

GANPAT UNIVERSITY									
FACULTY OF ENGINEERING & TECHNOLOGY									
Programme		Master of Technology				Branch/Spec.	Electronics and Communication Engineering – Embedded Systems		
Semester		II				Version	1.0.0.0		
Effective from Academic Year			2026-27			Effective for the Batch admitted in			July 2026
Course Code		3ES2PE01	Course Name			FPGA & SoC Design for Embedded Applications			
Teaching Scheme						Examination Scheme (Marks)			
(Per week)	Lecture (DT)		Practical (Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	0	0	-	3	Theory	50	50	100
Hours	3	0	0	-	3	Practical	00	00	00
Pre-requisites									
Digital Logic Design, VHDL/Verilog Basics, Computer Architecture, Microprocessors & Microcontrollers, and Embedded System Fundamentals.									
Course Outcomes									
On successful completion of the course, the students will be able to:									
CO1	Understand FPGA and SoC architectures for embedded applications.								
CO2	Learn HDL programming using Verilog/VHDL.								
CO3	Design and implement embedded hardware systems.								
CO4	Gain practical exposure to FPGA-based prototyping and debugging.								
Theory Syllabus									
Unit	Content								Hrs.
1	Introduction to FPGA and SoC: Basics of Digital System Design, FPGA Architecture and Components, SoC Fundamentals, CPLD vs FPGA vs SoC, FPGA Development Flow, Applications of FPGA in Embedded Systems.								8
2	HDL Programming: Introduction to Verilog/VHDL, Data Types and Operators, Behavioral and Structural Modeling, Sequential and Combinational Circuits, Finite State Machine Design, Testbench Development.								10
3	FPGA-Based Embedded Design: FPGA Synthesis and Simulation, Timing Analysis, Memory and Peripheral Interfacing, UART, SPI, and I2C on FPGA, Soft-Core Processors, Hardware Debugging Techniques.								10
4	SoC Design and Integration: ARM-Based SoC Architecture, Embedded Processor Integration, AXI Bus and Communication Interfaces, Hardware-Software Co-Design, Real-Time Embedded Applications, FPGA Acceleration Concepts.								9
5	Industrial Applications: FPGA in Automotive Systems, FPGA in AI and Edge Computing, Industrial Automation Applications, High-Speed Embedded Systems, Case Studies on FPGA Products.								8
Practical Content									

Practical, assignments and tutorials are based on above syllabus.

Text Books

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|---|---|
| 1 | FPGA Prototyping by Verilog Examples – Pong P. Chu. |
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Reference Books

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| 1 | Digital Design using VHDL – Charles Roth. |
| 2 | FPGA-Based System Design – Wayne Wolf. |
| 3 | Embedded SoPC Design with Nios II Processor – Bruce Land. |

ICT/MOOCs Reference

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|---|---|
| 1 | https://www.youtube.com/watch?v=hric4h80PDc&list=PLbMVogVj5nJSY-1XxFHgwtj2F7mB7NuV&index=4 |
| 2 | https://www.youtube.com/watch?v=pF1dRpdHweQ&list=PLbMVogVj5nJSY-1XxFHgwtj2F7mB7NuV&index=5 |

Mapping of CO with PO and PSO :

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	3	3	2	3	2	2	2	3	1	1	1	2
CO2	2	2	2	2	2	3	2	3	3	3	2	2	2	2	1
CO3	3	3	3	3	3	2	2	3	3	2	2	1	1	1	2
CO4	3	1	3	3	2	2	3	1	3	2	2	3	3	2	2