**Practical: 5**

**Aim: Design 4-bit Combinational Circuit Shifter.**

**Theory:**

Shift micro-operations are used for serial transfer of data. They are also used in conjunction with arithmetic, logic and other data-processing operations. The contents of a register can be shifted to the left or the right. At the same time that the bits are shifted, the first flip-flop receives its binary information from the serial input. During a shift-left operation the serial input transfers a bit into the rightmost position. During a shift-right operation the serial in transfers a bit into the leftmost position.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Select | Output | | | |
| S | H0 | H1 | H2 | H3 |
| 0 | IR | A0 | A1 | A2 |
| 1 | A1 | A2 | A3 | IL |

**Table:** Function table

The content of a register that has to be shifted is first placed onto a common bus whose output is connected to the combinational shifter, and the shifted number is then loaded back into the register**.** Acombinational circuit shifter can be constructed with multiplexers as shown in Fig A. The 4-bit shifter has four data inputs, A*o* through A3, and four data outputs, H*o* through H3. There are two serial inputs, one for shift left(IL) and the other for shift right (IR). When the selection input S = 0, the data are shifted right. When S = 1, the input data are shifted left. The function table shows input goes to each output after the shift. A shifter with n data input outputs requires n multiplexers.

**Procedure**:

1. Create the circuit as per function table.

2. Verify the function table for each operation.

**Circuit Diagram:**

