Mechatronics

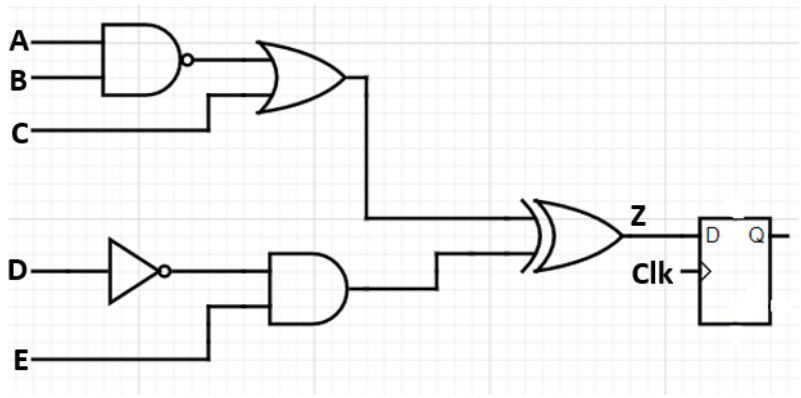
Assignment 1

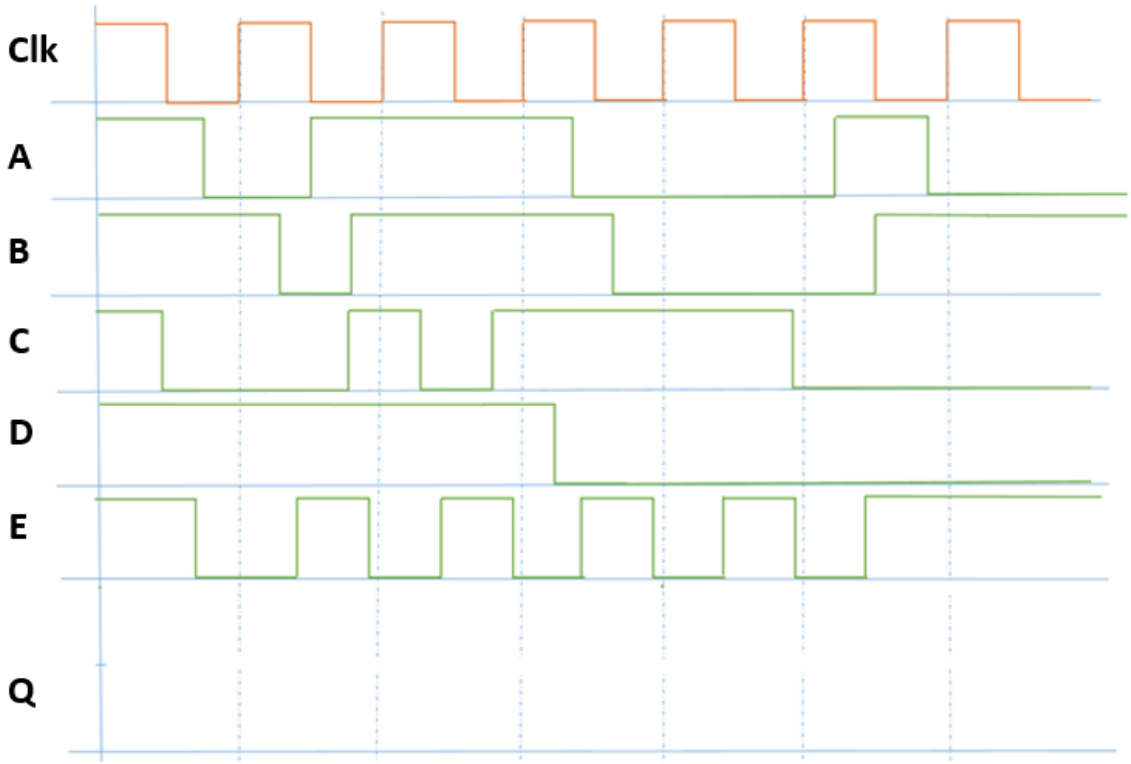
(Due on March 8th, 11.55 pm on Elearn Portal)

Note: Please submit a single PDF document with all the answers. Include your name and BITS ID in the document.

Late submissions will be marked as 0.

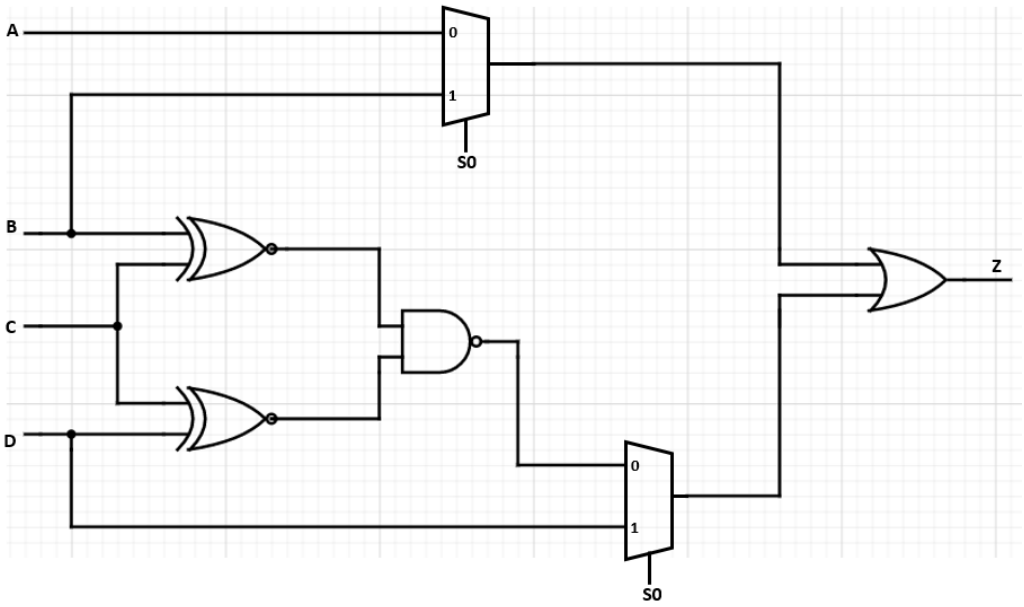
1. **Refer to the circuit below. Complete the timing diagram assuming the starting state of the flip-flop output Q is 1. Complete the truth table by taking the inputs from the timing diagram. (10)**





A	B	C	D	E	Z

2. For the circuit diagram below, fill the truth table. (10)



A	B	C	D	S0	Z
0	0	1	1	0	
1	0	0	0	1	
0	1	0	1	0	
1	0	1	0	0	
0	1	1	0	1	
0	0	0	0	1	
1	1	1	1	0	
0	0	0	1	0	
1	0	0	1	1	
1	1	1	0	1	

3) A type K thermocouple can measure temperature from -75 deg C to 200 deg C with an accuracy of 0.75%. **(10)**

i) Calculate the span of this sensor.

ii) Calculate the accuracy in terms of temperature in deg C.

iii) If the thermocouple gives an output of 2 mV/deg C, what is output voltage range of this thermocouple?

iv) Based on the below graph, calculate the measured sensitivity of the thermocouple at 378.37 deg C. What is the error between measured sensitivity vs expected sensitivity?

v) Based on the linear fit shown in the graph, at approximately what temperature is the error maximum? What is this error called?