

Course specification
(4204 Very-large-scale integration)

Faculty:	<i>HICIT- Higher Institute for Computers & Information Technology-El Shorouk Academy</i>
Programme(s) on which the course is given:	Under graduate program in Computer Science
Major or minor element of programme:	Compulsory
Department offering the programme	Department of Computer Science
Department offering the course:	Department of Computer Science
Year / Class	4 th Year – 2 nd semester
Date of specification approval	1/8/2023

A- Basic Information

Title: Very-large-scale integration	Code: 4203		
Weekly Hours:			
Lecture : 3	Exercise: -	Practical :3	Total: 6

B- Professional Information

1- Course Aims:

This course aims to provide students with a foundational understanding of Very Large Scale Integration (VLSI) technologies. By exploring semiconductor principles, CMOS logic gates, FPGA architecture, VHDL programming, and the Arduino platform, students will gain insights into modern electronic design and fabrication processes. The course aims to equip students with the knowledge and skills needed to conceptualize, design, and implement digital circuits, fostering their ability to create innovative solutions in the realm of integrated circuitry and electronic systems.

2- Program ILOs Covered by Course

Program Intended Learning Outcomes			
Knowledge and understanding	Intellectual Skills	Professional and practical skills	General and Transferable skills
A8, A10, A19	B1, B2, B4, B8, B10	C1, C5, C6	D12

2 - Intended learning outcomes of course (ILOs)

a- Knowledge and Understanding

a1. Define Very Large Scale Integration (VLSI) and its significance, Complementary Metal-Oxide-Semiconductor (CMOS) technology, Field-Programmable Gate Arrays (FPGAs), Arduino platform and its applications [A8, A10]

a2. Describe the steps involved in integrated circuit fabrication, the behavior of intrinsic and extrinsic semiconductors, the FPGA configuration process. [A19]

- a3. Identify the basic input and output interactions with Arduino, the structure of VHDL code for structural modeling. .[A8,A10]
- a4. Explain the role of VLSI in various electronic devices, semiconductor properties such as energy bands and doping, the operation and advantages of CMOS logic gates, the reconfigurable nature and benefits of FPGAs. [A8,A10]

b- Intellectual skills

- b1. Analyze the impact of VLSI on electronics. the effects of doping on semiconductor behavior scenarios where FPGAs offer advantages. the impact of logic placement on circuit performance. [B4]
- b2. Compare VLSI technology with earlier integration levels, semiconductor behavior to conductors and insulators. FPGAs with other digital devices. .[B1,B8,B10]
- b3. Differentiate between combinational and sequential logic circuits. [B2]

c- Professional and practical skills

- c1. Write VHDL code for basic structural modeling using components and connections. Simulate VHDL designs to verify their behavior.[C1,C5]
- c2. Develop VHDL code for sequential modeling, including flip-flops and state machines.[C5]
- c3. Construct testbenches for VHDL designs to perform functional simulations.
- c4. Analyze simulation results to validate the correctness of VHDL designs.[C5]

d- General and transferable skills

- d1. Work effectively as an individual and as a member of a team.[D12]
- d2. Write Structural Report.[D12]

3- Contents

Topic	Hours	Lecture	Practical
Introduction to VLSI technologies.	6	3	3
Semiconductor Basics.	6	3	3
Introduction to CMOS logic gates.	6	3	3
Logic Circuits (Combinational & sequential).	6	3	3
Introduction to FPGA.	6	3	3
FPGA Technology and Architecture.	6	3	3
Principle of VHDL programming language part (1).	6	3	3
Principle of VHDL programming language part (2).	6	3	3
Introduction to Arduino.	6	3	3
Installing Arduino IDE and how use it.	6	3	3
Architecture of Arduino board, programs with Arduino	6	3	3
Course Project	4	2	2
Selected Topics	2	2	

4 -Teaching and learning methods

Teaching and learning methods	Used
Active Learning	

Lectures(blending learning – online learning using virtual classroom)	√
Tutorial Exercises (hybrid learning – online learning)	√
Practical Lab(blending learning– online learning)	√
Exercises	
Discussions.	√
Self – Learning strategy	
Reading material	√
Websites search	√
Research and reporting	√
Self-studies	
Experimental strategy	
Group work	
Presentation	√
Problem solving strategy	
Problem solving/problem solving learning based	√
Case study	
Synchronous E-Learning	
Virtual lab	-
Virtual class	-
Chat Room	√
Video lectures	
Asynchronous E-Learning	
E-Learning	√

5 -Student assessment methods

Methods	Assessment	Used
Electronic Midterm Exam	To assess the knowledge and understanding achieved by the student during the previous weeks. (online on e-learning hub)	√
Pencil-to-Paper Final Exam	To evaluate what the student gain at the end of the course, and to assess: the knowledge and understanding, general skills, and intellectual skills.	√
Course Project	To allow students work in team, and to evaluate knowledge, understanding, intellectual, and transferable skills. (online on e-learning hub , FTF)	√
Electronic Course Work & Quizzes	To keep the student always in the course, and to evaluate knowledge, understanding, intellectual, and transferable skills.(online on e-learning hub)	√
Practical Exam	to measure the ability of students to design and implement a software program(FTF).	--
Participation	To assess the knowledge and understanding achieved by the student during the previous weeks.	√

