Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Department of Electronics and Telecommunication Engineering

Honor Courses E&TC Engineering 2024-25

HONORS SUBJECT DETAILS

Sem	Subject Code	Subject	Subject Credits	Teaching Scheme				Examination Scheme							Workload			Total WL
								Theory			Practical/ Tutorial							
				WL Type	TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR		TH	PR	Tut	
III	ET23281	Advanced Digital Design	3	TP	2	2	-	10	20	50	20	20	-		2	8	0	10
IV	**ET23291**	**ASIC Design and SoC**	**3**	**TP**	**2**	**2**	**-**	**20**	**20**	**50**	**20**	**20**	**-**		**2**	**8**	**0**	**10**
V	ET23381	VLSI Verification and Testing	4	TP	3	2	-	20	20	70	20	20	-		3	8	0	11
VI	ET23391	Scripting Languages and Verification	4	TP	3	2	-	20	20	70	20	20	-		3	8	0	11
VII	ET23481	Advanced CMOS VLSI Technology	4	TP	3	2	-	20	20	70	20	20	-		3	8	0	11
	Total:		**18**		**13**	**10**	**-**	**90**	**100**	**310**	**100**	**100**	**-**		**19**	**64**	**0**	**53**
					23			**500**			**200**				**700**			
					Internal:			**290**			**41.4**			**%**				
					External			**410**			**58.6**			**%**				

SD Biradar	Dr. BH Patil	Dr. SM Bhosle	Dr. RS Bichkar
Autonomy Coord.	HoD – E&TC	Dean Academics	Principal

VPKBIET BARAMATI PUNE (MS.)

ET23281:- ASIC Design and System on Chip (SEM IV)

Teaching Scheme:	Credits	Examination Scheme:
Theory: 02 Hours/Week Practical: 02 Hours/Week	03	Activity:20 Marks In Sem: 20 Marks End Sem:50 Marks Practical: 20 Marks Teamwork: 20 Marks

Prior knowledge of

1. Digital Logic Design

is essential.

Course Objectives:

CO1: Analyze the working principles and design techniques of digital CMOS circuits

CO2: Apply fabrication technology concepts, including layout design and design issues

CO3: Design and evaluate System on Chip (SoC) architectures

CO4: Explore and implement emerging trends in ASIC and SoC design,

Course Outcomes:

1. To provide a fundamental understanding of ASIC design principles and System-on-chip (SoC) architecture.
2. To familiarize students with the design flow of digital integrated circuits using CAD tools.
3. To introduce practical skills for implementing designs using Micro wind, MATLAB, and PYNQ boards.
4. To bridge the gap between theoretical knowledge and practical applications in VLSI and embedded systems.

Course Contents

Unit I: Digital CMOS Circuits (06 Hrs.)

Types of ICs: Full Custom, Semi-Custom, and Programmable Logic Devices. Types of ASICs: Standard Cell-Based, Gate Array-Based, Full Custom Design.

MOSFET parasitic, Technology scaling, Channel length modulation, Hot electron effect, Velocity saturation. CMOS Inverter, Device sizing, CMOS combinational logic design, Power dissipations, Power delay product, Body Effect, Rise and fall times, Latch-Up effect, Transmission gates.

Unit II: Fabrication Technology for ASICs (06 Hrs.)

Lambda rules, Design Rule Check, Fabrication methods of circuit elements, Layout of cell, Library cell designing for NAND & NOR, Circuit Extraction, Electrical Rule Check, Layout Vs. Schematic, Post-layout Simulation and Parasitic extraction, Design Issues like Antenna effect, Electro migration effect, Cross talk and Drain punch through, Timing analysis.

Unit III: System on Chip (SoC) Design (06 Hrs.)

SoC: Components and Architectures, Processor Cores in SoC: Soft Cores vs. Hard Cores. Communication Protocols: UART, I2c, SPI, AMBA (APB, AHB), AXI. Memory Subsystems and IP Integration. High-Level Synthesis Tools for SoC Design.

Unit IV: Emerging Trends in ASIC and SoC Design (06 Hrs.)

Low Power ASIC Design Techniques. Heterogeneous SoC Architectures, Role of Machine Learning in SoC Development, AI and ML Accelerators in SoC, Chiplets and 3D IC Integration, Hardware Acceleration using FPGA and PYNQ Boards. Green and Sustainable ASIC/SoC Design, Case Studies: Real-World Applications of ASICs and SoCs.

Textbooks & References:

1. "Application-Specific Integrated Circuits" by Michael John Sebastian Smith.
2. "CMOS VLSI Design: A Circuits and Systems Perspective" by Neil H.E. Weste and David Harris.
3. "Digital Design and Computer Architecture" by David Harris and Sarah Harris.
4. "System-on-Chip Design with Arm Cortex-M Processors" by Joseph Yiu.
5. MATLAB and Micro wind Tool Manuals.

Practical Syllabus

All practicals to be performed using Micro wind software.

1. Introduction to Micro wind: Design and simulate CMOS inverter, NAND and NOR layout.
2. Design and simulate Half Adder & Full Adder
3. Design and Simulate 2:1 Mux using logic gates & transmission gates
4. Design and Simulate One-bit SRAM Cell
5. Develop a project to implement any System on Chip using Simulink, HDL Coder and FPGA Board

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