

**Third Semester B.E. Degree Examination, December 2012**  
**Logic Design**

Time: 3 hrs.

Max. Marks:100

**Note: Answer FIVE full questions, selecting  
at least TWO questions from each part.**

**PART – A**

- 1 a. Differentiate analog and digital signals. Define period, frequency and duty cycle of a digital signal. Prove that the duty cycle of a symmetrical waveform is 50%. (06 Marks)
- b. What are universal gates? Realize  $((\overline{A+B}) \cdot C)$  using only NAND gates. (05 Marks)
- c. Describe positive and negative logic. List the equivalences between them. (04 Marks)
- d. What is the need for HDL? Explain the structure of VHDL / verilog program. (05 Marks)
  
- 2 a. Find the minimal SOP of the following Boolean functions using K-Maps:
  - i)  $f(a, b, c, d) = \sum m(6, 7, 9, 10, 13) + d(1, 4, 5, 11)$
  - ii)  $f(w, x, y, z) = \pi m(1, 2, 3, 4, 9, 10) + d(0, 1, 4, 15)$  (08 Marks)
- b. Simplify  $f(A, B, C, D) = \sum m(0, 1, 2, 3, 10, 11, 12, 13, 14, 15)$  using Quine-Mc Clusky method. (08 Marks)
- c. What are static hazards? How to design a hazard free circuit? Explain with an example. (04 Marks)
  
- 3 a. Design and implement BCD to excess-3 code converter using four 8:1 multiplexers. Take MSB 'A' as map entered variable (input variable) 'BCD' lines as select lines, assuming  $f(A, B, C, D)$  as BCD input. (08 Marks)
- b. Realize a logic circuit for Octal to binary encoder. (06 Marks)
- c. Draw the PLA circuit and realize the Boolean functions:  $X = A'B'C + AB'C' + B'C$ ,  $Y = A'B'C + AB'C'$ ,  $Z = B'C$  (04 Marks)
- d. Give the HDL implementation of 2:1 MUX. (02 Marks)
  
- 4 a. Draw the logic diagram, truth table and timing diagram for edge-triggered D-flip flop. (06 Marks)
- b. With a neat logic diagram and truth table, explain the working of JK Master-Slave Flip-Flop along with its implementation using NAND gates. (06 Marks)
- c. Analyze the behavior of the sequential circuit shown in Fig. Q4 (c) and draw the state table and state transition diagram. (08 Marks)

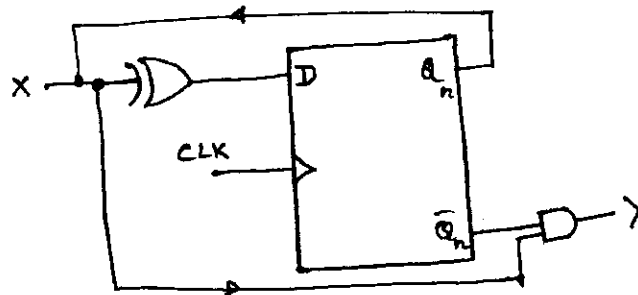


Fig. Q4 (c)

**PART – B**

- 5 a. Using positive edge triggered D flip-flops, draw the logic diagram for a 4-bit parallel-in-serial-out (PISO) shift register and explain its working to load 1001 into it and shift the same. (08 Marks)
- b. With a neat diagram, explain how shift registers can be applied for serial addition. (05 Marks)
- c. How long will it take to shift an 4 bit number into 4 bit PISO shift register that operates at clock frequency of 5 MHz. Also, what is the time required to extract 4-bit number from PISO operates at 5 MHz clock? (04 Marks)
- d. Write verilog/VHDL code for Johnson counter. (03 Marks)
- 6 a. With the help of neat block diagram and timing diagram, explain the working of a Mod-16 ripple counter constructed using positive edge triggered JK flip-flops. (08 Marks)
- b. Design a self-correcting Mod-5 synchronous down counter using JK flip-flops. Assume 100 as the next state for all the unused states. (08 Marks)
- c. List any two drawbacks of asynchronous counter. What is the clock frequency in a 3-bit counter, if the clock period of the waveform at last flip-flop is 24  $\mu$ s? (04 Marks)
- 7 a. How does state transition diagram of a Moore machine differ from Mealy machine? Draw the state transition diagram of synchronous sequential logic circuit using Mealy model that detects three consecutive zeros from an input data stream, X and signals detection by making output, Y = 1. (06 Marks)
- b. Draw the ASM chart for vending machine problem using Mealy model. (08 Marks)
- c. What is the use of state reduction technique? Demonstrate the state reduction by implication table method. (06 Marks)
- 8 a. With a neat diagram, explain the working of a 4-bit D/A converter. (08 Marks)
- b. What is the accuracy and resolution of an 8-bit D/A converter? Find the resolution and accuracy of the same if the full scale output is +10V. (04 Marks)
- c. Discuss the working of following A/D converters:
- i) Successive approximation A/D.
  - ii) Counter type A/D. (08 Marks)

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