EE200 DIGITAL LOGIC CIRCUIT DESIGN

The material covered in this lecture will be as follows:

⇒Introduction to registers and counters.

⇒Register with parallel load.

⇒Shift registers.

⇒Serial transfer.

After finishing this lecture, you should be able to:

⇒ Describe the main functions of registers and counters.

⇒ Differentiate between shift registers and registers with parallel load.

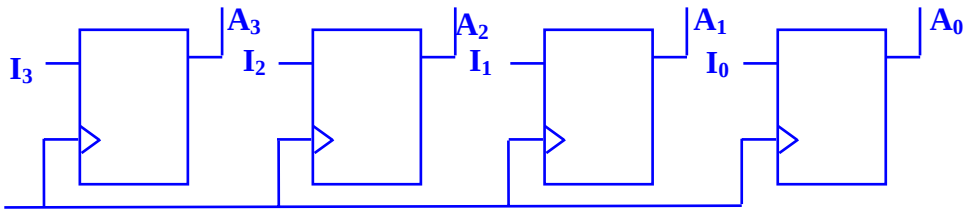
⇒ Understand the serial transfer operation in registers.

Introduction to Registers and Counters

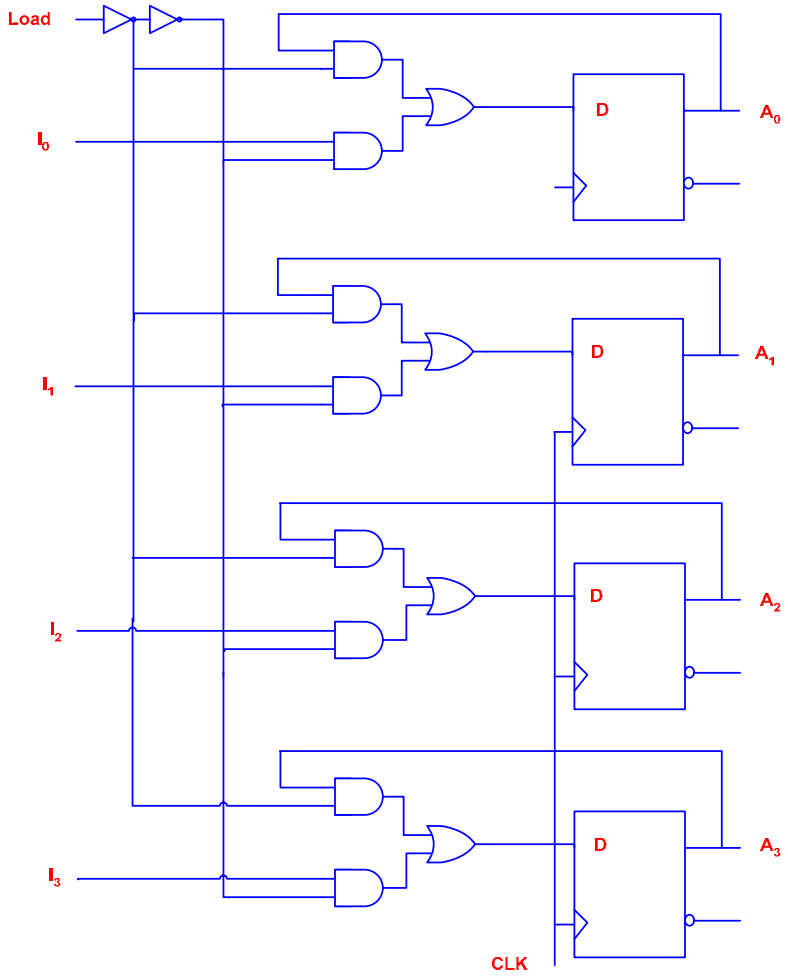
Registers and counters are practical examples of clocked sequential circuits. A register consists of a group of flip-flops each is capable of storing one bit of information. Logic gates could be used to arrange the loading of the register with data and reading of the contents. Counters may be considered as a special register, which counts in a certain count cycle determined by the design of the counting register.

A Simple 4-Bit Register

The following diagram shows a 4-bit register consisting of D flip-flops.



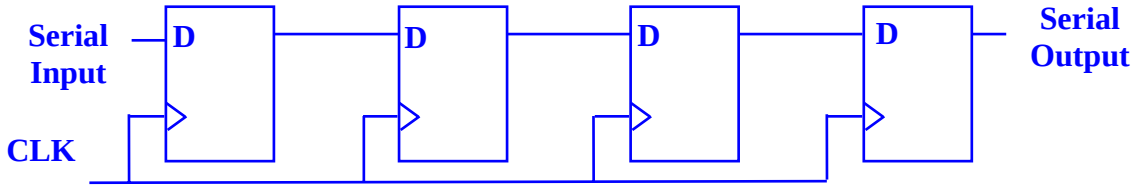
4-Bit Register with Parallel Load



The next state of the D flip-flop is equal to the D input. In order to keep the contents of the register unchanged while the clock pulses are applied, then the output is applied back to the D input when the load input is zero. When we want to load the register with new input **I**, then the load input goes to one, then D=**I**.

Shift Registers

Shift registers are registers that can shift binary bits in one direction or both directions upon the application of clock pulses. A 4-bit shift register is shown next. This is a shift right shift register as seen by the position of the serial input and serial output.

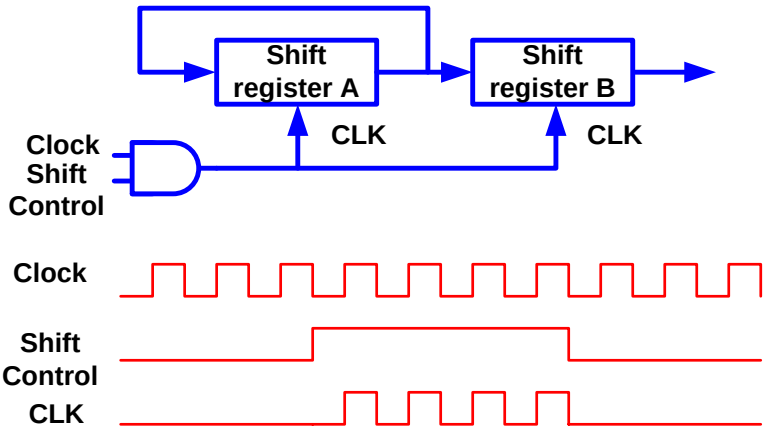


Serial Transfer

Serial transfer means that data is manipulated or transferred in the digital system one bit at a time. In the other method of transfer, which is called parallel transfer, data is transferred at the same time (by means of one clock pulse).

In the following Figure, data is transferred from register A to register B upon the application of four clock pulses. At the same time the 4 bits remain in register A by circulating it back in the register.

The contents of registers A and B before and after the application of the four clock pulses are given in the table.



If register A contains 1100 and register B 0101 initially. The contents of registers A and b after each clock pulse are given in the following table.

Timing pulse	Shift register A				Shift register B			
Initial	1	1	0	0	0	1	0	1
After T1	0	1	1	0	0	0	1	0
After T2	0	0	1	1	0	0	0	1
After T3	1	0	0	1	1	0	0	0
After T4	1	1	0	0	1	1	0	0