22EC303 VLSI DESIGN

Hours Per Week :

L	T	P	C
3	0	2	4

Source - https://www. electronicshub. org/vlsi-projects- for-engineering- students/

PREREQUISITE KNOWLEDGE: Electronics Components and Devices

COURSE DESCRIPTION AND OBJECTIVES:

VLSI design course deals with understanding of the basic electrical properties characteristics of CMOS circuit construction and also introduce the concepts and techniques of fabrication.

MODULE–1

UNIT-1 **12L+0T+8P=20 Hours**

ELECTRICAL CHARACTERISTICS OF MOS TRANSISTOR:

MOS TRANSISTOR INTRODUCTION: NMOS and PMOS Transistor operation, IDS-VDS relationship, Channel Length Modulation, Transistor parameters - threshold voltage, body effect, transconductance, output conductance, figure of merit.

UNIT-2 **12L+0T+8P=20 Hours**

CMOS DIGITAL CIRCUITS:

Static CMOS Logic gates: NMOS inverter, Various pull ups, CMOS Inverter, Static CMOS logic gates, Bi-CMOS inverter.

Logic Design: Pass transistor, Transmission gate logic, Alternate forms of CMOS logic – pseudo NMOS logic, dynamic CMOS logic, clocked CMOS logic, domino CMOS logic and DCVS logic, Combinational circuit design – 1-bit adder, array multiplier, Sequential Circuit Design - design of latches and flip-flops.

PRACTICES:

- Simulation of characteristics of MOSFET.
- Simulation of CMOS Inverter and all other logic gates.
- Simulation of logic gates using Pseudo nMOS logic.
- Simulation of logic gates using Dynamic logic.
- Simulation of 1-bit adder.
- Simulation of flipflops.

MODULE –2

UNIT-1 **12L+0T+8P=20 Hours**

CMOS ANALOG CIRCUITS:

CMOS Analog circuits: Single stage Amplifiers: Common-source stage, Source follower, Common-gate, Differential Amplifiers, current mirrors.

UNIT-2 **12L+0T+8P=20 Hours**

DESIGN FLOW, FABRICATION AND TESTING:

VLSI Design flow, Layout diagrams for nMOS and CMOS logic gates, Vlsi Fabrication: CMOS processes - NWell, PWell, Twin tub and Silicon on insulator, introduction to fabrication techniques, Introduction to testing, BIST.

SKILLS:

✓ *Design logic gates using CMOS logic, Pseudo, Dynamic, Domino and DCVSL logics.*

✓ *Design Digital circuits using CMOS logic.*

✓ *Design analog circuits using CMOS logic.*

PRACTICES:

- Simulation of CS Amplifier
- Simulation of CG Amplifier
- Simulation of CD Amplifier
- Simulation of differential Amplifier
- Simulation of current mirror
- Design of CMOS Inverter Layout

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyze the characteristics of MOSFET.	Analyze	1	1, 2, 4, 5, 9, 10, 12
2	Construct digital circuits using CMOS gates.	Apply	1,	1, 2, 5, 9, 10
3	Design analog circuits using CMOS gates.	Apply	2	1, 2, 3, 5, 9, 10
4	Outline the fabrication and testing	Apply	2	1, 2, 5, 9, 10, 12

TEXT BOOKS:

1. Douglas A Pucknell and Kamran Eshranghian, "Essentials of VLSI Circuits and systems", 3rd edition, Prentice Hall of India, 2011.
2. Behzad Razavi, Design of Analog CMOS Integrated Circuits, 2nd Edition, McGraw Hill Education, 2016.

REFERENCE BOOKS:

1. S.M. Sze, "VLSI Technology", 2nd edition, TMH, 2007.
2. Amar Mukherjee, "Introduction to nMOS and CMOS VLSI System Design", 1st edition, Prentice Hall, 1986.
3. Ajay Kumar Singh, "Digital VLSI Design", 1st edition, PHI Learning Private Limited, 2011.