## IEC121 Digital Design and Electric Circuits

Assignment 3

Answer the following questions on white sheets and scan and upload the solutions

1. A universal shift register can shift in both the left-to-right and right-to-left directions, and it has parallel-load capability. Draw a circuit for such a shift register.
2. Design a three-bit up/down Asynchronous counter using T flip-flops. It should include a control input called Up/Down. If Up/Down = 0, then the circuit should behave as an up-counter. If Up/Down = 1, then the circuit should behave as a down-counter.
3. The circuit in Figure below looks like a counter. What is the counting sequence of this circuit?
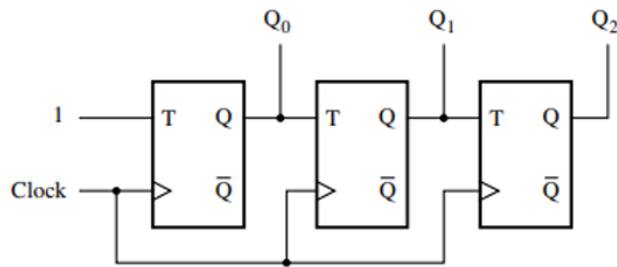
4. Given a 100-MHz clock signal, derive a circuit using T flip-flops to generate 50-MHz and 25MHz clock signals. Draw a timing diagram for all three clock signals, assuming no delays.
5. Draw the circuit of a 4-bit asynchronous Down counter using D flip-flops.
6. Draw the circuit of a Mod-8 synchronous counter using D flip-flops. Show how you will realize a Mod-8 Ring Counter using this counter and an additional combinational block.
7. Design a Modulo-7 synchronous counter using D flip-flops with a modification that the counting starts from 1 rather than 0.
8. Designafour-bit synchronous counter with parallel load. Use T flip-flops, instead of the D f lip-flops.
9. A PQ flip-flop has four operations, no change, clear to 0, set 1 and toggle, when inputs P and Q are 01, 00, 11 and 10, respectively.
   a. Determine the characteristic table of the flip-flop.
   b. Find the characteristic Equation of the flip-flop.
   c. Determine the excitation table.
   d. Convert the flip-flop to a D flip-flop.
10. Using positive edge triggered D flip-flop, design a synchronous counter which counts the following sequence 000, 111, 110, 101, 100, 011, 010, 001, 000.