Wharton County Junior College

Administrative Master Syllabus

Course Information

Course Title	Digital Fundamentals
Course Prefix, Num. and Title	CETT 1425 - Digital Fundamentals
Division	Technology and Business
Department	Electronics Engineering Technology
Course Type	WECM Course
Course Catalog Description	An entry level course in digital electronics to include numbering systems, logic gates, Boolean algebra, combinational logic, binary mathematics, digital codes, and Karnaugh maps. Emphasis on circuit logic analysis and troubleshooting digital circuits. Introduction to flip flops. Laboratory realization of logic circuits using TTL and CMOS gates. Laboratory use of logic probes, meters, and oscilloscopes for digital troubleshooting
Pre-Requisites	None
Co-Requisites	None

Semester Credit Hours

Total Semester Credit Hours (SCH): Lecture Hours: Lab/Other Hours	4:3:3
Equated Pay Hours	4.5
Lab/Other Hours Breakdown: Lab Hours	3
Lab/Other Hours Breakdown: Clinical Hours	0
Lab/Other Hours Breakdown: Practicum Hours	0
Other Hours Breakdown	0

Approval Signatures

Title	Signature	Date
Department Head:	David Kucera, Electronics Engineering Technology Program Director	10-26-2023
Division Chair:	David Kucera, Technology & Business Division Chair	10-26-2023
VPI:	Leigh Ann Collins Digitally signed by Leigh Ann Collins Date: 2024.05.21 10:12:17 -05'00'	

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Additional Course Information

Topical Outline: Each offering of this course must include the following topics (be sure to include information regarding lab, practicum, and clinical or other non-lecture instruction).

The following performance will be expected of any student completing this course with a passing grade. There is no absolute time limit on the performance of these objectives, unless noted, but the grade received by the student will depend, in part, on the relative speed and precision of the student's performance in these tasks. Where subjective evaluations are indicated, the instructor will make these judgments based on his or her knowledge of the skills required to place a graduate with the expectation of successful on-job performance. The student will be expected to show understanding of the following in written examination or laboratory demonstration:

- Define, give examples of, and clearly differentiate between "digital" and "analog" systems, their advantages and disadvantages.
- Correctly write the counts from 1 to 64 (decimal) in binary, octal, BCD, and hexadecimal.
- Convert a number of any reasonable size from binary, octal, decimal, hexadecimal, or BCD to any of the other number systems without using a calculator.
- Convert a number of any reasonable size from binary, octal, decimal, hexadecimal, or BCD to any of the other number systems using a calculator with appropriate conversion functions.
- Write the reasons for use of octal and hexadecimal number systems.
- Explain the difference between a place-weighted number system and a code.
- List compare and list respective advantages and disadvantages of BCD and binary numbers.
- Perform addition, direct subtraction, multiplication, and division on any two binary numbers of 16 digits.
- Perform subtraction on binary numbers by ones complement and twos complement methods.
- Draw the traditional and IEEE symbols for the inverter, AND, OR, NAND, NOR, and EXCLUSIVE OR gates.
- Write the truth-tables for the three-input AND, OR, NAND, and NOR functions.
- Write the truth-tables for the inverter and the EXCLUSIVE-OR functions.
- Write the Boolean equation for an arbitrary combinational network of 15 gate complexity.
- Use Boolean algebra to simplify an expression of not over five terms in three variables.
- Use Karnaugh maps to simplify a SOP expression of not over four variables.
- Convert to NAND realization an AND-OR Boolean expression in three variables of five terms.
- Demonstrate laboratory competency in the use of the simple logic probe.
- Given a Boolean equation of no more than five terms in four variables, build and prove the TTL or CMOS implementation of the equation given pinouts for the necessary gates, power supply, protoboard, and necessary wire.
- Demonstrate laboratory troubleshooting ability by locating a single stuck gate input in the laboratory implementation of a five-term, four-variable TTL Boolean equation using only the simple logic probe.
- Construct the truth table for a Boolean equation of no more than five terms in four variables.
- Given a stated problem in logic involving no more than four variables in three terms, produce a truth table and Boolean equation corresponding to the statement of the problem.
- Draw the diagram and write the truth table for the parallel full adder; describe the interconnection of full adders to produce multi-bit adders.
- Write the definition of combinational logic and the definition of sequential logic.
- Draw the NOR realization of an S-R latch.
- Write the truth-table for an S-R latch.
- Given an arbitrary input timing diagram for an S-R latch, draw the output waveform.
- Write the truth-table for a T flip-flop.
- Given an arbitrary input timing diagram for a T flip-flop, draw the output waveform.
- Write the truth-table for a J-K flip-flop.
- Given an arbitrary input timing diagram for a J-K flip-flop, draw the output waveform.

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Course Learning Outcomes:

Learning Outcomes – Upon successful completion of this course, students will:

1. Construct digital circuits such as combinational logic circuits, and clocking and timing circuits.
2. Demonstrate use of test equipment.
3. Identify various logic gates in circuits; analyze circuits using appropriate mathematical formulas.
4. Troubleshoot various digital circuits using schematic diagrams

Methods of Assessment:

Outcomes 1,2,3,4 will be assessed by:

- Exams
- Homework
- Labs
- Quizzes

Required text(s), optional text(s) and/or materials to be supplied by the student:

An appropriate electronics text covering Digital circuits. Example-Digital Systems principles and applications by- Tocci, Widmer, and Moss (latest edition)
Calculator – scientific with Sine, Cosine, Tangent capabilities

Suggested Course Maximum:

30 lecture, 20 Laboratory

List any specific or physical requirements beyond a typical classroom required to teach the course.

Lecture facilities for 30 students. Laboratory facilities for 20 students must include 10 bench positions each with a digital meter, logic probe, 50 MHz oscilloscope and probes, bread boarding facility with power supply and signal generator, and a stock of basic circuit components.

Course Requirements/Grading System: Describe any course specific requirements such as research papers or reading assignments and the generalized grading format for the course.

Evaluation of Performance:
Course grades will be determined by the percentage of course objectives for which the student can demonstrate mastery and by attendance. Mastery of course objectives will be determined by written examinations, physical soldering exams, an attendance grade as described in the Departmental Policy handout, a daily work grade which will include graded homework, graded laboratory work, and a comprehensive final exam.

Approximate Grade Evaluation Summary:

Major tests.....60%
Attendance.....10%
Lab reports, homework, and quizzes 15%
Final examination.....15%

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Grade Scale:
90 to 100 ..... A
80 to 89 ..... B
70 to 79 C
60 to 69 ..... D
0 to 59 ..... F

Curriculum Checklist:

☐ **Administrative General Education Course** (from ACGM, but not in WCJC Core) – No additional documents needed.

☐ **Administrative WCJC Core Course**. Attach the Core Curriculum Review Forms

- ☐ Critical Thinking
- ☐ Communication
- ☐ Empirical & Quantitative Skills
- ☐ Teamwork
- ☐ Social Responsibility
- ☐ Personal Responsibility

☒ **WECM Course** -If needed, revise the Program SCANS Matrix and Competencies Checklist