

Digital Applications CETT 1415_6A1_SummerI_Syllabus



Credit: 4 semester credit hours (3 hours lecture, 4 hours lab)

Prerequisite: CETT 1403 & CETT 1405

Course Description

This course covers digital techniques and numbering systems, digital logic circuits, digital integrated circuits, decoders, encoders, multiplexers, demultiplexers.

Required Textbook and Materials

1. *Digital Electronics 9th Edition* by William Kleitz, Pearson/Prentice Hall
 - a. ISBN number is 13:978-0-13-2543033
2. Flash Drive – 1GB Minimum
3. Notebook.

Course Objectives

Upon completion of this course, the student will be able to:

1. Demonstrate a working knowledge of digital quantities with emphasis on combinational and sequential design
2. Construct and troubleshoot combination and sequential circuits
3. Use Boolean algebra to describe the logic of a combinational designed circuit
4. Describe De Morgans Laws and apply them to a logic circuit

Course Outline

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| <p>A. Number Systems and Codes</p> <ol style="list-style-type: none">1. Digital versus Analog2. Digital Representations of Analog Quantities3. Decimal Numbering System (Base 10)4. Binary Numbering System (Base 2)5. Decimal-to-Binary Conversion6. Octal Numbering System (Base 8)7. Octal Conversions8. Hexadecimal Numbering Systems (Base 16)9. Hexadecimal Conversions10. Binary-Coded-Decimal System11. Comparison of Numbering Systems12. The ASCII Code | <ol style="list-style-type: none">5. Switches in Electronic Circuits6. A Relay as a Switch <p>C. Basic Logic Gates</p> <ol style="list-style-type: none">1. The AND Gate2. The OR Gate3. Timing Analysis4. Enable and Disable Functions5. Using IC Logic Gates6. Introduction to Troubleshooting Techniques7. The Inverter8. The NAND Gate9. The NOR Gate10. Logic Gate Waveform Generation11. Using IC Logic Gates |
| <p>B. Digital Electronic Signals and Switches</p> <ol style="list-style-type: none">1. Digital Signals2. Clock Waveform Timing3. Serial Representation4. Parallel Representation | <p>D. Boolean Algebra and Reduction Techniques</p> <ol style="list-style-type: none">1. Combinational Logic2. Boolean Algebra and Rules |

CETT 1415
Course Syllabus

3. Simplification of Combinational Logic Circuits Using Boolean Algebra
 4. De Morgan's Theorem
 5. The Universal Capability of NAND and NOR Gates
 6. Karnaugh Mapping
 7. System Design Applications
- E. Exclusive-OR and Exclusive-NOR Gates
1. The Exclusive-OR Gate
 2. The Exclusive-NOR Gate
 3. Parity Generator/Checker
 4. System Design Applications
- F. Arithmetic Operations and Circuits
1. Binary Arithmetic
 2. Two's-Compliment Representation
 3. Two'-Compliment Arithmetic
 4. BCD Arithmetic
 5. Arithmetic Circuits
 6. Four-Bit-Full Adder ICs
 7. System Design Applications
- G. Code Converters, Multiplexers, and Demultiplexers
1. Comparators
 2. Decoding
 3. Encoding
 4. Code Converters
 5. Multiplexers
 6. Demultiplexers

Grade Scale

90 – 100	A
80 – 89	B
70 – 79	C
60 – 69	D
0 – 59	F

Course Requirements

1. Contrast analog and digital devices and techniques.
2. List devices that use digital techniques.
3. Describe the advantages of using digital techniques.
4. Discuss the characteristics and uses of binary, BCD, Gray, and ASCII codes.
5. Code into ASCII, or decode from ASCII, any sequence of characters from ASCII.
6. Describe the differences between using the electromechanical devices and transistors for data representation.
7. Explain the circumstances where data would be transmitted serially.
8. Draw the waveform of a specific serial word.
9. Explain the circumstances where data would be transmitted parallel.
10. Draw a switch register, a relay register, and a transistor register containing a specific parallel word, then connect it to a data bus.
11. Describe and illustrate positive logic.
12. Describe and illustrate negative logic.
13. Identify and count in each of the four number systems (binary, octal, decimal, hexadecimal).
14. Find the compliment of any number (in binary, octal, and hexadecimal).
15. Change any positive number to its equivalent negative number.
16. Change any negative number to its equivalent positive number.
17. Add and subtract in each number system (correctly showing the carry/borrow).
18. Explain the weights of each position in each number system.

