



Faculty of Electrical & Electronics Engineering
BEE1213 DIGITAL ELECTRONICS

LAB 1: BASIC LOGIC GATES, BOOLEAN ALGEBRA & DIGITAL LOGIC SIMPLIFICATIONS

Mapping CO,PO,Domain,KI : CO4,PO5

CO4: Construct logic circuit and counter

PO5: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations.

Learning Outcomes

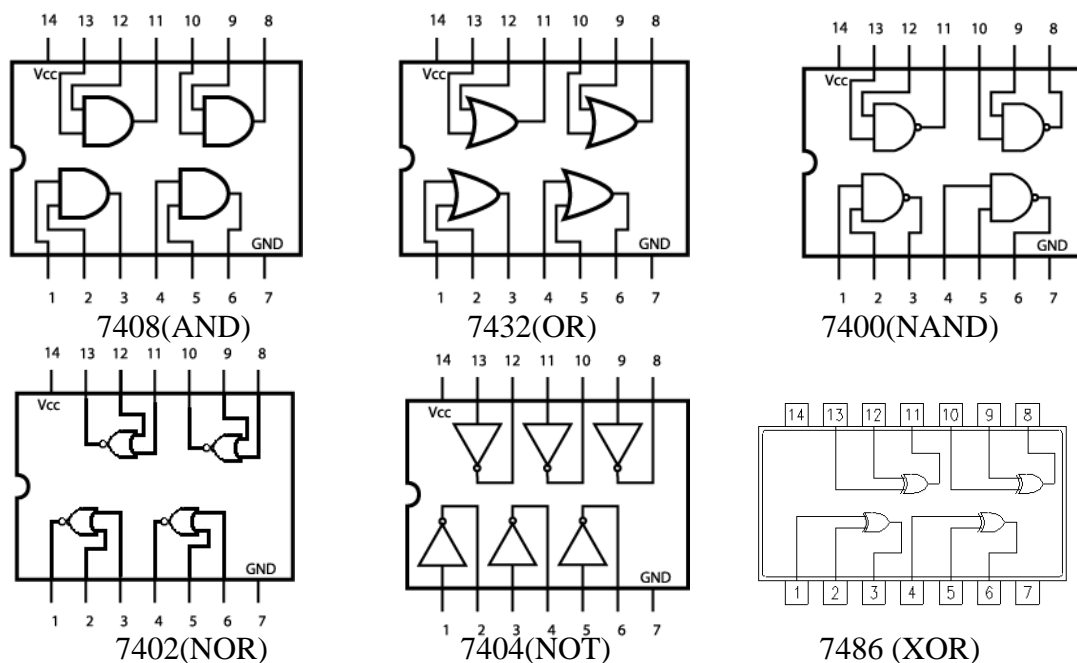
At the end of the experiment, student should be able to:

- i) Investigate AND, OR, NOT, NAND and NOR gate operations.
- ii) Study the fundamental laws of Boolean algebra associated with the AND, OR, NOT, NAND and NOR operations.
- iii) Demonstrate the function of XOR using basic gates.
- iv) Construct the circuit from given circuit diagram
- v) The use of universality of NAND and NOR gates

Technical Notes

This is the introductory laboratory session, to allow you to become familiar with very basic digital circuits and the equipment that you will use for the remainder of the experiments.

Useful IC Diagrams:



Equipment needed:

- Digital Trainer
- 7404 2-input NOT
- 7408 2-input AND
- 7432 2-input OR
- 7486 2-input XOR

Project Task:

As an apprentice engineer at PRISM Engineering Ltd., your first task in a semiconductor company is to get yourself familiarize with the basic logic circuit by analyzing the expression X, Y, Z below. Based on the Boolean expressions, your specified tasks are as follow:

$$X = B(AC)$$

$$Y = A(B + C)$$

$$Z = A \oplus B$$

- 1) **THEORETICAL:** Theoretically derive the result for each expression by deducing the truth table and construct the schematic diagram to the given expression. Redesign X and Y using only NOR gates. Redesign Z with only NAND gates. Complete the worksheet given.
- 2) **SOFTWARE SIMULATION:** Using Xilinx ISE Design Suite software, design X, Y and Z. Simulate each expression and generate the output waveform. Validate your waveform (How do you know if your waveform is correct?). You must do this prior to lab session. Demonstrate your simulation for each expression during lab session.
- 3) **HARDWARE:** Using the basic IC chips available, you are required to construct the logic circuit of the expression X, Y and Z, tabulate its output in truth table and compare results with theoretical answers.

Familiarize yourself with each IC by using their data sheets. You will be assessed based on all three parts of the lab: theoretical, simulation and hardware. A Q&A session will be done to test your understanding of what you're doing.

