

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 1249

Roll No.

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**B.Tech.**(SEM. III) ODD SEMESTER THEORY  
EXAMINATION 2013-14**DIGITAL DESIGN****SECTION-A**

1. Attempt all parts : (10×2=20)
- Convert  $(FAFA.B)_{16} = (?)_{10}$ .
  - Simplify the following Boolean Expressions  $(x + y)(x + y')$  to a minimum no. of literals.
  - How many address lines and input-output data lines are needed in  $256 K \times 64$  ?
  - How many Flip-Flops are required to design MOD-6 counter ?
  - Define the excutation table of S-R flip-flop.
  - Explain the difference between a Johnson counter and a ring counter.
  - Convert binary no. 101011 into gray code.
  - Design Ex OR gate using NAND gate only.
  - Find the complement of  $(\bar{x} + \bar{y} + z)(\bar{x} + y)(x + \bar{z})$ .
  - Explain Volatile and Non Volatile memory.

**SECTION-B**

2. Attempt any three parts : (3×10=30)
- Simplify the function in sum-of-minterms form :  
 $F(A, B, C, D) = \Sigma(4, 5, 6, 7, 12, 13, 14)$   
 $d(A, B, C, D) = \Sigma(1, 9, 11, 15)$  using Tabular Method
    - Implement the following Boolean function f, using the two-level forms of logic :
      - NAND-AND
      - AND-NOR

6. Attempt any one part :

- Explain the difference between asynchronous and synchronous sequential circuits.
  - Define fundamental-mode operation.
  - Explain the difference between stable and unstable states.
  - What is the difference between an internal state and a total state ?
- An asynchronous sequential circuit is described by the excitation function :

$$Y = x_1 x_2' + (x_1 + x_2')y \text{ and O/P } z = y.$$

- Draw the logic diagram of the circuit.
- Derive the transition table and output map.
- Obtain a two-state flow table.
- Describe the behavior of the circuit.

7. Attempt any one part :

- Derive the PLA programming table for the combinational circuit that squares a three-bit number.
- Design the ROM circuit for the BCD to excess-3 code converter.

- (c) OR-NAND and  
(d) NOR-OR.

$$F(A, B, C, D) = \Sigma(0, 4, 8, 9, 10, 11, 12, 14)$$

- (b) (i) Define a combinational circuit with three inputs  $x$ ,  $y$ , and  $z$  and three outputs  $A$ ,  $B$  and  $C$ . When the binary input is 0, 1, 2 or 3, the binary output is two greater than the input. When the binary input is 4, 5, 6 or 7, the binary output is two less than the input.
- (ii) Implement the following Boolean function with a  $4 \times 1$  MUX and external gates.  
 $F(A, B, C, D) = \Sigma(1, 3, 4, 11, 12, 13, 14, 15)$

- (c) (i) A sequential circuit has two JK flip flops A and B and one input  $x$ . The circuit is described by the following flip flop input equations :

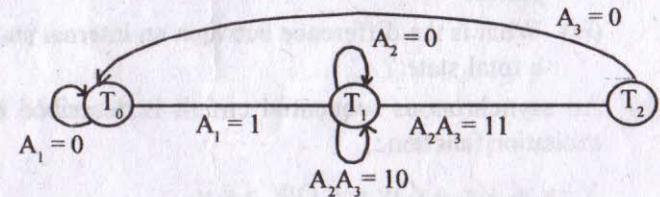
$$J_A = x \quad K_A = B'$$

$$J_B = x \quad K_B = A$$

- (a) Derive the state equations  $A(t+1)$  and  $B(t+1)$  by substituting the input equations for the J and K variables.
- (b) Draw the state diagram of the circuit.
- (ii) Show that a BCD ripple counter can be constructed from a four-bit binary ripple counter with asynchronous clear and a NAND gate that detects the occurrence of count 1010.
- (d) (i) Draw the logic diagram of the product-of-sums expression :  
 $Y = (x_1 + x_2')(x_2 + x_3)$ .
- Show that there is a static-0 hazard when  $x_1$  and  $x_3$  are equal to 0 and  $x_2$  goes from 0 to 1. Find a way to remove the hazard by adding one more OR gate.
- (ii) Obtain a primitive flow table for a circuit with two inputs  $x_1$  and  $x_2$  and two outputs  $z_1$  and  $z_2$ , that satisfy the following four conditions :
- (a) When  $x_1 x_2 = 00$ , the O/P is  $z_1 z_2 = 00$
- (b) When  $x_1 = 1$  and  $x_2$  changes from 0 to 1, the O/P is  $z_1 z_2 = 01$ .

- (c) When  $x_2 = 1$  and  $x_1$  changes from 0 to 1, the O/P is  $z_1 z_2 = 10$ .
- (d) Otherwise, the O/P does not change.

- (e) (i) Design the controller whose state diagram is shown in fig. Use one-flip-flop per state method.



- (ii) Obtain the 15-bit Hamming code word for the 11-bit data word 11001001010.

### SECTION-C

3. Attempt any **one** part : (5×10=50)
- (a) Find all the prime implicants for the following Boolean function, and determine which are essential :  
 $F(A, B, C, D) = \Sigma(0, 2, 3, 5, 7, 8, 10, 11, 14, 15)$
- (b) Simplify the following Boolean function, using five variable maps :  
 $F(A, B, C, D, E) = A' B' C E' + B' C' D' E' + A' B' D' + B' C D' + A' C D + A' B D$ .
4. Attempt any **one** part :
- (a) Implement a full subtractor with a decoder and NAND gates. The adder inputs are A, B and C. The adder produces outputs S and C.
- (b) What is the difference between flow chart and ASM chart ? Also draw an ASM chart state table for a two bit up-down counter having mode control input.  $M = 1$  (up counting) and  $M = 0$  (down counting). The circuit should generate an output 1, whenever count become minimum or maximum.
5. Attempt any **one** part :
- (a) Design MOD-12 Synchronous Counter.
- (b) Explain the four bit Universal Shift Register.