schedule, standards, sustainability, or usability.

- The **design** of digital circuits is the *precise* and *accurate* application of *relevant* engineering sciences and mathematics in order to create multiple working solutions and then considering purpose, *information*, *assumptions*, *consequences*, and recognizing *points of view* choosing the best solution to a specific need given design constraints.
- The **analysis** of digital circuits involves the *precise* and *accurate* determination of the electrical values, usually represented by logic values, at different points in the circuit to allow the verification of the correctness of operation intended by the design.

### **Student Learning Outcomes:**

- SLO 1. Students will understand and *accurately* apply the *relevant concepts*, strategies and tools in the design of combinational and synchronous sequential circuits.
- SLO 2. Students will *accurately* convert numbers from/to Decimal to/from Binary and other Radix systems.
- SLO 3. Students will apply Boolean <u>logic</u> and <u>accurately</u> manipulate and reduce switching expressions to minimum sum of products and product of sums forms.
- SLO 4. Students will <u>clearly</u> and <u>accurately **interpret**</u> (analyze) circuit diagrams to determine correctness of operation.
- SLO 5. Students will *clearly* identify the *consequences* of individual design decisions.
- SLO 6. Students will *clearly* identify the *purpose* of the different levels of integrated

circuit integration and their respective uses.

- SLO 7. Students will design and analyze combinational circuits comprised of logic gates, multiplexers and decoders with both single and multiple outputs for a *purpose* with *clarity, accuracy* and *precision.*
- SLO 8. Students will obtain a minimal sum of products of a given switching function by using K-maps.
- SLO 9. Students will design a multi-level gate network using gates from a specified set, and/or using XOR gates, and/or using multiplexers
- SLO 10. Students will determine the state diagram and the minimized state table for a given sequential system.
- SLO 11. Students will <u>accurately</u> apply the <u>relevant</u> strategies and tools in the design and analysis of sequential networks comprised of SR flip-flops, and/or T flip-flops, and/or JK flip-flops and/or D flip-flops and logic gates for a <u>purpose</u> with <u>clarity</u>, <u>accuracy</u> and <u>precision</u>.

#### **Critical Thinking Process (CTP)**

According to the ACT vocabulary we used, there are four major aspects of the Applied Critical Thinking Process, termed as the 4 C's: curiosity, connections, creativity and communication. In this course, the C in the student learning objectives is connections:

Making connections to a particular issue or problem: students will use established academic and industrial methodology to model a problem, design a database solution, and manipulate the data.

#### **Critical Thinking Activities and Assessment**

We will assess SLOs 4, 5, and 6 in the following way.

To Assess SLO 4: In these homework problems, the students are given circuit diagrams that they must accurately analyze (determine with accuracy the circuit behavior) using techniques discussed in class. Five homework problems from Chapter 13. The criteria for success is less than 3 problems correct is unacceptable, 3-4 problems correct is acceptable 5 problems correct is excellent.

To assess SLO 5: The students will be given an in class assignment where a student will discuss design tradeoffs and the consequences of selecting each design. The students will be given a problems statement and must design at least two working solutions (circuits). Then the students will discuss the design tradeoffs (pros and cons) and operational consequences of each implementation and make a recommendation regarding which design should be implemented given various constraints. The criteria for success is discussing 0 to 2 consequences is unacceptable, 3-4 consequences is acceptable and 5 or more consequences is excellent.

To assess SLO 6: A 10 point question will be given on Exam II. The students will be asked to discuss the appropriate use of the available technology (logic gates, multiplexers and decoders and small CPLDs, ROMs FPGAs and microprocessors) in the design of digital circuits. The criteria for success is achieving less than 4 points will be unacceptable, 4-7 points will be acceptable and greater than 7 points will be excellent.

