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| **Course Name:** | **Digital Design Laboratory** | **Semester:** | **III** |
| **Date of Performance:** | **16 / 07 / 2024** | **Batch No:** | **C3** |
| **Faculty Name:** |  | **Roll No:** | **16010123217** |
| **Faculty Sign & Date:** |  | **Grade/Marks:** | **\_\_\_/25** |

**Experiment No: 1**

**Title: Study of Basic Gates and Universal Gates**

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| **Aim and Objective of the Experiment:** |
| Understand Basic Logic Gates and Universal Gates |

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| **COs to be achieved:** |
| **CO1**: Recall basic gates & logic families and binary, octal & hexadecimal calculations and conversions. |

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| **Tools used:** |
| Trainer kits |

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| **Theory:** |
| Logic gates are electronic circuits that perform logical operations on one or more input signals to produce an output signal based on a set of logical rules. Logic gates can be classified into the following categories:   1. Basic Gates:    1. AND Gate: The AND gate produces a high output (1) only when all of its inputs are high (1).    2. OR Gate: The OR gate produces a high output (1) if any of its inputs is high (1).    3. NOT Gate (Inverter): The NOT gate produces the logical complement of its input. It takes a single input and produces the opposite value as the output. 2. Derived Gates:    1. NAND Gate: The NAND gate is a combination of an AND gate followed by a NOT gate. It produces the inverse of the AND gate's output. It outputs a low (0) only when all of its inputs are high (1).    2. NOR Gate: The NOR gate is a combination of an OR gate followed by a NOT gate. It produces the inverse of the OR gate's output. It outputs a high (1) only when all of its inputs are low (0).    3. XOR Gate (Exclusive OR): The XOR gate produces a high output (1) when the number of high inputs is odd. It outputs a low (0) when the number of high inputs is even.    4. XNOR Gate (Exclusive NOR): The XNOR gate produces a high output (1) when the number of high inputs is even. It outputs a low (0) when the number of high inputs is odd. 3. Universal Gates:   NAND and NOR gates are considered universal gates because any logic function can be implemented using only NAND gates or only NOR gates. This means that with a sufficient number of NAND or NOR gates, you can create circuits that can perform any logical operation. |

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| **Implementation Details** |
| 1. AND Gate: Y = A.B   Symbol  Draw the logic symbol of AND gate.  Pin Diagram  AND Gate  Truth Table:  Virtual Labs   1. OR Gate: Y = A+B   Symbol  OR Gate Truth Table - Definition, Symbol, Properties  Pin Diagram  IC 7432 Pin diagram, circuit design, Datasheet, Application - ETechnoG  Truth Table:     1. NOT Gate: Y = Ā   Symbol  NOT Gate in Digital Electronics - Javatpoint  Pin Diagram  IC 7404 Pin Diagram, Circuit Design, Data sheet, application - ETechnoG  Truth Table:     1. NAND Gate: Y = (A.B)’   Symbol    Pin Diagram    Truth Table:     1. NOR Gate: Y =   Symbol  NOR Gate: Explanation, Truth Table, Analogy - Shiksha Online  Pin Diagram  NOR Gate: The Mighty Gate That Builds Any Circuit (Explained)  Truth Table:  NOR Gate in Digital Electronics - Javatpoint   1. XOR Gate: Y =   Symbol    Pin Diagram  XOR Gate  Truth Table:  XOR Gate Truth Table, Symbol, Diagram, Application, Properties   1. XNOR Gate:   Symbol    Pin Diagram  Exclusive OR Gate | EXOR | EXNOR Gate | XNOR Logic Gate Truth Table  Truth Table:    **Implementation Using NAND Gate**  **NOT GATE**    **AND GATE**    **OR GATE**    **Implementation Using NOR Gate**  **NOT GATE**    **AND GATE**    **OR GATE** |

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| **Post Lab Subjective/Objective type Questions:** |
| 1. Implement the Boolean function using NAND gates and NOR gates F=A’B + AB’   Ans:       1. Implement using combination of gates F = ABC + AB’C + ABC’   Ans. |

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| **Conclusion:** |
| By doing this experiment we got to learn about different logic gates such as AND, OR, NOT, NOR, NAND, XOR, XNOR gates |

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| **Signature of faculty in-charge with Date:** |