

**Professional Course (Odd) Examination, 2024**

(CBCS)

(1st Semester)

**BACHELOR OF COMPUTER APPLICATIONS****( Digital Computer Fundamentals )**

Full Marks : 75

Time : 3 hours

*The figures in the margin indicate full marks for the questions***( PART : A—OBJECTIVE )**

( Marks : 25 )

## SECTION—I

( Marks : 15 )

**A.** Tick (✓) the correct answer in the brackets provided :

1×10=10

1. The 2's complement of the binary number 100101 is

- |            |     |            |     |
|------------|-----|------------|-----|
| (a) 111010 | ( ) | (b) 100110 | ( ) |
| (c) 011010 | ( ) | (d) 011011 | ( ) |

2. The 10's complement for  $(825)_{10}$  is

- |         |     |         |     |
|---------|-----|---------|-----|
| (a) 175 | ( ) | (b) 165 | ( ) |
| (c) 174 | ( ) | (d) 164 | ( ) |

3. The decimal equivalent of a binary number 11011 is

(a) 24 ( ) (b) 25 ( )

(c) 26 ( ) (d) 27 ( )

4. The octal equivalent of the number  $(45F)_{16}$  is

(a) 2137 ( ) (b) 2053 ( )

(c) 2127 ( ) (d) 2153 ( )

5. PLA stands for

(a) Popular Logic Array ( )

(b) Programable Logic Array ( )

(c) Programable Large Array ( )

(d) Product of Large Array ( )

6. Which Boolean algebra theorem states that  $A + A \cdot B = A$ ?

(a) Distributive law ( )

(b) Absorption law ( )

(c) De Morgan's theorem ( )

(d) Complement law ( )

7. The Boolean expression  $x \cdot x' = ?$

(a) 0 ( ) (b) 1 ( )

(c) x ( ) (d) x' ( )

8. What is the purpose of a decoder in a combinational circuit?

(a) To select one of several input signals ( )

(b) To perform addition or subtraction ( )

(c) To store binary data ( )

(d) To convert binary data into a more readable form ( )

3. (a) Write any five digital logic gates with graphic symbols and truth table.

9. In which counter does the flip-flop output transition serve as a source for triggering other flip-flop?

- (a) Binary counter ( )
- (b) Shift counter ( )
- (c) Ripple counter ( )
- (d) Up-down counter ( )

10. The counters in which the clock pulses are applied to the CP inputs of all flip-flops are called

- (a) all counters ( )
- (b) synchronous counters ( )
- (c) asynchronous counters ( )
- (d) syndicate counters ( )

B. State whether the following statements are True (T) or False (F) by putting a Tick (✓) mark :

1×5=5

1. Decimal number  $(41)_{10}$  to its binary number equivalent is  $(101001)_2$ .

( T / F )

2. In a NAND gate, the output is high when all inputs are high.

( T / F )

3. XOR is also called as universal gate.

( T / F )

4. A half-adder can add three bits.

( T / F )

5. In a synchronous binary counter, the flip-flop in the lowest order position is complemented with every pulse.

( T / F )

3. The decimal equivalent of a binary number 11011 is

SECTION—II

( Marks : 10 )

2×5=10

C. Answer the following questions :

1. What are alphanumeric codes?
2. State De Morgan's theorem.
3. Write the truth table of the function

$$F = x'y + xz' + y'z$$

4. What is encoder?
5. What is flip-flop?

( PART : B—DESCRIPTIVE )

( Marks : 50 )

1. (a) Draw the block diagrams of a digital computer and explain its units.  
(b) Convert  $(45)_{10}$  to binary, octal and hexadecimal.

OR

- (c) Obtain the  $r$ 's and  $(r-1)$ 's complements of the following numbers :  
(i)  $(110110)_2$   
(ii)  $(362)_{10}$   
(d) Convert  $(1101011110)_2$  to decimal, octal and hexadecimal numbers.

2. (a) Simplify the Boolean expression  $(BC' + A'D)(AB' + CD)$ .  
(b) Express the following function in a sum-of-product (SOP) :

$$F(w,x,y,z) = y'z + wxy' + wxz' + w'x'z$$

OR

- (c) Using Karnaugh's three-variable mapping, simplify the Boolean function  $F(x,y,z) = x'yz + x'yz' + xy'z' + xy'z$ .  
(d) Simplify the Boolean function  $F$ , together with Don't care condition.

$$F(A,B,C,D) = \Sigma(2, 4, 6, 10, 12)$$

$$D(A,B,C,D) = \Sigma(0, 8, 9, 13)$$

3. (a) Write any five digital logic gates with graphic symbols and truth table. 5  
 (b) Implement the Boolean function  $F = xyz + x'y' + y'z$  using AND, OR and NOT gates. 5

**OR**

- (c) Write the steps for subtraction with r's complement method. Give examples. 4  
 (d) Solve the following binary numbers : 6  
 (i)  $(1011)_2 + (101)_2$   
 (ii)  $(1101)_2 \times (110)_2$   
 (iii)  $(11010)_2 + (10001)_2$

4. (a) What is a decoder? Design a 3-to-8 line decoder showing its truth tables. 5  
 (b) What is a multiplexer? Explain the block diagram, logic diagram and function table of a 4-to-1 multiplexer. 5

**OR**

- (c) What are combinational circuits? Write the steps for designing one. 4  
 (d) What is a full adder? Write the Boolean expression, truth table and logic diagram implementation. 6  
 5. (a) What is *J-K* flip-flop? Write the logic diagram, characteristics table and graphic symbol of a *J-K* flip-flop. 6  
 (b) Write and explain the working of a shift register constructed using *D* flip-flop. 4

**OR**

- (c) Explain edge trigger flip-flop with the suitable diagram and characteristic table. 5  
 (d) Explain 4-bit ripple counter along with diagrams. 5

\*\*\*