Subject Code	Subject Name	Period/Week		Credit
		T	**P**	**C**
26831	Digital Electronics - I	**2**	**3**	**3**

Rationale	Diploma in Engineering Level students are required to acquire the knowledge and skill on concept of number system. logic gates, Boolean algebra, combinational logic circuits, Simplification of logic circuits and Sequential circuits which are used in most of digital system and the foundation of Microcontroller and Microcontroller.
Learning Outcome (Theoretical)	After Completing the subject, students will be able to: ☐ Describe Concept of digital electronics. ☐ State Number system, codes, conversion and binary arithmetic. ☐ Describe Logic gates and logic Family. ☐ State Simplification of logic circuits ☐ Explain Combinational logic circuits. ☐ Describe Encoder and Decoder. ☐ State Multiplexers and demultiplexer. ☐ Explain Sequential logic circuits. ☐ Describe Sequential Logic circuits
Learning Outcome (Practical)	After undergoing the subject, students will be able to: ▪ Verify the truth tables of logic gates (OR, AND, NOT, NAND & NOR). ▪ Verify the truth table of X-OR & X-NOR gate using basic gates. ▪ Perform the operation of NAND & NOR gate as universal gates. ▪ Design & develop a code converter circuit and observe its output operation. ▪ Verify the functions of half adder & half sub tractor. ▪ Verify the functions of full adder & full sub tractor. ▪ Verify the output operation of binary 4-bit parallel adder. ▪ Perform the operation of encoder & decoder. ▪ Perform the operation of a decoder driver & display operation using 7 segments Display. ▪ Perform the operation of Multiplexer & Demultiplexer. ▪ Verify the truth table of different S-R & D- flip-flops.

Detailed Syllabus (Theory)

Unit	Topics with Contents	Period	Marks
1	**FUNDAMENTALS OF DIGITAL ELECTRONICS.** 1.1 Define digital Electronics. 1.2 Mention the characteristics of digital signal. 1.3 Compare digital signal with analog signal. 1.4 Describe logic level, Negative logic level and positive logic level, 1.5 Explain the parameter Frequency, Time period, Rise time, Fall time, Rising edge, falling edge, On time, Off time and Duty cycle of digital signal. .	2	3
2	**NUMBER SYSTEMS AND CODES** 2.1 Define Number system and Base of number system. 2.2 Describe different types of number system (Decimal, Binary, Octal and Hexadecimal). 2.3 Convert one number system to another. 2.4 Determine 1's & 2's complement of binary number. 2.5 Compute binary arithmetic. 2.6 Describe 8421, Excess–3code, Gray code, BCD code, Hamming code, Unicode, and ASCII code. 2.7 Convert of one code to another. 2.8 Describe the addition and subtraction BCD coded number. 2.9 Describe Repeated Shift methods for division multiplication.	4	4
3	**LOGIC GATES** 3.1 Define logic gate. 3.2 Classify logic gate. 3.3 Describe logic statements, truth table, Boolean equation and symbol of different logic gates. 3.4 Analyze the electrical circuit for each gate. 3.5 Describe pin and signals of different gate IC.	3	4
4	**SIMPLIFICATION OF LOGIC CIRCUITS** 4.1 Define Boolean algebra. 4.2 Describe the laws and rules of Boolean Algebra. 4.3 State the DE Morgan's theorems. 4.4 Derive standard SOP and POS equation from truth table. 4.5 Explain shorthand notation $Y = m_1 + m_3 + m_4 + \ldots = \Sigma\,(1, 3, 4 \ldots)$ and $Y = m_1.\,m_3\,.m_4\ldots= \Pi\,(1.\,3.\,4 \ldots)$ 4.6 Simplify Boolean expression and logic circuit using Boolean algebra and DE Morgan theorem. 4.7 Define Karnaugh map. 4.8 Describe the structure and simplification methods of Karnaugh map. 4.9 Simplify up to four variable standard and nonstandard Boolean expression using Karnaugh map.	4	8
5	**Digital IC and Logic Family.** 5.1 Define Logic Family. 5.2 Classify digital IC based on scale of integration. 5.3 List the advantages of using IC in digital system. 5.4 Mention the different types of IC logic families 5.5 Explain fan-in, fan-out, noise-margin, propagation delay, TTL and	3	5

