66834 Digital Electronics

T	P	C
3	3	4

AIMS

- To develop knowledge & skills on codes and binary arithmetic operation.
- To provide knowledge & skills on logic gates, logic circuits, Boolean algebra and logic families.
- To assist to acquire the knowledge & skills on combinational logic circuit.
- To acquire knowledge & skills on Registers, Counters, Memories, Converters.

SHORT DESCRIPTION

Basic concept of digital electronics; Logic gates, Boolean algebra and logic simplification &Combinational logic circuits.

DETAIL DESCRIPTION

Theory:

1. Understand basic concept of digital electronics.

1.1 Define digital electronics& Digital Signal.
1.2 Mention the characteristics of digital signal.
1.3 Describe the advantages of working in digital mode.
1.4 Define logic level of digital signal.
1.5 Identify DC voltage level of digital signal.
1.6 Describe parameters of a digital pulse waveform such as rise time, fall time, pulse width and duty cycle.

2. Understand the binary arithmetic operation.

2.1 Define decimal, binary, octal and hexadecimal number system
2.2 Define BCD code, Excess–3code, Gray code, Hamming code, Unicode, and ASCII code.
2.3 Practice the conversion of one code to another.
2.4 Describe the addition and subtraction of BCD coded number and Excess-3 code.
2.5 State parity checked code and Hamming code.
2.6 Describe the error detection and correction with parity checked code.

3. Understand the concept of Logic gates.

3.1 Define logic gate.
3.2 Classify logic gate.
3.3 Explain logical statement, truth table, Boolean equation and symbol of AND, OR, NOT, NOR, NAND, EX-OR and EX-NOR gates.
3.4 Show that NAND & NOR gates used as Universal logic gates.
3.5 State the applications of logic gates.

4. Understand the features of the logic families and digital IC's.

4.1 Classify logic families.
4.1 Define SSI, MSI, LST and VLSI.
4.2 Describe Transistor logic families (DTL & TTL).
4.3 Describe MOS logic families (P-MOS, N-MOS & C-MOS)
4.4 State the characteristics of digital IC's.
4.5 State the meaning of the terms propagation delay time, speed, noise immunity, power dissipation, fan-in, fan-out, operating temperature and power rating of logic circuits.

5. Understand the concepts of electronic circuit of logic gates & logic IC's.

5.1 Describe the operation of standard TTL NAND gate.
5.2 Describe the operation of CMOS NAND & NOR gates.
5.3 State special logic gates such as buffer, tri-state and expandable gates.
5.4 Describe fixed function Integrated circuit IC's such as AND, OR, NAND etc.
5.5 Mention IC package, code numbers, and important specification of TTL/MOS commercial IC gates.

6. Understand logic simplification& design of digital circuit.

6.1 State the theorems of Boolean algebra.
6.2 State Demorgan's theorems and its applications.
6.3 Determine the terms-Sum of Product (SOP) form and Product of Sum (POS) form.
6.4 Determine the SOP & POS form from truth table.
6.5 Mention the basic principle of ORing and ANDing.
6.6 Define Karnaugh Map.
6.7 State the structure of Karnaugh map.
6.8 State the simplification process of Boolean expression from a K-map and design logic circuit (up to 4 variables).

7. Understand various combinational logic circuits.

7.1 Define combinational logic circuit with example.
7.2 Describe the operation of half adder and half Sub tractor.
7.3 Describe the operation of full adder and full Sub tractor.
7.4 Describe the operation of 4 bit parallel adder.
7.5 Describe the operation of 4 bit subtraction circuit.
7.6 Describe the operation of 4 bit BCD adder.
7.7 Describe the operation of multipliers & divisors.
7.8 Mention the application of combinational logic circuit.

8. Understand the concepts of encoder, decoder and display devices.

8.1 Define Encoder and Decoder.
8.2 Describe the operation of encoder and decoder circuit.
8.3 State the principle of operation of LCD, LED, seven-segment and dot matrix display.
8.4 Describe the operation of commonly used 4-bit BCD decoder/driver for seven segment display of common anode/cathode type.
8.5 Application of Encoder and Decoder.

9. Understand the features of multiplexers and demultiplexer.

9.1 Define multiplexers and demultiplexer.
9.2 Describe the operation of 2:1, 4:1 and 8:1 multiplexer with logic diagram.
9.3 Describe the operation of 1:2, 1:4 and 1:8 demultiplexer with logic diagram.
9.4 State the use of multiplexer &demultiplexer.
9.5 Explain the operation of Binary comparator.