CETT 1415
Course Syllabus

19. List any number in BCD.
20. Add and subtract BCD numbers.
21. Identify and draw the standard symbols for inverters, AND, OR, NAND, and NOR gates.
22. List the truth tables for each logic function and/or give the logic function for each truth table.
23. Write or identify the Boolean equation for each logic function.
24. List the unique inputs and unique outputs for each gate.
25. Determine the input conditions to a simple gate combination circuit that would produce the unique output.
26. Select inverters for inputs and/or outputs to make any gate perform the function of any other gate.
27. Identify the level of the input that would inhibit each gate, then determine what the output would be.
28. Identify the level of the input that would enable each gate, then determine what the output would be.
29. Write boolean equations for gates and given combinations of gates.
30. Draw gate diagrams for simple and given complex boolean equations.
31. List the truth tables for each gate or given combination of gates.
32. Draw the gate diagrams for given truth tables.
33. Write the boolean equation for given truth tables.
34. List the truth tables for given boolean equations.
35. Use the boolean rules and DeMorgan's theorem to simplify given complex boolean equations.
36. Use the boolean rules and DeMorgans's theorem to simplify given complex logic circuits.
37. Simplify given complex logic circuits using Karnaugh maps.
38. Draw the logic diagram with pinouts for the 7486 and the 4070. Then write the X-OR truth table and boolean equation.
39. Draw the diagram of a four-bit parity generator/checker. (odd and even)
40. Draw the block diagram of a serial data communication system showing how parity generators and parity checkers operate within the system.
41. Explain the operation of binary to Gray and Gray to binary code converters.
42. Draw the diagram of and explain the operation of a four-bit comparator circuit.
43. Explain the operation of the 7485 four-bit magnitude comparator.
44. Draw the block diagram of half adder and full adder, labeling inputs and outputs, with the truth table.
45. Draw the block diagram of and explain an eight-bit serial adder.
46. Explain the operation of a four-bit serial adder.
47. Draw the block diagram of and explain an eight-bit parallel adder.
48. List example problems that can be used to verify the operation of a 7483 four-bit adder/subtractor Include positive inputs with and without a carry in, and with and without a carry out.
49. Draw a circuit diagram of a four-bit adder/subtractor which can be built in the Lab (use the 7486 as a controlled inverter, the 7483, and necessary circuitry).

50. Draw a 7447 BCD to 7-segment display decoder/driver properly connected to a common anode display.
51. Recall material on decoders in the text.
52. Draw decoding circuits that will decode specific hex numbers on a four-bit data bus, an eight-bit data bus, and a sixteen-bit data bus.
53. Draw a BCD decoder circuit containing a 7442 and predict the output under all input conditions. Then use 2-7442s to decode a four-bit hexadecimal number.
54. Draw a decoder circuit containing a 3-line to 8-line 74138 decoder and predict the output under all input conditions.
55. Draw a basic encoder circuit, using SSI gates, that will encode a three-bit bus (or a four-bit bus) when one of eight (or one of sixteen) inputs is made active.
56. Draw a 74148 8-line to 3-line priority encoder circuit and predict the output under all input conditions.
57. Draw a 74147 10-line to 4-line priority encoder circuit and predict the output under all input conditions.
58. Recall the material on multiplexers and demultiplexers in the text.
59. Locate the data on the multiplexers and demultiplexers contained in the required reference book.
60. Identify the characteristics, pin numbers, designations, and function tables of the multiplexers in the required reference book.
61. Draw a simple multiplexer circuit and explain its operation.
62. Draw a simple demultiplexer circuit and explain its operation.
63. Draw a circuit using a multiplexer circuit that will convert an eight-bit parallel word to an eight-bit serial word (LSB first).
64. Draw a circuit using a multiplexer that will generate a specified serial binary word.