#### **METHODOLOGY**:

	and homework to be completed by the student, and the testing of material learned using exams. The laboratory will provide the student hands on experience with the digital circuits. Projects will be introduced in the lecture and the students will design digital circuits that meet the requirements of the assigned projects as part of the laboratory experience. These projects will introduce more complex design experiences than the traditional laboratory assignments.		
GRADING:	The students grade for the lecture will be determined as follows:		
	Short exams and homework	10%	
	Exam I	30%	
	Exam II	30%	
	Final (comprehensive)	30%	
Outcome Assessment:	The student's ability to perform on examinations and to respond to questions and answers during design presentations will be used to determine if the student has met the expectations of the course objectives.		
6 Drop Rule Limitation:	Students who entered college for the first time in Fall 2007 or later should be aware of the course drop limitation imposed by the Texas Legislature. Dropping this or any other course between the first day of class and the census date for the semester/session does not affect your 6 drop rule count. Dropping a course between the census date and the last day to drop a class for the semester/session will count as one of your 6 permitted drops. You should take this into consideration before dropping this or any other course. Visit <u>www.uhcl.edu/records</u> for more information on the 6 drop rule and the census date information for the semester/session.		
American Disabilities Act	If you are certified as disabled and entitled to accommodations under the ADA, section 503, please notify the instructor as soon as		

	possible. If you are not currently certified and believe you may qualify, please contact the UHCL Health and Disability Services office.
Grading Policy:	The grading policy of this course will follow the grading system as outlined in the 2018-2019 Catalog of the University of Houston-Clear Lake B-: 80.00-83.32 %
Missed Exams:	Exams must be taken during the assigned period. Arrangements must be made <b>prior</b> to the exam for any exceptions. If the instructor is not notified that a exam will be missed prior to the examination a grade of zero will be assigned. A missed exam will only be excused after the student has provided the instructor with certification of the reason the examination was missed.
Academic Honesty:	The UHCL Honesty Code is stated in the 2018-2019 catalog as: <b>I</b> will be honest in all my academic activities and will not tolerate dishonesty. Each student is expected to maintain complete honesty and integrity in the academic work completed at UHCL.
MATERIAL COVERED:	UNITS 1-16, UNIT 6 SELF STUDY Following is an estimate of the sequence of the presentation of class and laboratory materials.

The following is a minimum list of homework problems. These problems, similar problems, or the theories they represent have a high probability of appearing on the exams.

Week Beginning	Lecture Covers	Read Sections	Homework Problems
1/21	UNIT 1,2,3,4	All	1.1,1.3,1.4,1.7,1.10,1.13,
			1.17
1/28	UNIT 1,2,3,4	All	2.3,2.6,2.9,2.12,2.14,2.15
2/4	UNIT 1,2,3,4	All	3.6,3.9,3.10,3.13,3.15,3.18,3.23
2/11	UNIT 1,2,3,4	All	4.4,4.7,4.8,4.9
2/18	Exam I	All (5)	
2/25	UNIT 5	All	5.4,5.7,5.8,5.13,5.19,
			5.23, 5.27, 6.2,6.3,6.4
3/4	UNIT 7	All	7.1,7.3,7.8,7.9,7.10,7.18
3/11	UNIT 8	All	8.1,8.3,8.5
3/18	UNIT 9		9.1,9.2,9.6,9.14,9.15,9.19,9.20
3/25	Spring Break		10.1,10.3,10.5,10.8
4/1	Exam II	All	

4/8	UNIT 11&12	All	11.4,11.5,11.8,11.11,11.12,
			12.2,12.3,12.7,12.19
4/15	UNIT 13	All	13.2,13.3,13.5, 13.7,13.8
4/22	UNIT 14	All	14.4,14.7
4/29	UNIT 15	All	15.2,15.3,15.7,15.11
5/6	UNIT 16	All	

**SPECIAL DATES TO BE NOTED** Last day to drop 4/16/2019 Spring Break 3/11-16/2019 Last Day of Class 5/6/2019 FINAL EXAM 5/7-5/13 2019 for day and time see schedule