10. Understand the features of sequential logic circuits.

10.1 Define sequential logic circuit
10.2 State the terms clock, timing diagram & latch of digital system.
10.3 Explain the operation of basic SR latch, D flip-flop, clocked flip-flop, J-K flip-flop, Toggle operation & J-K master-slave flip-flop.
10.4 State the concept of positive & negative edge triggering and level triggering,
11.8 Describe the pin diagram of commonly used flip-flop IC's.

11. Understand the concepts of Data shift registers &counters.

11.1 Define Data shift registers & counters
11.2 State the operation of Shift right, shift left, SISO, SIPI, PISO, PIPO & universal shift register.
11.3 State the operation of 4-bit Up/Down counter, MOD counter, Programmable counter.
11.4 Application of registers & counters.

12. Understand the concepts of Memories.

12.1 Define Memories.
12.2 Classify Memories.
12.3 Explain the internal organization of semiconductor memory.
12.4 State the operation of static and dynamic RAM.
12.5 Describe the principle and operation of ROM, PROM, EPROM and EEPROM.
12.6 List the application of some commercial memory ICs.

13. Understand D/A converter.

13.1 State the principle of D/A conversion.
13.2 Mention the types of D/A converter.
13.3 Explain the operation of a binary weighted D/A and R-2R ladder D/A converter.
13.4 State the terms – resolution and accuracy, offset error and settling time of D/A converter.
13.5 State the application of D/A converter.

14. Understand A/D converter.

14.1 State the principle of A/D conversion.
14.2 List the type of A/D converter.
14.3 State the working principle of 3-bit parallel A/D converter.
14.4 Describe the operation of Digital Ramp A/D converter
14.5 Explain the operation of successive approximation and dual slope A/D converter.
14.6 State the terms – resolution, accuracy, and conversion time of A/D converter.
14.7 List the applications of popular A/D converter ICS.
14.8 Describe the operation of sample & hold circuits and its application.

PRACTICAL:

1. To verify the truth tables of logic gates (OR, AND, NOT,NAND & NOR)

1.1 Select logic gate ICs.
1.2 Select appropriate circuits, required tools, equipments and materials.
1.3 Insert the selected ICs to the Breadboard.
1.4 Connect the circuits as per diagram.
1.5 Switch on the DC power supply,
1.6 Verify the truth tables.

2. To verify the Truth table of X-OR & X-NOR gate using basic gates.

2.1 Select logic gate ICs.
2.2 Select appropriate circuits, required tools, equipments and materials.
2.3 Insert the selected ICs to the Breadboard.
2.4 Connect the circuits as per diagram.
2.5 Switch on the DC power supply,
2.6 Verify the truth tables.

3. To Show the operation of NAND & NOR gate as universal gates.

3.1 Select logic gate ICs of NAND gate& NOR gate.
3.2 Select appropriate circuits, required tools, equipments and materials.
3.3 Insert the selected ICs to the Breadboard.
3.4 Connect the circuits as per diagram for AND OR & NOT gate.
3.5 Switch on the DC power supply,
3.6 Verify the truth tables of AND OR & NOT gate operation.

4. To design & develop a code converter circuits and observe its output operation.

4.1 Select logic gate ICs.
4.2 Select appropriate circuits, required tools, equipments and materials.
4.3 Insert the selected ICs to the Breadboard.
4.4 Connect the circuits as per diagram.
4.5 Switch on the DC power supply,
4.6 Verify the truth tables

5. To verify the functions of half adder &half sub tractor.

5.1 Select ICs.
5.2 Select required tools, equipments and materials.
5.3 Draw the pin diagram and internal connection.
5.4 Insert the selected ICs to the Breadboard.
5.5 Draw appropriate circuits.
5.6 Connect the circuits as per diagram.
5.7 Switch on the DC power supply,
5.8 Verify the truth tables.

6. To verify the functions of full adder& full sub tractor.

6.1 Select ICs.
6.2 Select required tools, equipments and materials.
6.3 Insert the selected ICs to the Breadboard.
6.4 Draw the pin diagram and internal connection.
6.5 Draw appropriate circuits.
6.6 Connect the circuits as per diagram.
6.7 Switch on the DC power supply,
6.8 Verify the truth tables.

