

**B.TECH.**  
**(SEM IV) THEORY EXAMINATION 2022-23**  
**DIGITAL ELECTRONICS**

Time:3 Hours

Total Marks: 100

**Note:** Attempt all Sections. If require any missing data then choose suitably.

**SECTION A**

**1. Attempt all questions in brief.**

**2 x 10 = 20**

- (a) Explain Duality Principle. Prove that positive logic AND Gate is equivalent to negative logic OR Gate.
- (b) Explain 2-input EX-NOR Gate and implement it using minimum number of 2-input NOR Gates.
- (c) Explain Half adder circuit and implement it using 2-input NAND Gates.
- (d) Write down the differences between Combinational and Sequential digital circuits.
- (e) Differentiate between Synchronous and Asynchronous sequential circuits.
- (f) Explain in brief:- (i) Astable Multivibrator (ii) Bistable Multivibrator.
- (g) Explain the working of a PISO type shift register briefly.
- (h) What are Static and Dynamic Hazards?
- (i) What is Noise Margin?
- (j) What are the advantages of CMOS logic family?

**SECTION B**

**2. Attempt any three of the following:**

**10x3=30**

- (a) Find the Simplified logical expression for Y.  
 $Y(A,B,C,D,E) = \sum m(0,2,4,7,8,10,12,16,18,20,23,24,25,26,27,28)$ .
- (b) Implement a 1:8 De-mux with selection lines A,B,C using 1:2 De-mux. Verify your implementation with the help of Truth Tables.
- (c) What is Race-Around condition in J-K flip-flop? Explain it's solution Master- Slave J-K Flip-Flop.
- (d) Given the conditions, such that If input A = 0, the circuit oscillates between either one of the two cases. Case1:- 00-01-00-01 and Case2:- 10-11-10-11 And If A = 1, it switches inter between two cases. Draw the state transition diagram and implement the same using JK flip-flop and by using basic logic gates.
- (e) Implement a 3-input NOR Gate using CMOS and DTL logic families. Also Explain the working in both cases.

**SECTION C**

**3. Attempt any one part of the following:**

**10x1=10**

- (a) Implement NOT, OR, AND, EX-OR, EX-NOR, NOR (all 2-inputs except NOT Gate) gates using minimum number of 2-input NAND Gates.
- (b) Convert all possible 4-bit binary codes into Gray Code. Also show the implementation circuit using 2-input EX-OR Gates only.

4. **Attempt any one part of the following:** **10x1=10**
- (a) Implement a circuit using logic gates that compares the magnitudes of two 4-bit numbers.
  - (b) Implement the Boolean function  $F(A,B,C,D) = \sum m(0,1,2,5,8,13,14)$  using 8:1 MUX with A,C,D as selection lines.
5. **Attempt any one part of the following:** **10x1=10**
- (a) Implement S-R, T, D flip-flops using J-K flip-flop. Also show the implementation with help of State Tables.
  - (b) Design a MOD-12 asynchronous down counter using T flip-flops.
6. **Attempt any one part of the following:** **10x1=10**
- (a) Given a sequential logic circuit expression as  $X(t+1) = p'X + pY$   $Y(t+1) = pX' + p'Y$  where X and Y are the two flip-flop outputs and p is the main external input. Draw the state transition table for the above-given logic function. Also, draw the state transition diagram associated with it.
  - (b) Design a synchronous 3-bit FSM (which can be used for counting) using D flip-flops with no external inputs and count sequence as follows:- 0-1-3-7-4-2-0.
7. **Attempt any one part of the following:** **10x1=10**
- (a) Explain Propagation delay in logic families. Also explain why  $T_{PLH} > T_{PHL}$ .
  - (b) Explain ROM and its various types. Implement a 4-T SRAM cell using MOSFETs.