	CMOS logic levels and power dissipation			
	5.6 Describe the TTL, DTL, CMOS circuitry of NOT, AND, OR, NAND & NOR gates.			
6	**COMBINATIONAL LOGIC CIRCUITS.** 6.1 Define Combinational logic circuit. 6.2 Explain the operation of Binary comparator circuits. 6.3 Describe the Pin diagram of commonly used 4-bit comparator ICs. 6.4 Describe the operation of parity generator and detector circuit. 6.5 Describe the logic circuit error detection and correction with humming code.	**3**	**7**
7	**ARITHMATIC LOGIC CIRCUITS** 7.1 Describe the operation of half adder, full adder and4 bit parallel adder. 7.2 Explain the operation of half Sub tractor, full Sub tractor and 4 bit subtraction circuit. 7.3 Mention the Basic principle of ALU 7.4 Describe the pin and signals of ALU chips. 7.5 Explain the operation of shift and add multiplier circuit. 7.6 List the application of combinational logic circuit.	**3**	**7**
8	**MULTIPLEXERS AND DEMULTIPLEXER** 8.1 Define multiplexers and demultiplexer. 8.2 Describe the operation of 2:1, 4:1 and 8:1 multiplexer with logic diagram. 8.3 Describe the operation of 1:2, 1:4 and 1:8 demultiplexers with logic diagram. 8.4 State the use of multiplexer & demultiplexer. 8.5 Describe the Pin diagram of commonly used 4-bit comparator ICs 8.6 Distinguish between Decoder and Demultiplexer.	**3**	**6**
9	**ENCODER AND DECODER** 9.1 Define Encoder and Decoder. 9.2 Explain the logic circuit of 4 to 2, 8 to 3 & priority encoder. 9.3 Analyz the logic circuit of 2 to 4, 3 to 8 decoder circuit. 9.4 Describe the pins and signals of 74138 and 74154 decoder IC. 9.5 State the working principle of LCD, LED, Seven-segment and Dot matrix display. 9.6 Sketch the diagram of commonly used 4-bit BCD encoder/driver for seven segment display of common Anode/Cathode type.	**3**	**6**
10	**SEQUINTIAL LOGIC CIRCUITS** 10.1 Define sequential logic circuit. 10.2 Describe the operation of SR latch, D Latch with truth table and timing diagram. 10.3 Mention the disadvantages of SR Latch. 10.4 Discuss positive & negative level and edge triggering. 10.5 Explain the operation of JK Flip-Flop, D Flip-Flop and Master-slave Flip-Flop with truth table and timing diagram. 10.6 Define three state logic. 10.7 Describe the pin and signals of 7474,7476, 74273 and 74573 IC 10.8 List the application of different types of Flip-Flops.	**4**	**10**

	10.9 Describe internal block diagram of 555 timer IC. 10.10 Explain the operation of Clock generator ciruit using 555 timer.		
	Total	**32**	**60**

Detailed Syllabus (Practical)

Unit	Experiment name with procedure	Class	Marks

1	**VERIFY THE TRUTH TABLES OF LOGIC GATES Select the logic gate ICs.**
	    1.1 Select appropriate required tools, equipment's and materials.
	    1.2 Insert the IC to the Breadboard.
	    1.3 Connect and checked the circuits as per diagram on trainer board.
	    1.4 Switch on the DC power supply,
	    1.5 Verify the truth tables.
		1	4

2	**DESIGN & DEVELOP CODE CONVERTER CIRCUITS AND OBSERVE ITS OUTPUT.**
	    2.1 **Select the ICs.**
	    2.2 Select appropriate required tools, equipment and materials.
	    2.3 Insert the selected IC to the Breadboard.
	    2.4 Connect and checked the circuits as per diagram on trainer board.
	    2.5 Switch on the DC power supply,
	    2.6 Verify the truth tables
		1	4

3	**OBSERVE THE FUNCTIONS OF ADDER & SUBTRACTOR**
	
	    3.1 Select ICs.
	    3.2 Draw the pin diagram and internal connection.
	    3.3 Draw appropriate circuits.
	    3.4 Select required tools, equipment and materials.
	    3.5 Connect and checked the circuits as per diagram on trainer board.
	    3.6 Switch on the DC power supply,
	    3.7 Verify the truth tables.
		1	4

4	**VERIFY THE OUTPUT OPERATION OF BINARY 4 BIT PARALLEL ADDER.**
	    4.1 **Select appropriate ICs.**
	    4.2 Draw the pin diagram and internal connection.
	    4.3 Draw appropriate circuits.
	    4.4 Select required tools, equipment and materials.
	    4.5 Connect the circuits as per diagram on trainer board.
	    4.6 Switch on the DC power supply,
		1	4

