# DIGITAL ELECTRONICS

**Course Code: 22EE1107**

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**Prerequisites:** Electronic Devices & Circuits

**Course Outcomes:** At the end of the Course the student shall be able to

**CO1** Explain Conversion of numbers from one number system to another number system.

**CO2** Implement logic circuits using basic logic gates or universal logic gates and simplify logic expressions using basic theorems, K-map and Tabular method.

**CO3** Design combinational circuits using logic gates and realize logic expressions using MUX, Decoder and PLDs.

**CO4** Analyze the design aspects of sequential circuits using flip flops and differentiate Mealy & Moore type Sequential machines.

**CO5** Explain digital logic families and their characteristics.

## UNIT-I 08 Lectures

### NUMBER SYSTEMS & CODES:

Introduction to number systems, Complement representation of negative numbers, binary arithmetic, binary codes, Error detecting & correcting codes.

**Learning Outcomes:** The student will be able to

1. summarize advantages of using different number systems (L2)
2. explain usefulness of different coding schemes (L2)

## UNIT-II 12 Lectures

### BOOLEAN ALGEBRA AND SWITCHING FUNCTION

Fundamental postulates of Boolean algebra, Basic theorems and properties, switching functions, Simplification of Boolean equations, Digital logic gates, properties of XOR gates, universal gates - NAND/NOR realizations, K-map method, Prime implicants, don't care combinations, Minimal SOP and POS forms, Tabular Method, Prime-Implicant chart, simplification rules.

**Learning Outcomes:** The student will be able to

1. explain the functionality of logic gates (L2)
2. apply basic laws & De Morgan's theorems to simplify Boolean expressions (L3)
3. compare K- Map & Q-M methods of minimizing logic functions (L5)

## UNIT-III 10 Lectures

### COMBINATIONAL CIRCUITS

Adders, Subtractor, Multiplexer, Demultiplexer, MUX Realizationof switching functions, Encoder, Decoder, Parity bit generator, Code-converters, Basic PLD's-ROM, PROM, PLA, PAL Realizations.

Learning Outcomes: The student will be able to

1. analyze standard combinational circuits such as adders, subtractors etc. (L4)

2. design simple combinational logic circuits (L5)
3. implement logic functions with decoders and multiplexers (L3)
4. describe and compare functional differences between different type PLDs (L2)

**UNIT-IV** **12 Lectures**

**SEQUENTIAL CIRCUITS AND FINITE STATE MACHINES**

Classification of sequential circuits, Latches and Flip-flops, excitation tables, registers, shift registers, Steps in synchronous sequential circuit design, synchronous counters, ripple counters, Design of modulo-N Ring & Shift counters, Definition of FSM, Synthesis of Synchronous Sequential circuit – Sequence detector, Binary counter, Capabilities and limitations of FSM, Mealy and Moore models.

**Learning Outcomes:** The student will be able to

1. design sequential circuits using Latches and flip flops (L5)
2. construct digital systems using components such as registers and counters (L3)
3. compare Moore and Mealy machine models (L2)
4. design synchronous sequential circuits using flip flops (L5)

**UNIT-V** **08 LECTURES**

**DIGITAL LOGIC FAMILIES**

Introduction to logic families, RTL, DTL, TTL, Schottky TTL and Emitter coupled logic, NMOS, PMOS, CMOS logic, CMOS logic families, Comparison of logic families, CMOS: CMOS Inverter, CMOS characteristics, CMOS/TTL interfacing, Tri State Logic.

**Learning Outcomes:** The student will be able to

1. summarize significance of various digital logic families (L2)
2. examine Interface aspects of TTL & CMOS logic families (L4)
3. explain characteristics of digital ICs such as speed, power dissipation etc. (L2)

**TEXT BOOKS:**


1. Morris Mano, "Digital Design" PHI publications, 3rd Edition, 2006.
2. Anand Kumar, "Switching Theory and Logic Design" PHI publications, 2nd Edition, 2014


**REFERENCES:**


1. ZviKohavi, "Switching & Finite Automata theory" Tata McGraw Hill Publications, 2ndEdition, 2009.
2. R.P. Jain. "Modern Digital Electronics", 4th Edition, Tata McGraw Hill Publications, 2009.
3. John M. Yarbrough, "Digital Logic Applications and Design" Thomson Publications, 2006.


**WEB REFERENCES:**

1. https://onlinecourses.nptel.ac.in/noc21_ee39/preview (Digital System Design by Prof. Neeraj Goel, IIT Ropar)