

Professional Course (Odd) Examination, 2025

(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*)

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

1×10=10

1. The 10's complement of $(567)_{10}$ is

(a) 432 ()

(b) 433 ()

(c) 434 ()

(d) 435 ()

2. Which gate is known as logical multiplication?
- (a) OR gate ()
 - (b) XOR gate ()
 - (c) AND gate ()
 - (d) NAND gate ()
3. Conversion of binary number $(101010)_2$ to octal is
- (a) $(52)_8$ ()
 - (b) $(62)_8$ ()
 - (c) $(53)_8$ ()
 - (d) $(63)_8$ ()
4. An error detection code checks the code when
- (a) errors happen during transmission ()
 - (b) errors happen during runtime ()
 - (c) errors happen due to software fault ()
 - (d) All of the above ()
5. De Morgan's theorem is a fundamental principle in Boolean algebra that describes how complementation interacts with
- (a) NAND & NOR ()
 - (b) NAND & AND ()
 - (c) AND & XNOR ()
 - (d) AND & OR ()

6. Which law of Boolean algebra states that $(A + B) + C = A + (B + C)$?
- (a) Distributive law ()
 - (b) Associative law ()
 - (c) Commutative law ()
 - (d) None of the above ()
7. A full-adder is a digital circuit that adds _____ bit(s).
- (a) 1 ()
 - (b) 2 ()
 - (c) 3 ()
 - (d) 4 ()
8. A 4 : 2 encoder is a digital circuit that converts
- (a) 4 input lines into 2 output lines ()
 - (b) 4 input lines into the same 2 input lines ()
 - (c) 4 output lines into 2 input lines ()
 - (d) 4 output lines into the same 2 output lines ()
9. Flip-flop outputs are always
- (a) synchronous ()
 - (b) the same ()
 - (c) independent ()
 - (d) inverse of the other ()

10. An edge-triggered flip-flop is a type of flip-flop that changes its output only at the edge of a clock pulse (transition), not while the clock is

- (a) unstable ()
- (b) stable ()
- (c) triggered ()
- (d) All of the above ()

II. State whether the following statements are *True (T)* or *False (F)* by putting a Tick (✓) mark in the brackets provided : 1×5=5

1. NAND gate is known as universal gate.

(T / F)

2. *J-K* flip-flop is a bistable multivibrator with two inputs *J* and *K*.

(T / F)

3. Decimal number $(52)_{10}$ to its octal equivalent is $(46)_8$.

(T / F)

4. The sum of minterms is a way of expressing a Boolean function as logical OR of minterms.

(T / F)

5. A half-subtractor is a combinational logic circuit that performs subtraction of three binary bits.

(T / F)

SECTION—II

(Marks : 10)

III. Answer the following questions :

2×5=10

1. What is parity check bit?
2. State Karnaugh 3-variable map with truth table.
3. Write the truth table of the function

$$F = (x' + y)(x + z')(y' + z)$$

4. Define demultiplexer 1 : 8.
5. What is *D* flip-flop?

(PART : B—DESCRIPTIVE)

(Marks : 50)

Answer the following questions :

10×5=50

1. (a) What is an alphanumeric code? Also explain $(r - 1)$'s complement. 6
- (b) Convert $(37)_{10}$ to binary, octal and hexadecimal. 4

OR

2. (a) Explain digital computer with a suitable diagram. 5
- (b) What is a decimal code? Explain Binary Coded Decimal (BCD). 5
3. (a) Write the theorems and properties of Boolean algebra. 6
- (b) Explain De Morgan's theorem. 4

OR

4. (a) Explain two-, three- and four-variable *K*-maps. 5
- (b) What is the product of sum simplification? How will you simplify POS? 5
5. (a) Write all the digital logic gates with its graphic symbols. 6
- (b) Using 9's and 10's complement, solve the following : 4
- (i) $654 - 456$
- (ii) $798 - 321$

OR

6. (a) Draw a truth table for all the digital logic gates using 4-bit binary equivalent. 6
- (b) Solve the following using 1's complement : 4
- (i) $9 - 6$
- (ii) $5 - 1$
7. Briefly explain multiplexer and draw the block diagram, logic diagram and function table of a 4-to-1 multiplexer. 10

OR

8. (a) What is programmable logic array? Also draw a circuit diagram of PLA. 5
- (b) Explain the working of half-adder with logic diagram and truth table. 5
9. (a) What is a flip-flop? Write the characteristic table and graphical symbol of a *T* flip-flop. 5
- (b) What is the difference between synchronous and asynchronous counters? 5

OR

10. (a) Explain edge-triggered flip-flop with the characteristic table. 5
- (b) Explain 4-bit ripple counter along with diagrams. 5
