

Devi Ahilya Vishwavidhyalaya, Indore, India Institute of Engineering & Technology				II Year B.Tech. (Electronics and Instrumentation Engineering)		
Course Code & Name	Instructions Hours per Semester and Credits					
3REPC1 DIGITAL ELECTRONICS	Classroom Instruction (CI)		Lab Instruction (LI)	Term Work (TW) and Self Learning (SL)	Total no. of Hours Per semester	Total Credits (Total Hours/30)
	L	T	P	TW+SL	120	4
	30	10	20	60		

Course Learning Objectives:

1. To understand different Number system and Codes used to represent values and computation on them.
2. To illustrate different logic families used for logic gates implementation.
3. To understand use of basic logic gates to implement Boolean function.
4. To illustrate different methods of optimizing Boolean function.
5. To demonstrate working of different computational logic circuits.
6. To impart knowledge of designing different Combinational and Sequential digital Circuits.
7. To introduce basic ADC and DAC IC's for signal conversion.

Prerequisites:

Knowledge of Transistor, Diodes, Switching property, Boolean algebra.

COURSE CONTENTS

Unit –I

Foundation: Number system, Arithmetic operations using 1's,2's complement, various codes, Review of basic gates, universal gate application, Logic Families: - RTL, DTL, TTL &MOS, CMOS families for NOR/NAND gate, characteristics of Digital IC's- speed of operation, power dissipation, Fan-in, Fan-out, Noise margin, Current and Voltage parameters

Unit-II

Combinational Circuits: Boolean laws & algebra , Sum Of Product & Product Of Sum expression, K-Map and Tabular method of minimization, Combinational devices like Multiplexer, Demultiplexer, Decoders, Encoders, Tri -state Devices etc.

Unit-III

Combinational & Sequential Circuits: Combinational circuit design for Adder, Subtractor, Comparator, Multiplier, Code converters
Latches and Flip-Flops SR, D, T, JK, Master-slave , Flip- Flop conversions

Unit-IV

Counter and Registers: Synchronous counter, Asynchronous counter, Up-Down Counter, Shift Registers -serial in parallel out, serial in serial out, parallel in serial out, parallel in parallel out, Universal Shift Register

Unit-V

Digital to Analog Conversion Technique as Binary Weighted DAC, R-2R Ladder, DAC808 IC Analog to Digital Conversions as Flash type, Counter type, Successive Approximations type A/D converter, Specifications of A/D converters, ADC 804 and 808 ICs

Course Outcomes:

CO.No.	CO
CO1	To understand number systems, digital codes, basic logic gates, and compare characteristics of different logic families
CO2	To apply Boolean algebra, K-map, and tabular methods to simplify logic expressions and analyze basic combinational devices.
CO3	To design combinational circuits (adder, subtractor, comparator, converters) and explain working of latches & flip-flops.
CO4	To analyze and design various counters and shift registers used in digital systems.
CO5	To explain the operation of DAC/ADC techniques and evaluate performance of common converter ICs..

Books Recommended:

- [1] Anand Kumar, "Fundamentals of Digital circuits", PHI Publication, 2016
- [2] Mano M. Morris, "Digital Design", 3rd edition, Pearson Education 2006.
- [3] William H.Gothmann, *Digital Electronics: An Introduction to Theory and Practice*, Eastern Economy Edition, Prentice-Hall of India Private Limited, New Delhi., 2001
- [4] William I. Fletcher, *An Engineering Approach to Digital Design*, Pearson Education
- [5] S Salivahan, S Arivazhagan "Digital Circuit and Design", fourth edition, Vikas Publication

CO-PO-PSO Relationship

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO12	PSO 1	PSO 2	PSO 3
3REPC1.CO1	3	2	1									3	2	1
3REPC1.CO2	3	3	2		1							3	3	2
3REPC1.CO3	3	3	3	2	3							3	3	3
3REPC1.CO4	3	3	3		2							2	3	3
3REPC1.CO5	3	2	2		2							2	2	3

List of Practical Assignments :

During the learning of course, students need to do assignments:

Assignment 1: Design and analysis of various arithmetic and logical circuits.

Problem 1: Study and verify truth table of various gates AND, OR, NOR, NAND , XOR and XNOR gates IC's.

Problem 2: Adder and Subtractor.

- (i) Hardware Implementation of half and full adder using basic logic gates.
- (ii) Hardware Implementation of Full adder using two half adder circuit.
- (iii) Hardware Implementation of 4 bit parallel adder and subtractor circuit.

Problem 3: Comparator.

- (i) Hardware implementation of two bit magnitude comparator using basic logic gates.
- (ii) Hardware implementation of four bit magnitude comparator using MSI chip (IC 74LS85).

Problem 4: Hardware Implementation of two bit Multiplier using basic logic gates and a half adder circuit.

Assignment 2: Design and analysis of various arithmetic and logical circuits.

Problem 1: Code converters

- (i) Design a combinational circuit for four bit gray to binary converter.

Problem 2: Seven segment display

- (1) Design and implement BCD to seven segment decoder using basic gates.
- (2) IC level design IC 7447BCD to seven segment decoder/ driver.

Problem 3: Multiplexers

- (1) Design a 2:1 multiplexer with Enable/Disable input using AND, OR and NOT gate.
- (2) 2:1 multiplexer using MSI chip (IC 74LS157)
- (3) Design a 8:1 multiplexer using two 4:1 multiplexers.
- (4) Implement a four variable combinational circuit using 8:1 Mux.

Problem 4: Demultiplexer

- (1) Design a 1:2 multiplexer with Enable/Disable input using AND, OR and NOT gate.
- (2) 1:4 Demultiplexer using MSI chip (IC 74LS139).
- (3)

Assignment 3: Design and analysis of basic sequential circuits.

Problem 1: Latch and flip flop

- (1) Investigate the operation of various latch (NAND and NOR) and flip flop (RS and D) using NAND gates.
- (2) JK master slave flip flop using IC 74LS76.
- (3) Conversion of Flip flop (D to T, JK to T etc.)
- (4)

Assignment 4: Design and analysis of application oriented sequential circuits.

Problem 1: Shift Register

- (1) Design of serial in serial out shift registers with flip flop ICs.\
- (2) Study the shift right logical and shift left logical operations using IC74LS164 & 74LS194.

Problem 2: Counter

- (1) Design of a mod 3 synchronous counter and demonstration of its counting sequence using timing diagram.
- (2) Setup a four bit binary counter and demonstration of using its counting sequence using timing diagrams.
- (3) Setup a mod-10 BCD counter and demonstration of using its counting sequence using timing diagrams.