5.4 Course Work & Quizzes: To keep the student always in the course, and to evaluate knowledge, understanding, intellectual, and transferable skills

Assessment Schedule

Assessment	Week #
Participation	3-14
Electronic Mid Term Exam	8
Final Exam	16
Electronic/ hard copy Course Project	3-14
Electronic/ hard copy Course Work & Quizzes	2-14

Assessment Weight

Assessment	Weigh %
Participation	5%
Electronic Mid Term Exam	
Final Exam	80%
Course Project	10%
Course Work & Quizzes	5%
Total	100

Course Work & Quizzes: (Short Exams, Assignments, Researches, Reports, Presentations, Class/Project discussion)

6 -List of references

Essential books (text books)	"Weste, N. H., & Harris, D. M. (2011, January 1). <i>CMOS VLSI Design: a Circuits and Systems Perspective.</i> "
<u>Internet Location</u>	https://wiki.rice.edu/confluence/display/PARPROG/COMP322
Recommended books	- Chu, P. P. (2008, February 4). <i>FPGA Prototyping by VHDL Examples: Xilinx Spartan-3 Version.</i> Wiley-Interscience. https://doi.org/10.1604/9780470185315 - Chang, C. Y., & Sze, S. M. (1996, January 1). <i>VLSI Technology.</i> https://doi.org/10.1604/9780070630628
Periodicals, website	Powerpoint presentations of all course materials All labs material [https://moodle.sha.edu.eg/course/view.php?id=2268]

7- Required Facilities

7.1 Tools/Software

- Arduino

7.2 Teaching facilities:

	<i>Lecture</i>	<i>class</i>	<i>Lab</i>
Whiteboard	used	-	used
Pc/laptop	used	-	used
Data show	used	-	used
Webinars	MS TEAMS	-	MS TEAMS
SocialMedia	Facebook Page for 4 th year	-	Facebook Page for 4 th year
ChatRoom	ChatTeams	-	ChatTeams
Videos	-	-	-
Website	MOODLE	-	MOODLE

8 Course Matrices

8.1 Course Content/ILO Matrix

Course Contents	Knowledge & understanding				Intellectual skills			Professional and practical skills				General	
	a1	a2	a3	a4	b1	b2	b3	c1	c2	c3	c4	d1	d2
Introduction to VLSI technologies.	√	√	√	√		√		√	√				
Semiconductor Basics.	√				√	√				√			
Introduction to CMOS logic gates.	√	√			√	√				√			
Logic Circuits (Combinational & sequential).	√	√			√	√	√	√	√	√			
Introduction to FPGA.	√	√	√	√		√	√	√	√				
FPGA Technology and Architecture.	√	√	√	√		√	√	√	√				
Principle of VHDL programming language part (1).	√	√	√	√		√	√	√	√				
Principle of VHDL programming language part (2).	√			√		√	√	√	√				
Introduction to Arduino.	√			√	√	√	√	√	√				
Installing Arduino IDE and how use it.	√	√		√	√	√	√			√			
Architecture of Arduino board, programs with Arduino	√	√	√	√		√		√	√				
Course Project	√	√	√	√				√	√				
Selected Topics	√	√	√	√				√	√				

8.2 Learning Method /ILOs Matrix

Learning Methods	Knowledge and understanding				Intellectual skills			Professional and practical skills				General	
	a1	a2	a3	a4	b1	b2	b3	c1	c2	c3	c4	d1	d2
Lectures	√	√	√	√	√	√	√	√	√	√	√		
Tutorial Exercises					√	√	√	√	√	√	√		
Reading material	√	√	√	√	√	√	√	√	√	√	√		
Websites search	√	√	√	√	√	√	√		√			√	√
Research and reporting	√	√	√	√								√	√
Problem solving/problem solving learning based						√	√						
Group work								√	√	√		√	√
Presentations	√	√	√	√									
Exercises Lab								√	√	√	√		
Discussions.					√	√	√	√	√	√		√	√

8.3 Assessment Methods /ILOs Matrix

Assessment Methods	Knowledge & understanding				Intellectual skills			Professional & practical skills				General	
	a1	a2	a3	a4	b1	b2	b3	c1	c2	c3	d1	d2	
Electronic Mid Term Exam	√	√	√	√	√	√	√						
Final Exam	√	√	√	√	√	√	√						
Course Project	√	√	√	√	√	√	√	√	√	√	√	√	
Electronic Course Work & Quizzes	√	√	√	√	√	√	√	√	√	√	√	√	

9. Course ILOs Vs Program ILOs

Course ILOs \ Prog ILOs		Knowledge & understanding			Intellectual skills					Professional and practical skills			General
		A8	A10	A19	B1	B2	B4	B8	B10	C1	C5	C6	D12
K&U	a1	√	√										
	a2			√									
	a3	√	√										
	a4	√		√									
Int.	b1						√						
	b2				√				√				
	b3					√			√				
P. &P.	c1									√	√		
	c2										√		
	c3											√	
	c4										√		
General	d1												√
	d2												√

Course Coordinator: Dr. Tarek Abd El Azeem ()

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