22EE250	DIGITAL SYSTEMS

Category	L	T	P	Credit
PCC	3	0	0	3

Preamble

Digital systems encompass the circuits, that process signals by discrete bands of analog levels, rather than by continuous ranges (as used in analog electronics). All levels within a band represent the same signal state. Digital systems are designed to store, process, and communicate information in digital form. They are found in a wide range of applications, including process control, communication systems, digital instruments, and consumer products

Prerequisite

- **NIL**

Course Outcomes

On the successful completion of the course, students will be able to :

CO Number	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain different number systems, codes, code converters and digital logic families	TPS2	80	80
CO2	Design combinational circuit for the given applications using logic gates and standard combinational circuits (multiplexers and de multiplexers ,adders, subtractors, Encoders and Decoders)	TPS3	80	80
CO3	Design synchronous sequential circuits for the given requirement including counters and sequence detectors	TPS3	80	80
CO4	Explain the characteristics and working of asynchronous sequential logic circuits	TPS2	80	80
CO5	Implement combinational and sequential circuits using verilog simulation tool	TPS3	80	80
CO6	Implement the given digital application using Programmable Logic Devices and illustrate the function of memories.	TPS3	80	80

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1.	M	L						M		M				M
CO2.	S	M	L					M		M				S
CO3	S	M	L					M		M				S
CO4	M	L						M		M				M
CO5.	S	M	L					M		M				S
CO6	S	M	L					M		M				S

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT 1			CAT 2			ASSIGNMENT 1				ASSIGNMENT 2				TERMINAL			
TPS SCALE	1	2	3	1	2	3	3	4	5	6	3	4	5	6	1	2	3	4
CO1	**10**	10													4	5		
CO2	5	20	40				100								4	5	15	
CO3	5		10	5	5	20					60				4	5	15	
CO4				**5**	15										4	5		
CO5				5	5	15					20				2	5	10	
CO6				5	5	15					20				2	5	10	

Syllabus

Review of Number systems & Boolean Algebra: Decimal, binary, signed binary, octal, hexadecimal number - Binary arithmetic, one's and two's complements arithmetic - Base conversions - C**odes:** BCD, Excess-3, Gray, ASCII codes, Code conversions, Boolean Algebra and laws- Simplification of Boolean expressions – Canonical and Standard forms.

Logic gates & Logic Families: Logic gates and their truth table- Characteristics of digital ICs- Digital Logic Families - Comparison of TTL, ECL and MOS families - Operation of CMOS logic gates- Examples of IC gates.

Combinational logic circuits: Introduction to sum of products (SOP) & product of sums (POS) forms- Logic Minimization using K-map and their realization using logic gates - Quine-McCluskey method of function realization- Don't care conditions- Multiplexer, De-Multiplexer, Decoders- Realization of Boolean functions using multiplexers- Adders, Subtractors, Basic ALU design - Magnitude comparator, parity checker/generator, code converters, priority encoder.

Sequential Logic circuits: Moore and Melay Machines, Latches and Flip-Flops(SR,JK,T,D), State Diagrams, Timing Diagrams and state Tables, Sequential Circuit Design, Shift Registers, Synchronous counters (up, down, up-down, Ring), Examples of Counter ICs –IC 7493, IC 74161.

Asynchronous Sequential Logic circuits: Characteristics- Racing and Glitches**,** Asynchronous Counters (up, down, Mod-N).

Introduction to Verilog simulation tool: Verilog code for basic combinational and sequential circuits.

Memory & Programmable logic devices: RAM (static and dynamic), ROM (EEPROM, FLASH), Programmable Logic Array (PLA), Programmable Array Logic (PAL), Introduction to CPLD and FPGA

Reference Books and Web Resources

1. M.Morris Mano and Michael D.Ciletti, Digital Design, Sixth Edition, Pearson Prentice Hall, 2019
2. RP Jain, Modern Digital Electronics,fourth edition, Tata Mcgraw Hill Publishers,2010
3. Floyd and Jain, Digital Fundamentals, 8th Edition, Pearson Education, 2009
4. Charles H.Roth and Lizy K.John, Digital system design using VHDL, 3rd edition, Cengage learning, 2017
5. Donald Leach, Albert Malvino and Goutam Saha, Digital Principles and Applications, 8th edition ,McGraw Hill Publishers,2015
6. J. F. Wakerly Digital Design Principles and Practices, 5th edition, Prentice Hall of India, 2021.
7. NPTEL course: https://onlinecourses.nptel.ac.in/noc18_ee33

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lecture Hours
1	**Review of Number systems & Boolean Algebra:**	
1.1	Decimal, binary, signed binary, octal, hexadecimal number	1
1.2	binary arithmetic, one's and two's complements arithmetic - base conversions ,C**odes:** BCD, Excess-3, Gray, ASCII codes	2
1.3	Boolean Algebra and laws, Simplific ation of Boolean expressions	1
1.4	Canonical and Standard forms	2
2	**Logic gates & Logic Families:**	
2.1	Logic gates and their truth table**.** Characteristics of digital ICs, digital logic families, Comparison of TTL, ECL and MOS families	2
2.2	Operation of CMOS logic gates- Examples of IC gates.	1
3	**Combinational logic circuits:**	
3.1	Introduction to sum of products (SOP) & product of sums (POS) form- Logic Minimization using K-map and their realization using logic gates	2

3.2	**Quine-McCluskey** method of function realization. Don't care conditions, Multiplexer, De-Multiplexer,	3
3.3	Decoders, Realization of Boolean functions using multiplexers. Adders, Subtractors,	2
3.3	Magnitude comparator, parity checker/generator, code converters, priority encoder	2
4	**Sequential Logic circuits:**	
4.1	Moore and Melay Machines, Latches and Flip-Flops(SR,JK,T,D),	2
4.2	State Diagrams, Timing Diagrams and state Tables,	2
4.3	Sequential Circuit Design, Shift Registers, Synchronous counters (up, down, up-down, Ring).	3
4.4	Examples of Counter ICs –IC 7493, IC 74161.	1
5	**Asynchronous Sequential Logic circuits:**	
5.1	**C**haracteristics- Racing and Glitches	1
5.2	Asynchronous Counters (up, down, Mod-N)	2
6	**Introduction to Verilog simulation tool:**	
6.1	Verilog code for basic combinational and sequential circuits	2
7	**Memory & Programmable logic devices:**	
7.1	RAM (static and dynamic), ROM (EEPROM, FLASH)	2
7.2	Programmable Logic Array (PLA), Programmable Array Logic(PAL)	2
7.3	Introduction to CPLD and FPGA	1
	Total	**36**

Course Designers:

1. Dr.D.Kavitha, Assistant Professor, EEE dkavitha@tce.edu

2. Dr.B.Ashok Kumar, Assistant Professor, EEE ashokudt@tce.edu