A K T U

B.Tech II-Year

GATEWAY CLASSES

EC & EC Allied

DSD : Digital System Design

Unit-2 Lec-8

Gateway Classes



Avinash Sir

Today's target

- Barrel Shifter
- ALU
- PYQ

UNIT-2 : Combinational circuits:

- Analysis and Design of combinational circuits
- MSI devices like comparators, multiplexers, demultiplexers, encoder, decoder,
- circuit realization using Multiplexers and decoders, half and full adders, subtractors, serial and parallel adders, BCD adder, barrel shifter and ALU.

Gateway Classes

Barrel Shifter

A barrel shifter is a combinational circuit that can shift or rotate a binary number by a specific number of bits in a single operation.

Unlike normal shifters (which shift bit by bit), barrel shifters perform the shift in parallel, making them very fast.

Features

- Can shift data left or right.
- Can perform both logical and circular (rotational) shifts.
- Controlled by select lines which decide how many positions to shift.
- Used in multipliers, dividers, floating-point arithmetic, and processors.

Gateway Classes

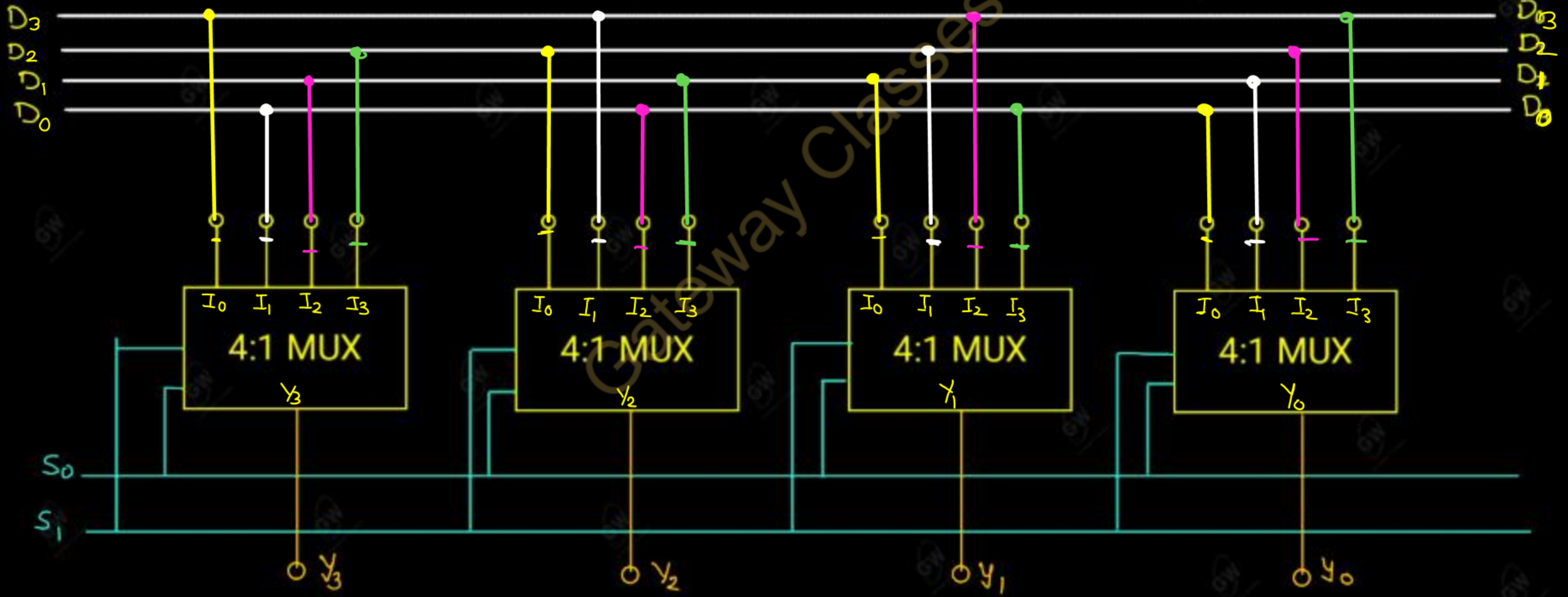
4 bit Barrel Shifter :-

Input: 4-bit number D3 D2 D1 D0

Control: 2 select lines S1 S0 → decides shift amount

Output: 4-bit shifted number

	S_0	S_1	Y_3	Y_2	Y_1	Y_0
I_0	0	0	D_3	D_2	D_1	D_0
I_1	0	1	D_0	D_3	D_2	D_1
I_2	1	0	D_1	D_0	D_3	D_2
I_3	1	1	D_2	D_1	D_0	D_3



Gateway Classes

ALU

An Arithmetic Logic Unit (ALU) circuit element is a combinational digital electronic circuit that performs arithmetic and bitwise logic operations on integer binary numbers.



ALU plays an important role as it executes and processes all the instructions, performs calculations, manipulates binary data, and performs various decision-making operations.

Gateway Classes

Features of ALU

- Can do arithmetic operations: addition, subtraction, (sometimes multiplication, division)
- do logical operations: AND, OR, NOT, XOR, XNOR, etc.
- Contains two sub-units:
  - AU = Arithmetic Unit
  - LU = Logic Unit
- Receives control signals guiding which operation to perform
- After operation, result is sent to memory or output unit

Functions of ALU

- Arithmetic operations: addition, subtraction, multiplication, division
- Logical operations: AND, OR, NOT, etc.
- Comparison operations: equal to, less than, greater than, etc.
- Shift operations: bit shifts (left shift, right shift) to manipulate data at bit level

Gateway Classes

Main Components / Sub-Units

Arithmetic Unit (AU)

- **Adder:** adds two binary numbers (half-adder, full-adder, ripple carry adder, etc.)
- **Subtractor:** often implemented using 2's complement method to subtract binary numbers
- **Multiplier & Divider:** in more advanced ALUs, dedicated circuits for multiply/divide

Logic Unit (LU)

- Uses logic gates: AND, OR, NOT, NAND, NOR, XOR, XNOR
- Can be composed in combinations to carry out complex logic operations
- Some gates have special uses:
    - XOR = "inequality detector" (gives 1 if inputs differ)
    - XNOR = "equality detector" (gives 1 if inputs are same)

Gateway Classes

How ALU Works (Working Principle)

Inputs & control signals

- Receives binary data inputs
- Receives control signals (from control unit) that tell which operation to do

Operation selection & execution

- Based on control signals, ALU picks which sub-unit to use (arithmetic, logic, shift, etc.)
- Performs the operation

Output result

- Sends result to memory or output units

Gateway Classes

Gateway Classes

Empowering Learners, Transforming Futures

GATEWAY CLASSES

Thank You

Gateway Classes

GET IT ON Google Play

Download on the App Store

Helpline No- 7819 0058 53