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3 (Sem-3/CBCS) PHY HC 3

2022

PHYSICS

(Honours)

Paper : PHY-HC-3036



(Digital Systems and Applications)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions as directed :

(any seven)

$1 \times 7 = 7$

(i) The deflection sensitivity of a CRO can be enhanced by reducing _____.

(Fill in the blank)

Contd.

(ii) The intel 8085 microprocessor is a 16 bits processor.

(State True or False)

(iii) The design of flip-flops are based on

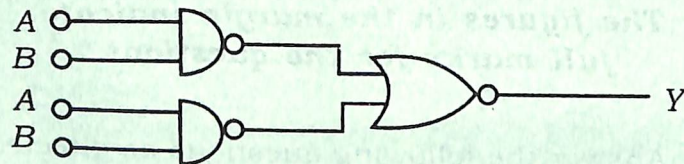
- (a) Sequential logic
- (b) Multiplexing
- (c) Combinational logic
- (d) Demultiplexing

(Choose the correct option)

(iv) The full form of MDR is _____.

(Fill in the blank)

(v) For the given circuit diagram, the output Y is



- (a) $A + B$
- (b) AB
- (c) $\overline{A + B}$
- (d) $\overline{A.B}$

(Choose the correct option)

(vi) The storage capacity of each stage in a shift register is _____ bits.

(Fill in the blank)

(vii) Monostable multivibrators can be used as frequency divider by using

- (a) Sawtooth wave generator
- (b) Triangular wave generator
- (c) Sine wave generator
- (d) Square wave generator

(Choose the correct option)

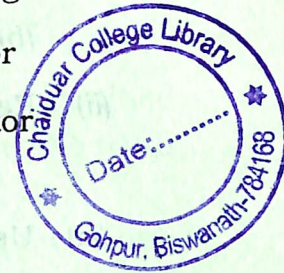
(viii) What is the full form of VLSI?

(ix) Mention one advantage of a digital circuit over an analog circuit.

(x) Write the names of an active component and a passive component in a circuit.

(xi) Convert the binary number 101.11_2 into decimal number.

(xii) Convert the decimal number 54.50 into binary number.



2. Answer the following questions in brief :
(any four) 2×4=8

(i) Convert the following hexadecimal numbers to binary

(a) B32

(b) AE2.4

(ii) Reduce the following Boolean function

$$\overline{A}\overline{B} + \overline{A}B + AB + \overline{A}\overline{B}$$

(iii) Using 2's complement, perform the subtraction

$$101.1101 - 101.0111$$

(iv) What do you mean by D/A converter? Name *two* types of D/A converter.

(v) What is synchronous counter? Write *two* basic applications of counters.

(vi) What is Primary memory? What is its function?

(vii) Draw the logic symbol of XOR gate and construct the truth table.

(viii) Mention *two* applications of Multiplexers.

3. Answer **any three** questions from the following : 5×3=15

(i) (a) Convert the following Boolean expression into standard SOP form

$$A + \overline{B} + CA$$

(b) Show that $(\overline{AC} + B)(\overline{A} + \overline{C}) = BAC$

(ii) Explain how SR flip-flop is obtained from using NAND gates. Draw the truth table.

(iii) With neat diagram explain the working of a serial-in parallel-out shift register. What is the basic difference between a shift register and a counter?

(iv) Simplify the Boolean function $F(A, B, C, D) = \sum(0, 1, 2, 4, 5, 6, 8, 9, 12, 13, 14)$ with the help of K-maps.

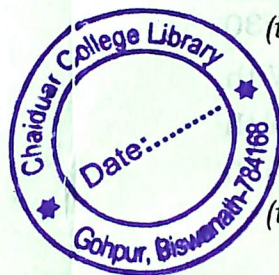
(v) Write short notes on: **(any one)**

(a) BCD decade counter

(b) Astable Multivibrator

(c) Clocked D flip-flop

(vi) Define Opcode and Operand. Write an 8085 Assembly Language Program (ALP) to store data of register C into memory location 2054H. 2+3=5



(vii) Prove the following equations with the help of truth tables :

(a) $\overline{A+B} = \overline{A} \cdot \overline{B}$

(b) $\overline{A \cdot B} = \overline{A} + \overline{B}$

(viii) Using NAND gates only, realize the following gates :

(a) AND

(b) OR

(c) NOT

4. Answer **any three** of the following questions:

10×3=30

(i) What are decoders and encoders ? With the help of a logic diagram and truth table explain.

2+4+4=10

(a) 2 to 4 decoder

(b) Octal to binary encoder.

(ii) What is a full Adder ? Draw the block diagram and truth table of a full Adder. Design a full Adder logic circuit by applying Karnaugh map.

1+4+5=10

(iii) (a) Draw the K-map to minimize the following expression.

$$\overline{A}BC + A\overline{B}C + \overline{A}B\overline{C} + A\overline{B}\overline{C}$$

(b) For the given truth table, find the minimized logical expression by the use of K-map and SOP method and draw the equivalent logic circuit :

4+6=10

| A | B | C | Output |
|---|---|---|--------|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 |

(iv) With the help of a logic diagram and function table explain

5×2=10

(a) 1 to 2 Demultiplexer

(b) 2 to 1 Multiplexer.

(v) Draw the block diagram of a CRO. What is the function of electron gun in a CRO ? Explain how the phase difference between two sinusoidal voltages of the same frequency and same amplitude can be determined by using CRO.

3+2+5=10

(vi) What is a microprocessor ? What is the difference between microprocessor and microcomputer ? Write the basic features of Intel 8085 microprocessor.

1+1+8=10

(vii) (a) Give the symbol and truth table of XNOR gate.

(b) Realize the NOT gate using transistor.

(c) What are preset and clear operations ?

3+3+4=10

(viii) (a) What do you mean by the following terms used in a Microprocessor ?

(i) Buses

(ii) Registers

(iii) ALU

(b) What is a Half Subtractor ? Give the symbol and the truth table.

6+4=10

