الجامعة الافتراضية السورية
SYRIAN VIRTUAL UNIVERSITY

Course Definition File

Logic Circuits

Information

Technology

Engineering

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1. Basic Information:

Course Name	Logic Cicuits
Course ID	BLC401
No. of Recorded Sessions*	10
No. of Synchronized Sessions*	12
No. of Quizzes (hrs.)	–
Exam (hrs.)	1:15
Registered Sessions Work Load (hrs.)	20
Synchronized Sessions Work Load (hrs.)	24
Credit Hours	5

* The duration of each session 1.5 hr

2. Pre-Requisites:

Course	ID
Algebraic Structures	BAS401

3. Course Objectives:

"Logic Circuits" aims to acquaint the student with the main concepts for analysis and design of logic circuits. It presents the various numbering systems, such as the binary system, hexadecimal, Binary Coded Decimal BCD and Gray Code. It presents the logical gates and how to use Boolean algebra theories and Karnaugh Maps to reduce, design, and analyze combinational circuits. It shows the main types of Latches and Flip-Flop circuits and the foundations of the design of sequential logic circuits are presented. The design of some applications for the logic circuit such as arithmetic circuits, counters, memories, and data buses.

In particular the student will be able to:

1. Understand the binary and hexadecimal numbering systems and how to make the conversion between them and the decimal numbering system and the coding of negative binary numbers and calculations in the binary numbering system. Understand Binary Coded Decimal BCD coding system and Gray Code and conversion between them and the binary system.
2. Understand the logic gates, analyzing, designing, drawing and reducing the combinational logic circuits using the theories of Boolean algebra and Karnaugh Maps.
3. Understand flip flops and latches, analysis, and design of sequential circuits.
4. Analysis and design of main applications logic such as arithmetic circuits, counters, decoders, coders, multiplexers, de-multiplexers memories and data buses.

4. Learning Outcomes (LO):

By the end of this course the learner is expected to be able to:

- Convert between binary, decimal, hexadecimal, Binary Coded Decimal BCD, and Gray code.
- Analyze and design combinational logic circuits.
- Analyze and design sequential logic circuits.
- Analyze and design arithmetic circuits (addition, multiplication and subtraction)
- Analyze and design data transfer circuits.
- Analyze and design counters.
- Understand main characteristics and structure of memories.

5. Assessment Results:

Chapter No.	Chapter Title	Intended Objectives	Assessment Type				
			Developed content/ Recorded Sessions	Practical Activities (Synchronized Sessions)	Quizzes and Exams	Presentations And Interviews	Reports
CH1	Coding and numbering systems -1	Comprehension -Analytical Thinking	X	X	X		
CH2	Coding and numbering systems -2	Comprehension -Analytical Thinking -	X	X	X		X
CH3	Logic Gates and Boolean Algebra	Comprehension -Analytical Thinking -Tools And Application	X	X	X		X
CH4	Combinational Logic Circuits	Comprehension -Analytical Thinking - Design-Tools And Application	X	X	X		X
CH5	Sequential Logic	Comprehension -Analytical	X	X	X		X

	Circuits	Thinking – Design–Tools And Application					
CH6	Arithmetic Circuits	Comprehension –Analytical Thinking– Design –Tools And Application	X	X	X		X
CH7	MSI Logic Circuits	Comprehension –Analytical Thinking– Design –Tools And Application	X	X			X
Ch8	The Counters	Comprehension –Analytical Thinking– Design –Tools And Application	X	X			X
Ch9	Memories and Data Buses	Comprehension –Analytical Thinking –	X	X			

6. Course Syllabus

Chapter No.	Chapter Title	Chapter Content (Syllabus)	No. of Theoretical Learning Units	No. of Practical Learning Units)
CH1	Coding and numbering systems –1	1. Numbering Systems 2. Presenting numbers 3. Binary numbering system 4. Conversion between binary and decimal 5. Arithmetic operations in binary.	1	1
CH2	Coding and numbering systems –2	1. Negative binary numbers 2. Subtraction of binary numbers by two's complement method 3. Hexadecimal 4. Binary Coded Decimal BCD 5. Gray Code	1	1
CH3	Logic Gates and Boolean Algebra	1. Boolean Algebra 2. Truth tables 3. Basic logic gates OR AND NOT 4. Algebraic presentation of logic circuit 5. NOR and NAND logic gates 6. Boolean algebra theorems 7. DeMorgan theorems	2	2

		8. EX-OR, EX-NOR gates 9. Presenting logic gates by NAND gates only or NOR gates only.		
CH4	Combinational Logic Circuits	1. Combinational logic circuits defenition 2. Min and Max terms 3. Logic functions reduction 4. Logic functions reduction algebraically 5. Karnaugh maps 6. Logic functions reduction by Karnaugh maps 7. Don't care condition 8. Design procedure of combinational logic circuits	2	2
CH5	Sequential Logic Circuits	1. Sequential logic circuits definition 2. Latches circuits 3. Flip-Flops circuits 4. Flip-Flops and clock signals 5. SC Flip-Flop 6. JK Flip-Flop 7. D Flip-Flop 8. Flip-Flop and unsynchronized inputs 9. Famous sequential circuits 10. Sequential circuits analysis	2	2

CH6	Arithmetic Circuits	1. Arithmetic circuits definition 2. Binary adder 3. Binary multiplier 4. Binary subtractor 5. Decimal adder	1	1
CH7	MSI Logic Circuits	1. MSI Logic circuits definition 2. Decoder 3. Encoder 4. Multiplexers or Data Selectors 5. De-multiplexers 6. Comparator	1	1
Ch8	The Counters	1. Counters definition 2. Counters types 3. Asynchronous counters 4. Synchronous counters 5. Design procedure for synchronous counter	1	1
Ch9	Memories and Data Buses	1. Memories definition and types 2. Memories specifications 3. Memories main principles 4. Read Only memories ROM 5. Random Access Memory 6. Data buses	1	1

7. Practical Activity:

- Tools and Labs:

Tool Name	Description
Visio	Diagrams drawing software
Logisim	Logic circuits simulator
Microsoft Word	Word processor

- Practical Activities per Chapters:

Chapter	Practical Activity	Remarks
CH1	☒ Exercises ☒ Homework	
CH2	☒ Exercises ☒ Homework	
CH3	☒ Exercises ☒ Homework	
CH4	☒ Exercises ☒ Homework	
CH5	☒ Exercises ☒ Homework	
CH6	☒ Exercises ☒ Homework	
CH7	☒ Exercises	

CH8	☒ Exercises	
CH9	☒ Exercises	

7. References:

- Scientific content from course Moodle page.
- Registered sessions
- Synchronized sessions
- Elahi, Ata. *Computer Systems: Digital Design, Fundamentals of Computer Architecture and Assembly Language*. Springer, 2017.
- Wilkinson, Barry. *The Essence of Digital Design. Essence of Engineering*. Prentice Hall, Upper Saddle River, 1998.
- Ndjountche, Tertulien. *Digital Electronics 1: Combinational Logic Circuits*. John Wiley & Sons, 2016.
- Ndjountche, Tertulien. *Digital Electronics 2: Sequential and Arithmetic Logic Circuits*. John Wiley & Sons, 2016.