**Multiplexer**: A multiplexer (MUX) is a device allowing one or more low-speed analogue or digital input signals to be selected, combined and transmitted at a higher speed on a single shared medium or within a single shared device. A MUX functions as a multiple-input, single-output switch. With two input signals and one output signal, the device is referred to as a 2-to-1 multiplexer; with four input signals it is a 4-to-1 multiplexer; etc.

**A 4 to 1 line Multiplexer**: For a 4-input multiplexer we would require two data select lines as 2 select inputs represent \(2^2 = 4\) data control lines. We need all 4 control lines since we have to select one particular input out of four discrete inputs. Now we design a circuit with four inputs, \(I_0, I_1, I_2, I_3\) and two data select lines \(S_0\) and \(S_1\) as shown below:

Here we need to presume that all the input lines \((I_0, I_1, I_2, I_3)\) are always 1. Now when the select inputs \(S_0\) and \(S_1\) are 0,0; all three inputs to the first AND gate become 1 thereby reflecting that \(I_0\) is going as output \((M)\). Other combinations of select inputs are working similarly for selecting other inputs.

**Assignments**:

1. What is a multiplexer? Why do we need select lines?
2. Design an 8 to 1 line multiplexer along with its Truth Table.