

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; "Digital Integrated Circuits", 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.