Course Name : Electronics Engineering Group

Course Code : EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ED/EI/IU

Semester : Third

Subject Title : Principles of Digital Techniques

Subject Code : 17320

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	25#	--	25@	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

Digital Electronics plays important role in advancements of microelectronics design, manufacturing, computer technology and information systems that have caused the rapid increase in the use of digital circuits. Hence in every application digital technique is the backbone. Digital electronics requires the background of discrete signaling and logical functions, semiconductor switch theory. Hence this subject is introduced for students to sharpen their skills of digital implementation by learning the concept of number systems, logic gates, combinational and sequential logic circuits, memory, counter and shift register.

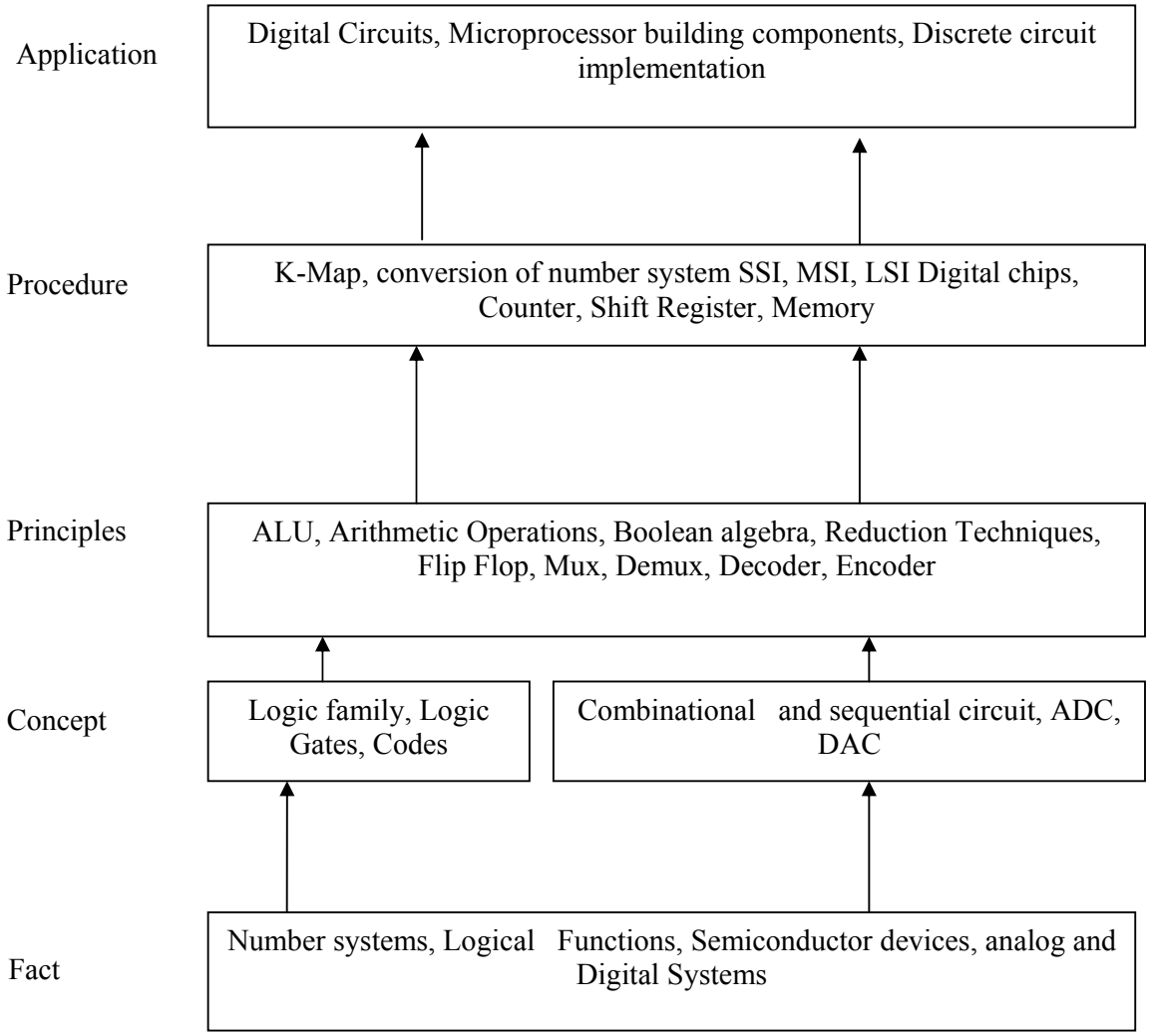
General Objectives:

The student will be able to

The subject student will be able to

1. Understand basic digital circuits.
2. Understand conversion of number systems.
3. Implement combinational and sequential circuits.
4. Understand logic families, data converters

Learning Structure:



Theory:

Topics and Contents	Hours	Marks
Topic 1: Number System **Specific Objectives:** ➢ Make conversion from one Number system to another. ➢ Perform simple arithmetic operations. **Contents :** **1.1 Introduction to digital signal, Advantages of Digital System over analog systems, (8 Marks)** • Number Systems: Different types of number systems(Binary, Octal, Hexadecimal), conversion of number systems, • Binary arithmetic: Addition, Subtraction, Multiplication, Division. • Subtraction using 1's complement and 2's complement **1.2 Codes : (4 Marks)** • Codes -BCD, Gray Code, Excess-3, ASCII code • BCD addition, BCD subtraction using 9's and 10' complement **(Numericals based on above topic)**.	04	12
Topic 2: Logic gates and introduction to logic families ➢ Define Logic gates & logic families. ➢ Develop logic for simple digital circuit **Contents:** **2.1 Logic gates: (8 Marks)** • Basic gates and Derived Gates • NAND and NOR as Universal gates. • Boolean Algebra: Fundamentals of Boolean laws. • Duality Theorem, De Morgan's theorems. (numerical based on simplification of logic equations) **2.2 Logic Families: : (8 Marks)** • Characteristics of logic families & Comparison between different logic families. • Logic families such as TTL, CMOS, ECL. • TTL NAND gate – Totem pole output, open collector. • CMOS Inverter	06	16
Topic 3 : Combinational Logic Circuits • Realize various digital Circuits using K-map. • Realize various combinational logic circuits. • Use peripheral devices like buffer. **Contents:** **3.1 Introduction: (8 Marks)** • Standard representation of canonical forms (SOP & POS), Maxterm & Minterm), conversion between SOP and POS forms. • K-map reduction technique upto 4 variables. (SOP & POS form), Design of half and full Adder, half and Full Subtractor using K-map, • Code Converter using K-map: Gray to Binary, Binary to Gray Code Converter (up to 4-bit), • IC 7447 as BCD to 7 segment decoder – driver	14	22

• IC 7483 as Adder & Subtractor, 1 digit BCD adder. • Block Schematic of ALU IC 74181 and IC 74381. **3.2 Necessity, Applications and realization of following: (14 Marks)** • Multiplexers(MUX): MUX tree • Demultiplexers (DEMUX): Demux tree, Demux as decoder • Study of IC 74151, IC 74155 • Priority Encoder 8:3, Decimal to BCD Encoder • Tristate logic, Unidirectional & bidirectional buffer ICs: IC 74244 and IC 74245		

Topic 4: Sequential Logic Circuit
• Distinguish various Flip flops, counters and shift registers.
• Implement asynchronous counter.
• Apply IC 7490, 7495 to design counter.
Contents:
4.1 Sequential circuits: (12 Marks)
• Comparison between Combinational & Sequential circuits,
• One bit memory cell - RS latch – using NAND & NOR.
• Triggering Methods (Edge and level trigger)
• Flip Flops - S R Flip flop, Clocked SR flip flop with preset and clear, Drawbacks of SR Flip flop
• Clocked JK Flip flop with preset & clear, Race around condition in JK flip flop, Master slave JK flip flop.
• D and T type flip flop.
• Excitation table of flip flops.
• Block schematic and function table of IC-7474, 7475,74373
4.2 Study of Counters : (8 Marks)
• Counter: Modulus of counter, their types as Asynchronous and Synchronous counter.
• Asynchronous counter: (Ripple counter , 4 bit up/down Counter
• Synchronous counter: Excitation table of flip flops, implementation of 3 bit synchronous counter, its truth table and waveforms.
• Block schematic and waveform , IC 7490 as MOD-N Counter
4.3 Shift Register: (4 Marks)
• **logic diagram , Truth Table and waveforms of : 4-bit Shift** registers (SISO,SIPO, PISO,PIPO)
• 4 Bit Universal Shift register.
• Applications of Shift Register (Logic Diagram with waveforms) of:
  • Ring counter
  • Twisted ring counter
	12	24

Topic 5 : Data Convertors ➢ Identify operation of DAC and ADC. ➢ Use of IC 0800, 0809 in practical applications**.** **Contents:** **5.1 Introduction and Necessity of Code Convertors:** • DAC Types and comparison of Weighted resistor method, (Mathematical derivation) and R-2R Method (Mathematical derivation up to 3 variable), **5.2 ADC Types and their comparison**: Block Diagram and working of	06	16

following ADCs **:** **(08 Marks)** • Single slope ADC, Dual slope ADC, SAR ADC • IC PCF 8591 : 8 BIT ADC-DAC		
Topic 6: Memories ➢ Classify memories. ➢ Apply ICs 2716, 7481, 6116 in practical applications. **Contents:** 6.1 Principle of operation and classification of memory. • Organization of memories • RAM (Static, Dynamic), Volatile and Non-Volatile • ROM (PROM, EPROM, EEPROM) • Flash memory. • Comparison between EPROM and Flash **Study of memory ICs :** • Identification of IC number and their function of following ICs: IC 2716, IC 7481& IC 6116.	06	10
Total	**48**	**100**

Practicals:

Intellectual skills:

1) Identify different ICs of logic gates, combinational and sequential circuits and memories.
2) Distinguish and realize combinational and sequential circuits.
3) Verify standard T.T and test ICs.

Motor skills:

1) Make proper connections as per given circuit diagram.
2) Build, test and debug the digital circuit.
3) Observe result and proper handling of equipments.

List of Experiments:-

Sr. No	Title of Experiment
1	Verify the truth table of Basic logic gates using diode and transistor.
2	Verify De Morgan's Theorem
3	Verify NAND and NOR gate as universal logic gate.
4	Verify Truth Table of bi-directional buffer – IC 74245
5	Realize adder and subtractor.
6	Verify the operational features of ADC – IC 0809/IC 0808 and DAC – IC 0800.
7	Verify the operation of Multiplexer IC 74151 and Demultiplexer IC 74155.
8	Realize and verify RS flip flop using NAND gate and verify master slave JK Flip-Flop using IC 7476.
9	Implement 4 bit ripple counter
10	Implement 4 bit R-2R D/A converter.

Learning Resources:

1. **Books:**

Sr. No	Title	Author	Publisher
01	Digital Principles	Malvino Leach	Tata McGrew Hill (TMH)
02	Modern Digital Electronics	R.P. Jain	Tata McGrew Hill (TMH)
03	Digital Electronics, Principles and Integrated Circuits	Anil K. Maini	Wiely India Edition
04	Digital Electronics (Second Edition)	P.Raja	SCITECH Publications (India) Pvt. Ltd.
05	Digital Electronics	G.K.Kharate	OXFORD Publication