DIGITAL CIRCUITS

Course Code	23EE3502	Year	III	Semester	I
Course Category	Professional Core	Branch	EEE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	BEEE
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand the fundamental principles of Boolean algebra, combinational circuits, and sequential logic systems including flip-flops and counters and digital integrated circuits. (L2)
CO2	Apply logic minimization techniques and design optimized combinational circuits using Karnaugh maps, adders, multiplexers, and decoders. (L3)
CO3	Implement memory elements, registers, and counters using flip-flops and programmable logic devices (PLDs) such as PROM, PAL, and PLA. (L3)
CO4	Analyze synchronous sequential circuits using state diagrams, Mealy/Moore models, perform state reduction, assignment for efficient design and performance characteristics of digital IC families. (L4)
CO5	Prepare well-structured reports and assignments based on digital circuit design and analysis.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2	3											2	3	2
CO3	3												3	2
CO4		3		2									3	2
CO5									3	3				

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Combinational logic circuits – I** Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, simplification of logic functions using Boolean theorems, NAND and NOR implementations, Karnaugh maps – 3,4,5 variables, Incompletely specified functions (Don‘t care terms), Simplifying Max term equations, Quine-McCluskey minimization technique, General approach to combinational logic design, Look ahead carry adder, Cascading	**CO1 CO2 CO5**

	full adders, 4-bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder, Binary comparators.	
II	**Combinational logic circuits – II** Decoders, BCD decoders, 7 segment decoder, higher order decodes. Multiplexer, higher order multiplexing, de-multiplexers, higher order de-multiplexing, realization of Boolean functions using decoders and multiplexers. Encoders, priority encoder, Read only and Read/Write Memories, Programmable ROM, PAL, PLA-Basics structures, programming tables of PROM, PAL, PLA, realization of Boolean functions.	**CO1** **CO2** **CO3** **CO5**
III	**Sequential logic circuits** Timing considerations of flip-flops, master-slave flip-flop, edge triggered flip-flops, characteristic equations, flip-flops with reset and clear terminals, excitation tables, conversion from one flip-flop to another flip-flop, design of asynchronous and synchronous counters, design of modulus-N counters, Johnson counter, ring counter, design of registers - buffer register, control buffer register, shift register, bi-directional shift register, universal shift register.	**CO1** **CO3** **CO5**
IV	**Sequential Circuit Design** Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, Analysis of clocked sequential circuits, realization of sequence detector circuit, state reduction and assignments, design procedure.	**CO1** **CO4** **CO5**
V	**Digital integrated circuits:** Logic levels, propagation delay time, power dissipation, fan-out and fan-in, noise margin, logic families – RTL and DTL Circuits, TTL, Emitter-Coupled Logic, Metal-Oxide Semiconductor, Complementary MOS, CMOS Transmission Gate Circuits.	**CO1** **CO4** **CO5**

Learning Resources
Text Books:
1. Zvi. Kohavi, “Switching and finite automata theory”, 3rd edition, Cambridge University Press, 2010. 2. M. Morris Mano and M. D. Ciletti, “Digital Design”, 4th Edition, Pearson Education, 2006.
Reference Books:
1. Charles H. Roth Jr, “Fundamentals of Logic Design”, Jaico Publishers, 5th Edition, 1992. 2. A. Anand Kumar, “Switching Theory and Logic Design”, Prentice Hall India Pvt., Limited, Third Edition, 2016.
E-Resources: 1. https://nptel.ac.in/courses/117106086. 2. https://nptel.ac.in/courses/108105113.