FUTURE UNIVERSITY IN EGYPT جامعة المستقبل

Faculty of Engineering & Technology

Microelectronics Systems

Information :

Course Code :	ELE 570	**Level :**	Undergraduate	**Course Hours :**	3.00- Hours

Department : Specialization of Electronics & Communication

Instructor Information :

Title	Name	Office hours
Associate Professor	Mohamed Hassan Mohamed Elmahlawy	8
Teaching Assistant	Bassel Yasser Mohamed Kamel	

Area Of Study :

Analyze CMOS digital circuits in Transistor Level.
Understand design rules for VLSI technology, scaling effects and physical limits to device fabrication.
Understand the basic principles and theory of operation of static and dynamic CMOS digital circuits.
Determine the performance of CMOS digital circuits in terms of noise-margin, speed, fanout, and power dissipation.
Understand the basic principles and theory of operation of static and dynamic memory circuits.
Design, and simulate digital circuits using the Electronic Design Automation (EDA).

Course outcomes :

a.Knowledge and Understanding: :	
1 -	a1. Define basic definitions, terminologies, and state-of-the art of CMOS technology including the design rule checking in the layout level.
2 -	a2. Explain the analysis and design of the static and dynamic CMOS inverter in terms of noise-margin, speed, fanout, and power dissipation.
3 -	a3. Illustrate the analysis and design of static and dynamic CMOS combinational gates for functionality, performance, and their applications.
4 -	a4. Explain the analysis and design of static and dynamic sequential circuits using different clocking strategy and their applications.
5 -	a5. Describe semiconductor memories and RAM cores including peripheral memory circuits.
b.Intellectual Skills: :	
1 -	b1. Analyze the voltage transfer characteristics and the transient characteristics of the basic static CMOS inverter.
2 -	b2. Solve problems related to digital circuits in the transistor level with their different applications.
3 -	b3. Evaluate the performance of digital circuits
4 -	b4. Compare between different logic styles in digital circuits.
5 -	b5. Design electronic digital circuits for different digital system applications.

c.Professional and Practical Skills: :	
1 -	c1. Clarify theories and techniques of mathematics to solve digital circuit problems in the transistor level.
2 -	c2. Build the components and requirements for designing a complete digital circuit.
3 -	c3. Develop the design and implementation of digital circuits using the Electronic Design Automation (EDA).
4 -	c4. Write technical reports.
d.General and Transferable Skills: :	
1 -	d1. Collaborate effectively within multidisciplinary team
2 -	d2. Communicate effectively.
3 -	d3. Effectively manage tasks, time, and resources.
4 -	d4. Search for information and engage in life-long self-learning discipline.

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Definitions and Terminologies State-of-the art of CMOS Technology	3	3	-
Design Rules MOSFET Model MOSFET Characteristics Design methodology and tools	5	3	2
Static Behaviour of CMOS Inverter	7	3	4
Dynamic Behaviour of CMOS Inverter	10	6	4
Static Combinational Circuits	5	3	2
Designing for Speed and Low Power	5	3	2
Dynamic Combinational Circuits	5	3	2
Static Sequential Circuits	7	3	4
Dynamic Sequential Circuits	7	3	4
Design Sequential Logic Circuits using different Clocking Strategy.	5	3	2
Semiconductor Memories and RAM Cores.	8	6	2
Peripheral Memory Circuits.	5	3	2
Effects of scaling circuit dimensions, and physical limits to device fabrication.	3	3	-

Teaching And Learning Methodologies :

Interactive Lecturing
Discussion
Problem Solving
Experiential Learning
Cooperative Learning
Research
projects

Course Assessment :

Methods of assessment	Relative weight %	Week No	Assess What
assignments	10.00		
Final-term examination	40.00	15	
Lab Experiment	5.00		
Mid-term exams	30.00	7	
Oral Exam	5.00		
Quizzes	10.00		

Course Notes :

MOS LOGIC gates; NMOS, CMOS pseudo NMOS; dynamic logic; dynamic cascaded logic; domino logic; 2 and 4 phase logic; pass transistor logic. Control and timing; synchronous and asynchronous; self-timed systems; multi-phase clocks; register to register transfer; Effects of scaling circuit dimensions; physical limits to device fabrication. Static & dynamic memories.

Recommended books :

Recommended book (text books): Jan M. Rabaey; ñDigital Integrated Circuitsò, 2nd Edition; Prentice Hall; 2003.
Essential book: Neil H.E. Weste and David Harris; "CMOS VLSI Design, A Circuits and Systems Perspective", 4rd Edition; Pearson Addison-Wesley; 2011.