

# Th.3 - DIGITAL ELECTRONICS

(Common to ETC, AE&I, CSE, IT, EIC, Mechatronics)

Theory	: 4 Periods per week	I.A.	: 20 Marks
Total Periods	: 60 Periods	Term End Exam	: 80 Marks
Examination	: 3 Hours	TOTAL MARKS	: 100 Marks

## Chapter wise Distribution of periods with Total periods

Sl. No.	Topics	Periods
1.	Basics of Digital Electronics	12
2.	Combinational logic circuits	12
3.	Sequential logic circuits	12
4.	Registers, Memories & PLD	08
5.	A/D and D/A Converters	07
6.	Logic Families	09
TOTAL		60

### Rationale:

Today term digital has become a part of our everyday life. The tremendous power and usefulness of digital electronics can be seen from the wide variety of industrial and consumer products, such as automated industrial machinery, computers, microprocessors, pocket calculators, digital watches, microcontrollers, Digital life support machines, real time systems and clocks, TV games, etc. which are based on the principles of digital electronics. The areas of applications of digital electronics have been increasing every day. In fact, digital systems have invaded all walks of life. This subject will very much helpful for student to understand clearly about the developmental concept of digital devices

### Objective:

#### After completion of this course the student will be able to:

1. Explain Binary, Octal, Hexadecimal number systems and compare with decimal system.
2. Perform binary addition, subtraction, Multiplication and Division.
3. Write 1's complement and 2's complement numbers for a given binary number & Perform subtraction
4. Compare weighted and Un-weighted codes and its applications
5. State Boolean expressions for the given statement of the problem
6. State De-Morgan's theorems & Apply De Morgan's theorems and other postulates to simple Boolean expressions.
7. Use Karnaugh Map to simplify Boolean Expression (upto3 variables only).
8. Implement of Logic Gates, i.e. AND, OR, NOT operators with truth table.
9. Working of combinational logic circuits, function of the Half-adder, full-adder.
10. Explain 2's complement parallel adder/subtractor circuit.
11. Working of Serial & parallel adder with block diagram/circuit diagram
12. Explain the Operation of 4x1 Multiplexer & 1x4 De-Multiplexer, Decoders, Encoder, comparator.
13. Understanding the working of Sequential Logic circuits
14. Construct SR, JK, D, T, Master Slave Flip Flop.
15. Counters and different types and operations
16. Explain the working of Registers and memories & PLD

17. Explain various types of memories, Differentiate between ROM and RAM
18. Working of A/D and D/A converters & Necessity of A/D and D/A converters.
19. Explain Various logic families and Characteristics of Digital ICs

### **Detailed Contents:**

#### **Unit-1: Basics of Digital Electronics**

- 1.1 Number System-Binary, Octal, Decimal, Hexadecimal - Conversion from one system to another number system.
- 1.2 Arithmetic Operation-Addition, Subtraction, Multiplication, Division, 1's & 2's complement of Binary numbers & Subtraction using complements method
- 1.3 Digital Code & its application & distinguish between weighted & non-weight Code, Binary codes, excess-3 and Gray codes.
- 1.4 Logic gates: AND, OR, NOT, NAND, NOR, Exclusive-OR, Exclusive-NOR--Symbol, Function, expression, truth table & timing diagram
- 1.5 Universal Gates & its Realisation
- 1.6 Boolean algebra, Boolean expressions, Demorgan's Theorems.
- 1.7 Represent Logic Expression: SOP & POS forms
- 1.8 Karnaugh map (3 & 4 Variables) & Minimization of logical expressions, don't care conditions

#### **Unit-2: Combinational Logic Circuits**

- 2.1 Half adder, Full adder, Half Subtractor, Full Subtractor, Serial and Parallel Binary 4 bit adder.
- 2.2 Multiplexer (4:1), De-multiplexer (1:4), Decoder, Encoder, Digital comparator (3 Bit)
- 2.3 Seven segment Decoder  
(Definition, relevance, gate level of circuit Logic circuit, truth table, Applications of above)

#### **Unit-3: Sequential logic Circuits**

- 3.1 Principle of flip-flops operation, its Types,
- 3.2 SR Flip Flop using NAND, NOR Latch (un clocked)
- 3.3 Clocked SR, D, JK, T, JK Master Slave flip-flops-Symbol, logic Circuit, truth table and applications
- 3.4 Concept of Racing and how it can be avoided.

#### **Unit-4: Registers, Memories & PLD**

- 4.1 Shift Registers-Serial in Serial -out, Serial- in Parallel-out, Parallel in serial out and Parallel in parallel out
- 4.2 Universal shift registers-Applications.
- 4.3 Types of Counter & applications
- 4.4 Binary counter, Asynchronous ripple counter (UP & DOWN), Decade counter. Synchronous counter, Ring Counter.
- 4.5 Concept of memories-RAM, ROM, static RAM, dynamic RAM, PS RAM
- 4.6 Basic concept of PLD & applications

## Unit-5: A/D and D/A Converters

- 5.1 Necessity of A/D and D/A converters.
- 5.2 D/A conversion using weighted resistors methods.
- 5.3 D/A conversion using R-2R ladder (Weighted resistors) network.
- 5.4 A/D conversion using counter method.
- 5.5 A/D conversion using Successive approximate method

## Unit-6: LOGIC FAMILIES

- 6.1 Various logic families & categories according to the IC fabrication process
- 6.2 Characteristics of Digital ICs- Propagation Delay, fan-out, fan-in, Power Dissipation, Noise Margin, Power Supply requirement & Speed with Reference to logic families.
- 6.3 Features, circuit operation & various applications of TTL(NAND), CMOS (NAND & NOR)

### Coverage of Syllabus upto Internal Exams (I.A.)

#### Chapter 1,2,3

#### Books Recommended

SI No.	Name of Authors	Title of Book	Name of Publisher:
1	RP JAIN	Modern Digital Electronics	TMH
2	Ananda Kumar	Fundamental of Digital Electronics	PHI Publication
3	P.RAJA	Digital Electronics	SCITECH Publication
4	S.Salivahanan ,S.Arivazhagan	Digital Circuits Design	VIKAS Pub House
5	M. Morris Mano	Digital Logic and Computer Design	MGH
6	Dr. R. S. Sedha	Digital Electronics	S. chand