

Faculty of Engineering & Technology

VLSI Design

Information :

Course Code : ELE 562 **Level :** Undergraduate **Course Hours :** 3.00- Hours

Department : Specialization of Electronics & Communication

Area Of Study :

By the end of this course, students will be able to:

- Develop students knowledge about the analysis of CMOS Digital Circuits.
- Enrich students knowledge about VLSI technology.
- Develop students knowledge about fundamentals of static and dynamic memory circuits.
- Train students to use software tools using the Electronic Design Automation (EDA).

Description :

Introduction to VLSI systems, Review of digital systems, CMOS logic and fabrication, MOS transistor theory, Layout design rules, Circuit characterization and performance estimation, Circuit simulation, Combinational and sequential circuit design, Static and dynamic CMOS gates, Memory system design, Design methodology and tools.

Course outcomes :

a. Knowledge and Understanding: :

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|-----|---|
| 1 - | a1- Illustrate methods of fabrication of Integrated circuits and CMOS digital applications. |
| 2 - | a2- List different styles of logic circuits. |
| 3 - | a3- Estimate noise-margin, switching speed and power dissipation. |
| 4 - | a4- Recognize static and dynamic implementation of CMOS digital circuits. |

b. Intellectual Skills: :

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|-----|--|
| 1 - | b1- Analyse the voltage transfer characteristics and transient characteristics of the basic CMOS inverter. |
| 2 - | b2- Compare between different logic styles. |
| 3 - | b3- Evaluate performance of digital circuits. |

c. Professional and Practical Skills: :

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| 1 - | c1. Apply theories and techniques of mathematics, basic electricity and electronics to solve electronic circuit problem. |
| 2 - | c2. Seek the components and requirements for designing a complete application circuit. |
| 3 - | c3. Use computational facilities and related software tools to design digital circuits. |

d. General and Transferable Skills: :

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| 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 | 5 | 3 | 2 |
| Design Rules, MOSFET Model, MOSFET Characteristics, Design methodology and tools | 5 | 3 | 2 |
| Static Behaviour of CMOS Inverter | 5 | 3 | 2 |
| 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 | 5 | 3 | 2 |
| Dynamic Sequential Circuits | 5 | 3 | 2 |
| Design Sequential Logic Circuits using different Clocking Strategy. | 10 | 6 | 4 |
| Semiconductor Memories and RAM Cores. | 10 | 6 | 4 |
| Peripheral Memory Circuits. | 5 | 3 | 2 |

Teaching And Learning Methodologies :

Interactive Lecturing
Discussion
Problem Solving
Experiential Learning
Cooperative Learning
Research
Assignment / Project

Course Assessment :

| Methods of assessment | Relative weight % | Week No | Assess What |
|-----------------------|-------------------|---------|-------------|
| Assignments | 10.00 | | |
| Final exam | 40.00 | | |
| In Class Quizzes | 10.00 | | |
| Lab Experiment | 5.00 | | |
| Mid-Term Exams | 30.00 | | |
| Oral Exam | 5.00 | | |

Recommended books :

Recommended book (textbook): 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", 3rd Edition; Pearson Addison-Wesley; 2005.