	4.7 Verify the truth tables.		

5	**VERIFY THE OPERATION OF BINARY COMPARATOR**
	    5.1 Draw appropriate circuits.
	    5.2 Select required tools, equipment and materials.
	    5.3 Connect and checked the circuits as per diagram on trainer board.
	    5.4 Switch on the DC power supply.
	    5.5 Verify the truth tables.
		1	**4**

6	**OBSERVE THE OPERATION OF ENCODER & DECODER.**
	    6.1 Select appropriate ICs.
	    6.2 Draw the pin diagram and internal connection.
	    6.3 Draw appropriate circuits.
	    6.4 Select required tools, equipment and materials.
	    6.5 Connect and checked the circuits as per diagram on trainer board.
	    6.6 Switch on the DC power supply,
		1	**4**

7	**CONSTRUCT A 7 SEGMENT DISPLAY DRIVER**
	    7.1 Select appropriate ICs.
	    7.2 Draw the pin diagram and internal connection.
	    7.3 Draw appropriate circuits.
	    7.4 Select required tools, equipment and materials.
	    7.5 Connect and checked the circuits as per diagram on trainer board.
	    7.6 Switch on the DC power supply,
	    7.7 Verify the truth tables.
	.
		1	**4**

8	**OBSERVE THE OPERATION OF MULTIPLEXER & DEMULTIPLEXER.**
	    8.1 Select appropriate ICs.
	    8.2 Draw the pin diagram and internal connection.
	    8.3 Draw appropriate circuits.
	    8.4 Select required tools, equipment and materials.
	    8.5 Connect and checked the circuits as per diagram on trainer board.
	    8.6 Switch on the DC power supply.
	    8.7 Verify the truth tables.
		1	**4**

9	**VERIFY THE TRUTH TABLE OF DIFFERENT S-R & D FLIP-FLOPS. Select appropriate ICs.**
	
	    9.1 Draw the pin diagram and internal connection
	    9.2 Draw appropriate circuits.
	    9.3 Select required tools, equipment and materials.
	    9.4 Connect and checked the circuits as per diagram on trainer board.
	    9.5 Switch on the DC power supply,
		1	**4**

	9.6 Verify the truth tables. 9.7 Make D flip flop from SR Flip-Flop			
10	**VERIFY THE TRUTH TABLE OF DIFFERENT J-K FLIP-FLOPS.** 10.1 Draw the pin diagram. 10.2 Draw appropriate circuits. 10.3 Select required tools, equipment and materials. 10.4 Connect and checked the circuits as per diagram on trainer board. 10.5 Switch on the DC power supply, 10.6 Verify the truth tables. 10.7 Make D and T Flip-Flop from JK Flip-Flop		1	4
11	**CONSTRUCT A CLOCK GENERATOR CIRCUIT** 11.1 Draw appropriate circuits. 11.2 Select required tools, equipment and materials. 11.3 Connect and checked the circuits as per diagram on trainer board. 11.4 Switch on the DC power supply, 11.5 Observe the output wave shape.		2	10
		Total	12	50

Necessary Resources (Tools, Equipment and Machinery):

Sl. No.	Item Name	Quantity
1	*DC power Supply, Function generator, Oscilloscope,Digital Electronics Trainer, Power project board/ bread board*	**30 Nos**
2	7400, 74002, 7404, 7408, 7432, 7483, 7485, 7486, 7441, 7442, 7446, 7447, 7474, 7476, 74137, 74138, 74141,74157, 4511.	**10 Nos each**
3	7-segment Display Module, 555IC	**10 Nos each**
4	Resin, Soldering lead, Soldering tip, Fixable wire, Wire Brush,	**As required**

Recommended Books:

Sl No.	Book Name	Writer Name	Publisher Name & Edition
1	A Text Book of Digital Electronics	R. S. Sedha	Chand
2	**Modern Digital Electronics**	R P JAIN	
3	Digital Fundamentals	Thomas L. Floyd	
4	**Digital Electronics**	**D. R. Kaushik**	**Dhanpat Rai Publication Company**

Website References:

Sl. No.	Web Link	Remarks
1	https://www.tutorialspoint.com/	

2	https://www.electronics-tutorials.ws/	
3	https://www.youtube.com/channel/	
4	https://youtu.be/qsWkA-5grogo	
	https://youtu.be/eXyGIPrD5Qk	
	https://you.be/f-WiulYIrow	

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