

Military Institute of Science and Technology
Department of Computer Science and Engineering
CSE-22, Level-3, FALL Term
CSE-316 (Digital System Design Sessional)
GROUP A1, A3, A5, A7, A9 (SECTION-A)

CO1: Design different components of the microprocessor using the concept of computer system design.

CO2: Implement combinatorial and sequential systems using simulation software.

Instructions:

- 1. Design the 4-bit ALU [Use of multiplexer is strictly prohibited].**
- 2. Try to optimize the design.**
- 3. The ALU design must be submitted on **Week 6** in both hardcopy (on paper) and softcopy (using Proteus).**
Do the following:
 - a. Determine the total number of ICs and gates used in your design.**
 - b. In the hardcopy, write down the tables, equations, total number of gates, total number of ICs, and IC model number.**
- 4. After that, you must submit the final hardware connection on **Week 8**.**
- 5. Finally you have to submit a report on ALU design.**

Problem:

Design a 4-bit Arithmetic Logic Unit (ALU), which generates the following operations. Also, show the four status registers (Sign flag, Carry flag, Overflow flag, Zero flag).

Operation	Function
$F = A$	Transfer A
$F = A + 1$	Increment A
$F = A - B - 1$	Subtraction
$F = A - B$	Subtraction with borrow
$F = A \text{ OR } B$	Logical OR
$F = A \text{ AND } B$	Logical AND

Report Writing Guidelines:

Points that need to be mentioned in the report are discussed below:

- 1. Introduction:** Basic introduction about ALU.
- 2. Design Procedure:** This section includes details about the working principle of the ALU. You may refer to the digital circuits used to design the ALU and describe the data input, selection input, carry, output, and pins associated with the equipment. A short description of how the ALU performs arithmetic and logical operations should be explained.
- 3. Truth Table and Equations:** Show the truth table for the given functions and formulate the equation of X, Y, and Z.
- 4. Status Flags:** Design of the four status flags (Zero, Overflow, Carry, and Sign Flag).
- 5. Circuit diagram (Proteus)**
- 6. IC Description:** Model, IC name, Quantity of Gates, and Quantity of ICs used.
- 7. Discussion and Conclusion.**