7. To verify the output operation of binary 4 bit parallel adder.

7.1 Select appropriate ICs.
7.2 Select required tools, equipments and materials.
7.3 Insert the selected ICs to the Breadboard.
7.4 Draw the pin diagram and internal connection.
7.5 Draw appropriate circuits.
7.6 Connect the circuits as per diagram.
7.7 Switch on the DC power supply,
7.8 Verify the truth tables.

8. To Show the operation of encoder& decoder.

8.1 Select appropriate ICs.
8.2 Select required tools, equipments and materials.
8.3 Insert the selected ICs to the Breadboard.
8.4 Draw the pin diagram and internal connection.
8.5 Draw appropriate circuits.
8.6 Connect the circuits as per diagram.
8.7 Switch on the DC power supply,
8.8 Verify the truth tables.

9. To Show the operation of a decoder driver & display operation using 7 segment display.

9.1 Select appropriate ICs.
9.2 Select required tools, equipments and materials.
9.3 Insert the selected ICs to the Breadboard.
9.4 Draw the pin diagram and internal connection.
9.5 Draw appropriate circuits.
9.6 Connect the circuits as per diagram.
9.7 Switch on the DC power supply,
9.8 Verify the truth tables.

10. To Show the operation of multiplexer & demultiplexer.

10.1 Select appropriate ICs.
10.2 Select required tools, equipments and materials.
10.3 Insert the selected ICs to the Breadboard.
10.4 Draw the pin diagram and internal connection.

10.5 Draw appropriate circuits.
10.6 Connect the circuits as per diagram.
10.7 Switch on the DC power supply,
10.8 Verify the truth tables.

11. To verify the truth table of different S-R & D flip-flops.

11.1 Select appropriate ICs.
11.2 Select required tools, equipments and materials.
11.3 Insert the selected ICs to the Breadboard.
11.4 Draw the pin diagram and internal connection.
11.5 Draw appropriate circuits.
11.6 Connect the circuits as per diagram.
11.7 Switch on the DC power supply,
11.8 Verify the truth tables.

12. To verify the truth table of different J-K flip-flops.

12.1 Select appropriate ICs.
12.2 Select required tools, equipments and materials.
12.3 Insert the selected ICs to the Breadboard.
12.4 Draw the pin diagram and internal connection.
12.5 Draw appropriate circuits.
12.6 Connect the circuits as per diagram.
12.7 Switch on the DC power supply.
12.8 Verify the truth tables.
12.9 Observe the Toggle operation in JK flip-flop.

13. To verify the operation of Binary comparator.

13.1 Select appropriate ICs.
13.2 Select required tools, equipments and materials.
13.3 Insert the selected ICs to the Breadboard.
13.4 Draw the pin diagram and internal connection.
13.5 Draw appropriate circuits.
13.6 Connect the circuits as per diagram.
13.7 Switch on the DC power supply,
13.8 Verify the truth tables.

14. To verify the operation of Different Shift Registers.

14.1 Select appropriate ICs.
14.2 Select required tools, equipments and materials.
14.3 Insert the selected ICs to the Breadboard.
14.4 Draw the pin diagram and internal connection.
14.5 Draw appropriate circuits of shift registers.
14.6 Connect the circuits as per diagram.
14.7 Switch on the DC power supply.
14.8 Verify the truth tables.

15. To verify the operation of Different Memories.

15.1 Select appropriate ICs.
15.2 Insert the selected ICs to the Breadboard.
15.3 Draw the pin diagram and internal connection.
15.4 Draw appropriate circuits.
15.5 Select required tools, equipments and materials.
15.6 Connect the circuits as per diagram.
15.7 Switch on the DC power supply,
15.8 Verify the Memory Read/Write operations.

16. To verify the operation of Different Counters.

16.1 Select appropriate ICs.

16.2 Insert the selected ICs to the Breadboard.

16.3 Draw the pin diagram and internal connection.

16.4 Draw appropriate circuits.

16.5 Select required tools, equipments and materials.

16.6 Connect the circuits as per diagram.

16.7 Switch on the DC power supply,

16.8 Verify the truth tables.

REFERENCE BOOKS

1. Digital Fundamentals- Thomas L. Floyd
2. Digital Principles– Roger L. Tokhem
3. Digital system – Ronald J. Tocci and Widmer.
4. Principle of Digital Electronics & Application - Malvino
5. Digital Systems: Principles and Applications – Ronald J, Tocci, Neal Widmer, Greg Moss
6. Schaums Outline Introduction to Digital Systems -- James Palmer, David Perlman