NATIONAL INSTITUTE OF TECHNOLOGY, ROURKELA

B.Tech(4th)End Semester Examination April-2011

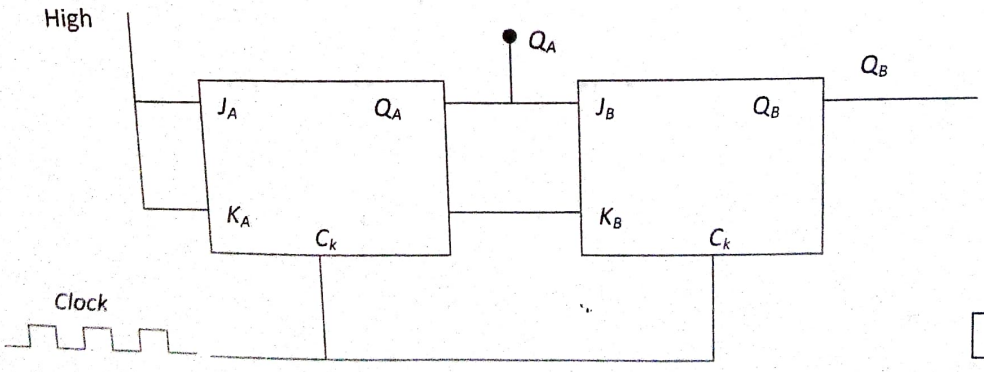
Digital Electronics (EC202)

Total Marks: 50

Duration: 3hrs

Instruction: *Answer All, Marks indicated on the right*

1. a) Implement the function $f(w_1, w_2, w_3) = \sum m(0, 2, 3, 4, 5, 7)$ using a 3-to-8 binary decoder and an *OR* gate, b) Write VHDL code that represents the above function f by using one selected signal assignments. (2 + 3)
2. Derive a circuit that uses 2-to-1 multiplexer for a function $f = w_1'w_3' + w_2w_3' + w_1'w_2$ by using the truth table method. (3)
3. What is the cost of this function $f = w_1'w_2' + w_2'w_3' + w_1w_2w_3$? Use Shannon's expansion to derive a multilevel circuit that has a lower cost and give the cost of your circuit. (1 + 4)
4. Given a 100-MHz clock signal, derive a circuit using D flip-flops to generate 12.5 MHz clock signal. Draw the timing diagram for this signal by assuming reasonable delays. (4)
5. Explain how a J-K flip-Flop can be realized using D flip-flop and other logic gates. (4)
6. Sketch the Q output of flip-flop B (Q_B) of the following figure in proper relation to the clock. Assume the flip-flops are initially RESET. (3)



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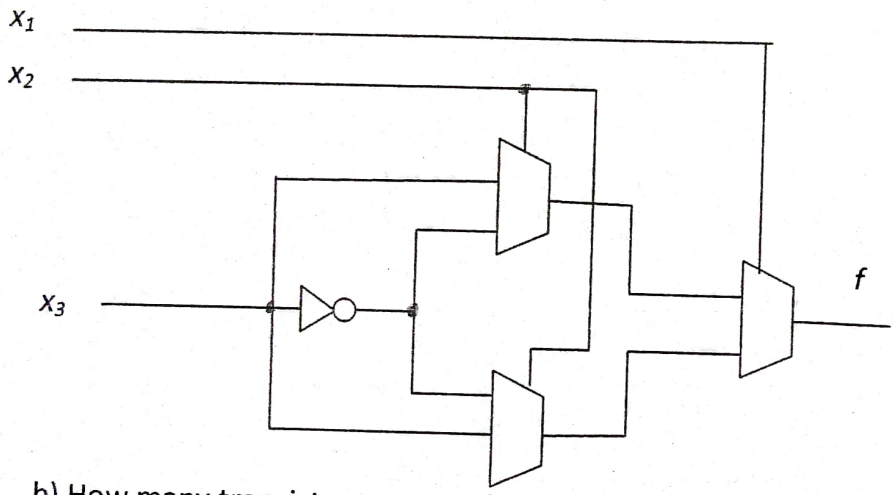
7. Design a counter that counts pulses on line *w* and displays the count in the sequence 0, 2, 1, 3, 0, 2, ... Use a) D flip-flop, b) JK flip-flop and c) T flip-flop. (2 + 3 + 2)

8. a) Design a MOD-8 Up-Down synchronous counter using J-K flip-flop, b) Write the VHDL code that represents the MOD-8 Up-Down synchronous counter. (3 + 3)

9. a) What is a CMOS transistor b) Why is it so popular? c) Derive a CMOS complex gate for the function $f(x_1, x_2, x_3, x_4) = \sum m(0, 1, 2, 4, 6, 8, 10, 12, 14)$ and give the truth table of it. (1 + 1 + 6)

10. a) What will be the expression for the following CMOS circuit built with multiplexers? (3)



b) How many transistors are needed to build this CMOS circuit? (2)

All The Best.