**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)**                1×7=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.

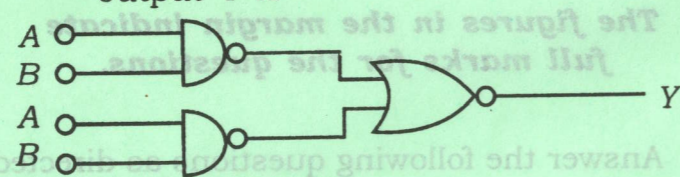*(State True or False)*

(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

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

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

   (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)* $\overline{A + B} = \overline{A}.\overline{B}$

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

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

*(a)* AND

*(b)* OR

*(c)* NOT

4. Answer **any three** of the following questions: $10 \times 3 = 30$

*(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.

$$\overline{ABC} + \overline{ABC} + \overline{ABC} + ABC$$

*(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 $5 \times 2 = 10$

*(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

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