INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

LOW POWER VLSI CIRCUITS								
VII Semester: ECE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AECD53	**Elective**	3	-	-	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: VLSI Design								

I. COURSE OVERVIEW:
This course provides an in-depth exploration of low power very large-scale integration (VLSI) circuits, which are critical in modern electronic systems for conserving energy and extending battery life. Students will delve into various design techniques, methodologies, and technologies aimed at minimizing power consumption in digital integrated circuits.

II. COURSES OBJECTIVES:
The students will try to learn

I. Understand the need of Low power circuit design.
II. Analyze and design Low-Voltage Low-Power combinational circuits.
III. Known the design of Low-Voltage Low-Power Memories

III. COURSE OUTCOMES:
At the end of the course students should be able to:

CO1: Understand the basic need of low power VLSI circuits to reduce the power dissipation
CO2: Interpret the low power circuit design approaches for different level measures
CO3: Make use of trends in VLSI implement low power adders Embedded hardware and software development cycles and tools.
CO4: Describe the pipelining approach for low power circuits
CO5: Classify different types of multipliers used to design low power multipliers.
CO6: Demonstrate the basic concepts of memories for designing of low power SRAM and DRAM memories

IV. COURSE CONTENT:

MODULE - I: FUNDAMENTALS (09)

Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects – Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

MODULE –II: LOW-POWER CIRCUIT DESIGN APPROACHES (09)

Low-Power Design through Voltage Scaling – VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches. Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, Mask level Measures.

MODULE –III: LOW VOLTAGE LOW POWER ADDER (10)

Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Low-Voltage Low-Power Design Techniques.

Trends of Technology and Power Supply Voltage, Low-Voltage Low-Power Logic Styles.

MODULE –IV: LOW-VOLTAGE LOW-POWER MULTIPLIERS (10)

Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh Wooley Multiplier, Booth Multiplier.

MODULE –V: LOW-VOLTAGE LOW-POWER MEMORIES (10)

Basics of ROM, Low-Power ROM Technology, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit.

V. TEXT BOOKS:

1. CMOS Digital Integrated Circuits –Analysis and Design –Sung-Mo Kang, Yusuf Leblebici, TMH,2011.
2. Fundamentals Low-Voltage, Low-Power VLSI Subsystems –Kiat-Seng Yeo, Kaushik Roy, TMH Professional Engineering.

VI. REFERENCE BOOKS:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective –Ming-BO Lin, CRC Press,2011.
2. Low Power CMOS VLSI Circuit Design –Kaushik Roy, Sharat C. Prasad, John Wiley & Sons, 2000.
3. Practical Low Power Digital VLSI Design –Gary K. Yeap, Kluwer Academic Press, 2002.

ELECTRONICS RESOURCES:

4. NPTEL :: VLSI Physical design
5. NPTEL :: Low Power VLSI Circuits & Systems
6. NPTEL :: low power VLSI circuits and systems
7. https://ece.nitk.ac.in/course/ec802-low-power-vlsi-design

VII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Definition and terminology
4. Tech-talk topics
5. Assignments
6. Model question paper - I
7. Model question paper - II
8. Lecture notes
9. Early learning readiness videos (ELRV)
10. Power point presentations