Disabilities Statement

The Americans with Disabilities Act of 1992 and Section 504 of the Rehabilitation Act of 1973 are federal anti-discrimination statutes that provide comprehensive civil rights for persons with disabilities. Among other things, these statutes require that all students with documented disabilities be guaranteed a learning environment that provides for reasonable accommodations for their disabilities. If you believe you have a disability requiring an accommodation, please contact the Special Populations Coordinator at (409) 880-1737 or visit the online resource:

<http://www.lit.edu/depts/stuserv/special/defaults.aspx>

Student Code of Conduct Statement

It is the responsibility of all registered Lamar Institute of Technology students to access, read, understand and abide by all published policies, regulations, and procedures listed in the *LIT Catalog and Student Handbook*. The *LIT Catalog and Student Handbook* may be accessed at www.lit.edu or obtained in print upon request at the Student Services Office.

Course Schedule

Week	Topic	Reference
1/2	Course introduction and policies <ul style="list-style-type: none"> • Lecture • Lab: Multisim 	Handouts
1/2	Number Systems and Codes/Digital Electronic Signals and Switches <ul style="list-style-type: none"> • Lecture • Lab: Multisim • Test One 	Chapters 1/2
2/3	Basic Logic Gates <ul style="list-style-type: none"> • Lecture • Lab: Experiments • Project: As Assigned 	Chapter 3
3	Boolean Algebra and Reduction Techniques <ul style="list-style-type: none"> • Lecture • Lab: Chapter Exercises • Project: As Assigned • Test Two 	Chapter 5
4	Exclusive-OR and Exclusive-NOR Gates <ul style="list-style-type: none"> • Lecture • Lab: Experiments • Project: As Assigned 	Chapter 6
4	Arithmetic Operations and Circuits <ul style="list-style-type: none"> • Lecture • Lab: Experiments • Project: As Assigned • Test Three 	Chapter 7
5	Code Converters, Multiplexers, and Demultiplexers <ul style="list-style-type: none"> • Lecture • Lab: Experiments • Project: As Assigned 	Chapter 8
6	Final Project <ul style="list-style-type: none"> • Lecture • Project: As Assigned • Test Four 	

Course Schedule

Week	Assignment/Activities	Due Date	Location
1	Cover Syllabus Introduction Discussion Assignments Tests	Monday 06/03, 2024 5:00PM	Getting Started
1	Review Ch-1&2 Lab work Assignment 1	Thursday 06/06, 2024 5:00PM	Text Book Ch-1&2
2	Review Ch-1&2 Assignment-2	Thursday 06/06, 2024 5:00PM	Text Book Ch-1&2
2	Test 1 Ch-1&2	Monday, 06/10, 2024 5:00PM	Classroom 221
3	Review Ch-3&5	Tuesday 06/11, 2024 5:00PM	Text Book Ch-3&5
3	Chapter 3&5 Review Assignment 3 Lab work	Wednesday, 06/12,2024 5:00PM	Text Book Ch-3&5
4	Chapter 3&5 Review Assignment 4 Lab work	Thursday 06/13, 2024 5:00PM	Text Book Ch-3&5
4	Test-2	Monday 06/17, 2024 5:00PM	Classroom 221

CETT 1415
Course Syllabus

4	Review Ch-6&7	Tuesday, 06/18, 2024 5:00PM	Text Book Ch-6,&7
4	Chapter 6,&7 Lab Work Assignment 5&6	Wednesday 06/19, 2024 5:00PM	Text Book Ch-6&7 Classroom 221
4	Review Chapter 6&7 Lab Assignment	Monday 06/24,2024 5:00PM	Classroom 221
5	Ch-6&7 Test-3	Monday, 06/25,2024 5:00PM	Classroom 221
5	Review Ch-8	Tuesday, 07/03,2024 5:00PM	Ch-8 Classroom 221
5	Review Ch-8 Assignments 7&8	Wednesday, 07/04, 2024 5:00PM	Ch-8 Classroom 221
5	Review Ch-8 Lab Project	Thursday 07/05, 2024 5:00PM	Ch-8 Classroom 221
6	Test- 4	Tuesday 07/09, 2024 5:00PM	Ch-8 Classroom 221